CHORIZO PROJECT

Deliverable 3.2

0FLW INTERVENTIONS

CHORIZO PROJECT

D3.2

0FLW interventions

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Executive summary

The CHORIZO project aims to improve the understanding of the impact of social norms on behaviours related to food waste generation. This document starts from the list of actions against Food Loss and Waste (FLW) collected within the CHORIZO project (Deliverable 1.2). It establishes the foundation for the conceptualization of interventions in relation to social norms and 'what-if' scenarios with a perspective of modelling effective 0FLW interventions.

This work emphasises the importance of targeted and customised interventions that include considerations on specific context-related social norms. A pivotal aspect in behavioural change interventions involves recognizing diverse social roles and settings. Here, we define the concept of social roles as expected behavioural patterns in specific contexts, exploring potential conflicts within or between these roles. In the context of the six Case Studies of the CHORIZO project, this work explores the relevant social norms within and beyond each setting, their targets groups and networks of influence. Furthermore, this report introduces potential 'what-if' scenarios emerging in the Case Studies, highlighting possible awareness-raising interventions, economic incentives and 'nudging' strategies related to social norms for 0FLW interventions. The importance of the co-design process is highlighted for the definition of possible settings (e.g., in-home settings, out-of-home settings and alternative settings) for the modelling of interventions, basing this segmentation on the similarities with the case studies in which to model interventions.

In summary, this work presents a new conceptualization for behavioural interventions in FLW reduction, integrating the identification and exploitation of social norms and social roles in the settings of their influence. This report serves as a basis for upcoming modelling activities, paving the way for a deeper understanding of how social norms influence food waste generation or reduction within the CHORIZO project.

Abbreviations and Acronyms

Acronym	Description
ABMs	Agent Based Models/Modelling
CSs	Case Studies
EU	European Union
FLW	Food Loss and Waste
FW	Food Waste
HUMAT	A framework that identifies key characteristics of social norms and their role
MOA	Motivation-Opportunity-Ability
NGO	Non-Governmental Organization

1   INTRODUCTION

The Chorizo Project ("Changing practices and Habits through Open, Responsible, and social Innovation towards ZerO food waste") is a Horizon Europe, European Union (EU) funded project, which aims to improve the understanding about how social norms (rules and expectations that are socially enforced) influence behaviour related to food waste generation. Behavioural change is a critical aspect of addressing food loss and waste (FLW) challenges as it is the result of multiple and interconnected behaviours taking place at different moments and stages of the food supply chain.

However, understanding complex systems demands more than just an understanding of individual behaviour. Individual behaviours and choices are not the only aspects that matter when it comes to food waste generation. Indeed, individuals are deeply affected by the collective behaviours of their peers, building a complex network of social norms that evolve with time and is deeply connected with the contextual group of individuals that interact with each other. As a result of this, social norms represent a crucial element in understanding food waste related behaviours as food waste results from a complex set of behaviours, not always bounded to rationality or individual free will.

In the interest of understanding social norms and their link with food waste related behaviours, a definition of a theoretical framework was defined. This framework represented the decisions and actions of individuals along the food supply chain in Vittuari et al. (2023) (CHORIZO D3.1 See Appendix). Social norms related to food waste were conceptualized and connected to other food waste related behavioural drivers (i.e. factors affecting behaviours). The CHORIZO theoretical framework integrates Motivation-Opportunity-Ability (MOA) and HUMAT frameworks to identify key characteristics of social norms and their role in shaping food waste related behaviours.

The MOA framework considers food waste as an unintended consequence of iterative decisions and behaviours driven both by internal (individual) and external (social and societal) factors (Vittuari, Garcia Herrero, et al., 2023). Consumers' information processing and consequent decisions are mediated by personal Motivations, Opportunities, and Abilities. Given the connections to the personal sphere, the context in which consumers live deeply influences those drivers. Motivation represents the intentions and their strength of one or more individuals to carry out a set of actions. It is influenced by the awareness about the problem, the perception over the effectiveness consumers can have in minimizing food waste, the emotion and engagement towards food waste minimization. Social norms represent a particular set of motives for taking action that impact the overall motivation. Ability represents the capacity of each individual in dealing with the creation, management, and reduction of food waste by relying on personal knowledge and skills. Opportunity is defined as the possibility of one or more individuals in accessing external material and non-material resources such as time, technology, infrastructures and legal and regulatory frameworks.

HUMAT framework is a cognitive architecture for decision-making that provides a backbone for modelling human behaviour. It depicts how individuals make decisions by solving cognitive dissonances ("dilemmas") among competing individual motives and by interacting with other agents to either persuade them or learn from their experiences. While the MOA framework provides a detailed snapshot of the drivers behind a decision, the HUMAT architecture is a dynamic process that represents the individual's actions and strategies that lead to those decisions. As already discussed in Vittuari et al. (2023), MOA highlights motivation (i.e. different set of intentions) behind decisions, while HUMAT highlights individual motives that add up with different importance to the overall motivation. In HUMAT motivation is represented by expected satisfaction from that action and attitude formation (Do I like eating strawberries or not?), not necessarily carrying out an action (Should I eat a strawberry?).

While the CHORIZO theoretical framework identifies social norms as potential drivers for food waste related behaviours, it is still unclear what are the elements of social norms to be addressed that make them relevant to food waste behaviour. Are social norms meant to be changed, created or exploited by food waste interventions? What are the tools to leverage social norms for changing food waste related behaviours and choices? The aim of this report is to address these questions and inform on possible interventions leveraging existing or changing social norms towards positive changes in food waste behaviours.

The document is organized as follow: the second section explores the messages learned from the collection of actions aimed at preventing or reducing FW in the EU. The third section provides a conceptualisation of the intervention logic for food waste interventions. The fourth section takes into consideration the importance of understanding social roles to design behavioural change interventions in specific settings. The fifth section is dedicated to what-if scenarios related to case studies settings (i.e. household, food services, hotels, food banks, datemarking, and schools), that will be relevant for the future conceptualization of Agent-Based Models (ABMs).

2   LEARNING FROM THE CHORIZO COLLECTION OF EUROPEAN ACTIONS

Within the CHORIZO project, a comprehensive overview of past and current FLW prevention actions across EU member countries was provided (den Broeder, 2023). The 395 actions collected via desk research were categorized according to their characteristics (e.g., the food waste prevention levels), their implementation challenges, their impact (social, economic, and environmental), their gender implications, and if or to what extent the actions considered social norms towards food waste.

Actions were analysed primarily with qualitative methods throughout the descriptions and the information provided during a desk research phase. At a later stage, when quantitative data were available, those helped to improve the analysis. Some of these actions were further explored via in-depth interviews to collect more insights on impacts, effectiveness and implementation. The reflections in this paragraph come from the results of the analysis collected in den Broeder (2023) (CHORIZO D1.2 See Appendix) and are primarily developed from the description of each action's aim as this was always clearly available.

The collection of actions was classified according to the MOA framework that, as previously mentioned, encompasses three pivotal components: Motivation, Opportunity and Ability. Motivation reflects an individual's level of desire or willingness to engage in a specific action. This includes awareness, attitudes and also social norms. However, robust motivation alone may not necessarily translate into an effective behaviour. Opportunity indicates the context, surrounding an individual, that can either facilitate or hinder the implementation of a behaviour, including external factors such as social or economic conditions that can influence the feasibility of action. Ability concerns an individual's actual capacity to perform a specific action. This encompasses personal skills, available resources and physical conditions. This classification was based solely on the description of the aim of the action itself. While the aim of the actions was sufficient to identify the main categories of drivers affected by the action (i.e. Motivation, Opportunity, or Ability) it was not possible to directly link the action to social norms. This represents a first result that is highly significant as social norms have rarely, if ever, been considered directly in the aim of actions related to food waste interventions.

For the process of analysis of the list of actions, two different perspectives were used according to, (i) the position of the referenced action within the pyramid of the FW hierarchy or (ii) the step in the supply chain on which the referenced action is involved.

The total number of actions analysed and included in the FW hierarchical pyramid is 395. Following the segmentation carried out using this point of view, **preventive actions (196 actions)** and FW **re-use actions (168 actions)** cumulatively account for 92.1%. Individually, **preventive actions account for 49.6%** of the total and FW **re-use actions** account **for 42.5%** of the total. The "hierarchical pyramid of waste" distinctly emphasizes prevention (instead of reuse) as one of the most important levels in addressing FLW. Directing efforts towards preventing waste at its source (e.g., private homes, supermarkets and restaurants) can successfully contribute to the overall reduction of food waste. Prioritizing FLW prevention actions is also pivotal in reshaping the social norms associated with such behaviours, especially those that specifically target households, retail outlets, and food services. Preventive actions, when widely adopted, can serve as models or best practices and foster positive behavioural patterns within communities. Observing members of one's community actively engaging in food waste prevention can help promoting social norms that endorse and encourage such behaviours.

Following the product supply chain perspective, retail, food services and households were taken into consideration. The rationale behind this decision is that these settings represent the project's case studies and take into consideration not only individual motives but also opportunities and abilities.

This is important because not only motivations are directly influenced by social norms, but people's opportunities and abilities are indeed an equally important aspect.

The classification of actions against FLW through the MOA framework revealed several relevant findings. Considering the retailers, 15.1% of actions targeting the motivation dimension was found. These results suggest that in the retail sector, actions aimed at changing motivation to reduce food waste, constitute only a small part of the total initiatives. Regarding Food Services, the actions targeting motivation, account for 51.5% of all actions, which makes up a significant part of the total initiatives. In regard to households, 50% of actions focused on motivation to reduce FLW, and most of these actions could potentially be connected to social norms. This suggests that in the context of households, motivation and social influence could play a relevant role in promoting sustainable behaviours. In summary, the results indicate that the target of actions varies by sector. Certainly, it is interesting to note that the concentration of actions targeting motivations increases when it comes to households and food services and generating more awareness about the phenomenon. Equally relevant, although to a lesser extent than the retailers' category. Here, prevention strategies can be designed to take advantage of these social dynamics.

While actions refer to individual or collective steps taken to address food waste, interventions tend to have a broader systemic focus and can involve interdisciplinary approaches. While actions might be more immediate and may not always be rigorously assessed in terms of their impact, interventions are more structured efforts, more methodically planned and evaluated in scientific studies for their effectiveness and broader impact. In this conceptualization some actions might have the characteristics of interventions but not all of them can be defined as such. From now on we will discuss only the latter category as they are the key to creating large-scale change and addressing the structural causes of food waste.

3 CONCEPTUALIZING THE INTERVENTION LOGIC FOR CONSUMER FOOD WASTE INTERVENTIONS

As just introduced in the previous section, interventions are generally understood as structured efforts and tools that are primarily implemented and evaluated to influence behaviours. Opportunities to systematically and practically reduce food waste are referred to in this report as 'levers' and will help in designing effective interventions to tackle consumer food waste. Many researchers already provided several attempts to collect, classify and evaluate the vast heterogeneity in food waste prevention and reduction interventions[1]. One of the most effective classification schemes exploit the role of drivers and levers in changing behaviours (Vittuari et al., 2023). This classification allows to clearly associate drivers with potential objectives and therefore provide a meaningful tool to design interventions in close connections with their objectives, the drivers they target and the levers they exploit. To change the behaviours of groups in order to reach a tipping point, it is of utmost importance not to choose among the different drivers, but to use more than one (Lam et al., 2017).

As stated in the previous work (Vittuari et. al 2023 – CHORIZO D3.1), a critical aspect in exploring and modelling social norms in the food waste domain is the role of social networks and the necessity of imposing a specific structure governing how agents connect within networks in order to model them. For this reason, discussing both food waste interventions under the lens of social norms and social norms under the lens of food waste interventions, provides the opportunity to highlight and define new aspects that have been overlooked so far.

3.1 Interventions shaping profiles within social norms

As defined in CHORIZO's theoretical framework (Vittuari et al., 2023, CHORIZO D3.1 See Appendix), social norms are "rules/guides for actions perceived by individuals aspiring/belonging to the norm's target group as expected by others". Social norms shape individual behaviour and operate through expectations about actions[2].

Social norms shape individuals' behaviours. With the aim of reducing or preventing food waste, identifying the mechanisms and the characteristics through which social norms influence behaviours is necessary to decide which are the applicable interventions to implement. Social norms can be **injunctive**, referring to perceptions about normatively appropriate actions in a specific context; or **descriptive**, referring to the prevalent or common behaviour observed in a specific setting.

Settings can be characterized by different levels of familiarity and observability:

- **Familiarity** is related to the level of experience that an individual has of what are the appropriate behaviours to be adopted in a specific setting. For example, dining at home is a repetitive and familiar situation, while having breakfast in an hotel or dining in a new restaurant is less familiar and the appropriate behaviour is more uncertain;
- **Observability** is related to the fact that an individual's behaviour can be private or observable by others. For example, dining at home has a lower level of observability compared to dining in a restaurant, where other clients can observe one's behaviours.

The levels of familiarity and observability that characterize different contexts are also related to the type of social norms that are more prevalent (see Fig. 1). Non-observable and familiar contexts are

[1] See among others Caldeira et al., (2019), García-Herrero et al., (2023) and Swannell et al., 2023.
[2] For example, the expectation of ordering a huge amount of food and the expectation to limit the amount of food ordered are two different norms.

more associated with injunctive norms, as individuals retain information about the appropriate behaviours that others expect. In novel and observable settings, on the other hand, the importance of descriptive social norms increases, as individuals gather information about appropriate behaviours by observing what others are doing.

In novel and observable settings, therefore, descriptive norms are more volatile and dynamic, meaning that they are subject to change according to the specific situation in which individuals are.
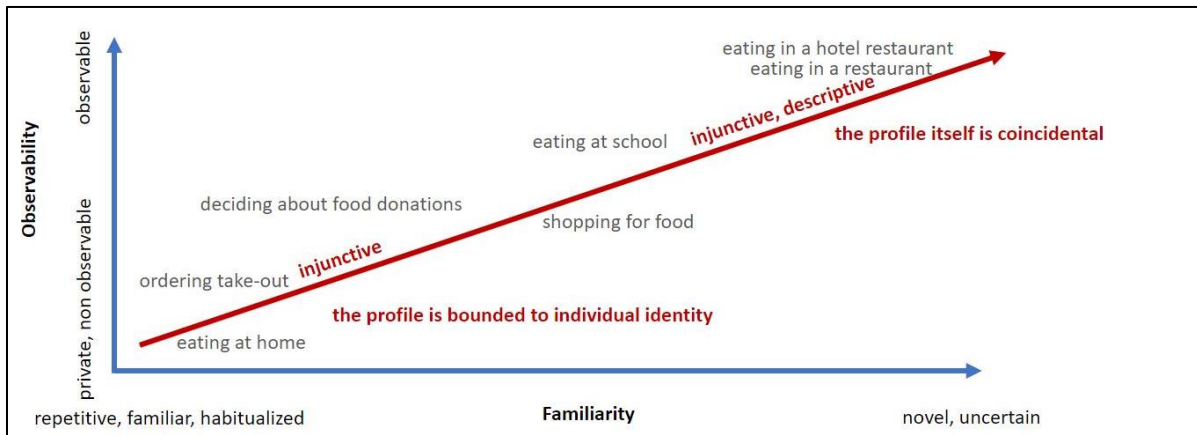

Figure 1 Familiarity and Observability of social norms in specific settings

Alongside the consideration of settings, the individual level represents another crucial aspect of understanding social norms. Social norms might target specific groups based on characteristics such as gender, and individuals may or may not conform to particular social norms. Thus, when investigating social norms and designing behavioural change interventions related to them, it is crucial to distinguish between different profiles in relation to these social norms (Tabel 1 Social norms individuals' profiles).

	Expect the norm to apply to the target group	Do not expect the norm to apply to the target group
Belong to the target group	Compliers	Rebels
Do not belong to the target group	Advocates	0 giver

(Network of influence)

Tabel 1 Social norms individuals' profiles

Here, profiles are defined according to two dimensions: Belonging/Not belonging to the target group[3], Expecting/Not expecting the norm to apply to the target group:

- **Compliers** are individuals that belong to the target group, comply to the social norm, and expect others in their group to also comply to the social norm;

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[3] The target group includes individuals that are actually the implementers (or those who are expected to implement) of the action regulated by the social norm (Vittuari et al., 2023. CHORIZO D3.1)

- **Rebels** are individuals that belong to the target group but do not comply and do not expect others in their group to comply with the social norms[4];
- **Advocates** are individuals that do not belong to the target group, but expect the target group to comply with the social norm;
- **0 giver** are individuals that do not belong to the target group and do not expect others to comply with the social norm[5].

Individuals, regardless of the profile to which they belong, have a **network of influence,** composed by others whose opinion matters to them. In HUMAT, the network of influence reflects all alters in an ego network that the ego (intended as the individual) considers when deciding how to behave in a specific situation. The composition of the network of influence - meaning the proportion of compliers, advocates, rebels and unbothered – affect individual's behaviours and, consequently, the perceived importance of the social norm.

To provide a concrete example, the social norm 'women should be thin in order to be beautiful' specifically identifies women as the target group. Women can be differentiated between those who expect the social norm to be applied to them – the compliers – and those who disagree – the rebels. On the other hand, men – who are not part of the target group – can be advocates, thus expecting women to be thin in order to be beautiful, or 0 giver , thus not expecting the social norm to be applied to women.

3.2   Interventions directly addressing social norms for behavioural change

Another crucial point emerging from desk research, interviews and actions collection is the fuzziness around what defines an intervention addressing social norms. For the purpose of this project, an intervention directly addressing social norms must:

- **addresses a specific norm**: the norm must be clearly identifiable;
- **identifies the target group**: it must be clear who are the individuals who are expected to follow the norm;
- **involves that an information that act on individuals' perceptions is transmitted**: the information can be transmitted through communication or observation;
- **identify a network of influence**: the people that influence individuals' perception about the social norm must be identifiable.

Interventions can address social norms in three ways: by creating new social norms; by changing existing social norms; or by using or reinforcing existing social norms.

There is a fairly large number of scientific articles examining the role of social norms and their impacts on consumer behaviours (Melnyk et al., 2021), providing in some cases conflicting findings. In some studies, interventions with messages designed to decrease an undesirable behaviour, have generated the opposite result (Perkins et al., 2015; Wechsler et al., 2015). Starting from this consideration, it is

[4] It is worth noting that the concept of complying might introduce another dimension of nuisance as one might not comply to the social norm but still expect others to do so. However, the compliers group, already implies that those that expect also comply so this would relate only to the rebel group. We assume that the majority of individuals who expect also comply and thus we can safely ignore this minority that would regard rebels.

[5] Also, here it should be noted that some individuals not belonging to the target group might expect others not to comply to the norm. We can assume that in the food waste domain very few people might be advocates against a norm and if they to not expect other to comply they just ignore it. These are assumptions that might be taken into further consideration when collecting empirical data on social norms.

crucial to understand what are the most effective ways to design social norm interventions, while taking into consideration the possible moderating features (e.g., social norm framing, settings).

In the academic literature, only few studies have adopted an experimental design and tested actual interventions to investigate the influences of social norms on food waste related behaviours. These interventions mostly employ written messages as tools to manipulate and present social norms to the target group.

Zheng et al. (2023) investigated the effects of **information framing,** in relation to descriptive and injunctive social norms, on consumers' willingness to reduce FW, by implementing two experimental interventions. The first one tested the effectiveness of positively-framed descriptive norms ("*More and more people choose to reduce food waste*") in comparison to negatively-framed descriptive norms ("*A large amount of food is wasted every year in the world*"). The second one tested the effectiveness of positively-framed injunctive norms ("*Please save food*") in comparison to negatively-framed ones ("*Please do not waste food*"). Findings show that positively-framed descriptive norms are more effective in encouraging consumers to reduce waste than negatively-framed ones. Surprisingly, negatively-framed descriptive norms heightened the willingness to waste food. On the other hand, negatively-framed injunctive norms resulted to be more effective than positively-framed one in steering consumers' willingness to reduce food waste.

In a second experiment, the authors explored the **role of dining settings** in relation to social norms effectiveness in promoting individuals' willingness to reduce food waste. In a business setting, the positively-framed descriptive norms proved to be the most effective; while in friends and family dining setting, the negatively-framed injunctive norm was more effective.

With regards to another dining setting, **restaurants**, another intervention was tested by Stöckli et al. (2018), whose study aimed at investigating the influence of social norms prompts on **leftovers take-away**. The intervention involved the use of an information-alone prompt and of an informational and normative prompt: results showed that in the control group (no prompts shown), 25% of clients asked to take away leftovers, in the information-alone prompt condition 55%, and in the informational and normative prompt condition the percentage increased to 64%. However, the study did not demonstrate that informational and normative prompts were more effective in increasing leftovers takeout than information-alone prompts.

van Herpen et al. (2021) also examined the framing effect on **leftover take away in restaurants**. To investigate the act of asking for a doggy bag, which could be associated with a **feeling of shame**, they tested a set of experiments to investigate the influence of switching to an opt-out system, in which consumers are offered a doggy bag by default. Results indicate that adopting an opt-out strategy increases the uptake of doggy-bags (74% compared to 27% for the opt-in strategy). These results show that offering doggy bags as a default choice diminishes the feeling of shame in consumers and is effective in increasing the takeout of leftovers.

In relation to buffet restaurants, Kallbekken & Sælen (2013) conducted a field experiment, analysing the effect of a sign encouraging customers to visit the buffet more than once, suggesting that is the socially acceptable behaviour, on food waste. Authors also implemented a second treatment, reducing the plate size. In the treatment groups, results indicate that introducing the sign reduces food waste by 20.5%, while reducing the plate size reduces food waste by 19.5%. Unfortunately, this study does not provide an explanation of the mechanism that link encouraging going for seconds and the reduction of food waste.

To determine how to introduce behaviour change into university dining facilities, Whitehair et al. (2013) tested an intervention involving the introduction of a message prompt conveying a descriptive social norm. The results of this intervention showed a 15% reduction in food waste.

In relation to food waste linked to consumers' reduced preference for **suboptimal food**, do Carmo Stangherlin et al. (2020) investigated the impact of social norms on suboptimal food purchase intention. After establishing a realistic social norm through an initial study, addressing individuals' perceptions and beliefs about that norm (Biel & Thøgersen, 2007) – the authors implemented a message intervention with a control group and a treatment group, to test its effect on participants' intention to purchase suboptimal products. The message included the role of food waste awareness and environmental concern as mediating factors. Results show that the purchase intention for some of the suboptimal products was higher in the experimental group than in the control one, with environmental concerns and food waste awareness partially contributing to this effect.

3.3   Interventions indirectly addressing social norms for behavioural change

The complexity underlying consumer food waste requires tailored and diversified actions to stimulate behavioural change. Therefore, not only social norms but also other types of drivers need to be addressed. As mentioned before, a classification of interventions is necessary to support the understanding of the mechanisms involved in reducing food waste through consumer behavioural change. In this section, other types of interventions are discussed (Tabel 2 Examples of interventions from the literature), particularly emphasizing their connection and potential rebound effects on social norms related to food waste. The types of intervention provided below includes some ideal types, and it must be highlighted that interventions can integrate different characteristics and are rarely of one single type.

In the extensively rich literature on food waste reduction and prevention interventions, high heterogeneity can be found in the studied settings, in the methods adopted for implementation and in the measurements applied for impact evaluation. For this reason, a comparison of behavioural change impacts would lead to inconsistent results and, in any case, driving conclusions on the overall assessment of food waste prevention and reduction interventions is beyond the scope of this report[6].

Awareness raising: one of the most common and widespread interventions are food waste awareness campaigns. They usually display several types of information based on posters, cards, pamphlets or digital tools (app, websites, social networks) to highlight food waste problems and the related economic, societal and environmental impacts. The aims can be multiple and go from boosting consumers' perceptions and intentions to reduce food waste to triggering guilt, concern, and other personal emotions (positive or negative). Due to the relative low-cost and easily operational features, the awareness campaigns are one of the major food waste reduction strategies in the consumption stage, despite different impact levels across cases which are often impossible to compare due to differences in measures and intervention design (Jagau & Vyrastekova, 2017; Soma et al., 2021; Visschers et al., 2016; Ahmed et al., 2018; Alattar & Morse, 2021; Dolnicar, 2020; Manomaivibool et al., 2016; Stöckli, Niklaus, et al., 2018; Werf et al., 2019). They can also be easily implemented both for in home and out of home consumption by adjusting the messages for each specific setting.

This particular set of interventions can be highly connected to social norms both in direct and indirect ways. In the first case, messages can be tailored to change, exploit or create a specific norm; in the second case, messages can indirectly tap into the social norms' mechanisms, especially if the campaign is meant for public spaces.

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[6] Please consider Vittuari et al., (2022) for extensive reviews on the matter.

Economic and material incentives/deterrent: consumers' habits can be boosted also through economic and material incentives or coercions as changing pricing models from fixed to variable prices based on consumers demand (Eckert Matzembacher et al., 2020). Building on this, several interventions explored the impact of direct rewards to no-waste consumers (Dolnicar, 2020). Other works explored the impact of fines for unconsumed food, leading to a 50% reduction in food waste from 94.3 g to 43.8 g (Kuo & Shih, 2016). These incentives or coercions interventions are especially applied in out-home contexts since they are generally accompanied with the tailored restaurant sales regulations. Overall, in the literature it is well established that interventions of this typology lead to food waste reduction.

This set of interventions is not related to social norms per se but to the mechanisms of rewards and punishment that can be associated to food waste related social norms (e.g. the social norm stating that it is wrong to waste food). Settings in which norms are stronger might make economic-type interventions more prone to have an impact.

Nudging strategies and change of consumer's choice architecture: choice-architecture indicates the physical or social setting in which decisions are typically made under the existing or current conditions. This can include the characteristics of the default setting, the number of options, the attributes, or the description of these options (Thaler & Sunstain, 2008). Choice-architecture interventions have been increasingly investigated as efficient tools to nudge behavioural change in the food waste domain as they are often low-cost and easy to implement (Szaszi et al., 2018).

Considering that individuals make nonoptimal decisions due to bounded rationality and incomplete information, the approach is based on the principle that a change in the status quo of a situation can lead to a change in individual choices towards a more favourable outcome (Thaler & Sunstein, 2008). When identifying a specific behavioural problem, choice-architecture interventions can target that behaviour by changing the way options and decision-making formats are arranged in the food and eating environment (Münscher et al., 2016).

Even though consumers may hold strong intentions to avoid food waste, lack of suitable opportunities may also result in food waste. The nudging strategies could potentially promote food waste reduction from this perspective. For example, serving smaller portions (Ahmed et al., 2018; Kallbekken & Sælen, 2013b; Visschers et al., 2016), simple tools to measure food preparing amount (van Dooren et al., 2020), different plate shape and size (Richardson et al., 2021), or changes in the canteens' settings and decorations (Hamdi et al., 2020). Other types of strategies can involve the size of packaging (Hebrok and Boks, 2017) as well as technology-based smart fridge or smart kitchen tools that contribute to food waste prevention by improving optimization of food management (Hebrok & Boks, 2017; Vittuari et al., 2021).

Also, this set of interventions usually does not include reflections on social norms mechanisms behind behaviours. However, the different profiles linked to social norms previously discussed (see Table 1) could have different sensibility in response to these interventions.

Training or knowledge enhancement: food management skills, cooking skills, storage skills and leftover handling methods have been mentioned across many relevant studies as important tools for effective food waste prevention and reduction strategies (Karunasena et al., 2021). All these skills could be transferred to consumers in a variety of ways addressing different consumer segments like school curricula, videos and competitive gamification (Nabi et al., 2021), mobile applications, social media and digital networks (Fami et al., 2019; Marek-Andrzejewska & Wielicka-Regulska, 2021). Education initiatives can assume various forms, from ad hoc curricula in class to the use of virtual platforms and apps, to single events to sensitize both in-household and out-of-home behaviours (Goodman-Smith et al., 2020; Stöckli & Dorn, 2021). Experiential learning projects succeed in training

and increasing knowledge in high educated students to address food waste reduction and to build their own ability to transform food systems (Ahmed et al., 2018). Moreover, the adoption of food waste-reducing routines related to planning, shopping, storing and cooking can significantly affect the levels of food waste for in home consumption (Romani et al., 2018; Young et al., 2018).

As for nudging strategies, the level of efficacy of this type of intervention could also be connected to different levels of engagement depending on the different social norms' profiles and roles (e.g. only "good housewives/husbands" might feel the need to learn such skills).

Drivers	Levers – Areas of opportunity for action	Intervention type	Potential interventions	Setting
MOTIVATION	Social pressure - showing what other have done	Social influences	Public/community events to share knowledge on food management	In home/Out of home
			Social sharing platform	In home/Out of home
			Platform to show how the other shoppers avoid food waste	In home/Out of home
	Improve consumer perceptions on their role	Awareness raising	Raise awareness about the importance and the effectiveness of individual actions	In home/Out of home
	Improve better attitudes		Raise awareness on the cost-saving potential of food waste	In home/Out of home
	Trigger guilt, concern, and other personal emotions (positive or negative)		Raise awareness about economic, environmental, and social values and consequences	In home/Out of home
OPPORTUNITY	Promote monetary and non-monetary incentives	Economic and material incentives/disincentives	Different pricing models: variable price buffet service, fixed price buffet/canteen service, fixed price table service	Out of home
			Material reward for never wasting food during hotel staying	Out of home
			Fine for leaving too much food unconsumed	Out of home
			Smaller package size	In home/Out of home

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Drivers	Levers – Areas of opportunity for action	Intervention type	Potential interventions	Setting
	Environments nudging food waste reduction practices	Nudging strategies & change of consumers choice architecture	Reduce serving portion size	Out of home
			Change plate shape and size	Out of home
			Decorations, flavour stations	Out of home
	Affordable technologies and tools		Smart kitchen, smart fridge	In home
			Provide measuring cups and easy portion calculators	In home
ABILITY	Promote and introduce food planning or storage methods, cooking skills, and food reduction tips in educational and community-based initiatives	Training or knowledge enhancement	Incorporate food management skills into school curricula	Out of home
			Promote tips and skills on cooking with leftovers	In home
			Introduce exiting competitions through gamification of food management skills	In home/Out of home
			Increase household inventory turnover and encourage more frequent purchases	In home
			Promote storage solutions and skills	In home
			Provide skills on shopping and meal planning	In home

Tabel 2 Examples of interventions from the literature

4 TAILORING INTERVENTIONS ACCORDING TO DIFFERENT SETTINGS AND SOCIAL ROLES

A 'one-size-fits-all' approach in intervention design may be less effective than targeted and tailored interventions based on scientific evidence. Understanding the reasons behind food waste and identifying groups of people with similar characteristics related to food waste can help identifying relevant segments within the population. 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. Targeting means 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.

When designing and implementing behavioural change interventions that aim at modifying prevalent social norms, the different **social roles** owned by individuals must be considered. Social roles are defined as a pattern of behaviour that is expected of a person in a specific setting, or in other words an individual's position in a social situation (Cottrell, 1942). Each individual performs different social roles according to the different target group they belong to (e.g., family, work) and to the social norms they perceive applying to them. Sometimes, social roles held by an individual can convey behavioural expectations that conflict one another: in this case, conflict between roles arises. For instance, a woman dining at a friends' house may perceive that, as a guest, she is expected to consume everything, while as a woman, society expects her to be skinny in order to be considered beautiful. In this case, the conflict is between the gender role and the guest role.

In other cases, there may be a conflict within one's role. This happens, for example, when parents act according to the "good provider" social norm by serving enough food so that everyone at the table eats what they like. This can conflict with the good household manager social norm, which means not wasting money on food that will be thrown away. In this case, the conflict is within the role of provider.

This distinction between roles is relevant for intervention conceptualization, as interventions can be designed to influence the expected behaviour of different roles. This provides new insights on the well-established importance of targeting different segments of consumers with tailored interventions.

Within the CHORIZO project six settings can be used to identify, in each of them, the target group, the type of social norms (descriptive or injunctive), and the social roles (e.g., good provider) related to the food waste behaviours. Furthermore, the network of influence, and the conflicts that might arise within social roles can also be identified.

Household food waste in and off crisis periods (CS 1): The main social norm identified in this setting is the "good provider", an injunctive social norm. In this case, the target group includes the people providing food and responsible for the family meals. The network of influence group includes other members of the households, including children. With regards to children, a particular attention must be paid for age differences, as the presence of children of different ages may convey differences in how the social norm is formulated and how strong its influence is on the "good provider" behaviour. In addition, in the cases in which the "good provider" is responsible for offering meals to guests, guests can also be included in the network of influence. In relation with the "good provider" social norm, conflicts may arise if the people responsible for providing and preparing food is also responsible for managing household's finances: ensuring that plenty of food is available and prepared, and potentially wasted, arises a potential conflict as this entails spending more than needed. In this setting, characterized by high familiarity and low observability (see Figure 1 Familiarity and Observability of social norms in specific settings), injunctive social norms are more prevalent, as individuals already retain information about the appropriate behaviours and what others expectations are.

Hospitality food waste (CS 2): In the setting of hotels' buffet, both the network of influence and the target groups are represented by the hotel guests, who are influenced by the observable behaviour of other guests and social norms about the appropriate behaviours to adopt in this setting (e.g., how much food it is appropriate to take at the buffet). In this setting, social norms are descriptive, and the only social role identifiable is the one of guests. No conflict among social roles was identified.

Food services food waste (CS 3): similarly to the hospitality sector, the target group and network of influence in food services setting are represented by customers. The staff may also represent part of the network of influence, for example, by presenting the doggy-bag option as a standard choice for costumers. In kitchens, staff can be also considered the target group being influenced by norms on how to manage leftovers or food in general. In this setting, social norms are mainly descriptive. The main social role identified in this setting is the one of restaurants' guests and no conflict among roles was identified.

School food waste and relation with malnutrition and obesity (CS 4): In this context, teachers, parents, and students collectively form the target group as they are the primary entities involved in addressing school food waste, obesity, and malnutrition. They share a common interest in promoting healthier eating habits and reducing food waste within their school. The network of influence may be represented either by other parents, students and teachers within the same school or by schools that are actively addressing the same issues of school food waste, obesity, and malnutrition in their context. These reference schools can serve as examples of successful practices and experiences that can be adapted to the target school's specific circumstances. Considering teachers, families and students as a unique entity and target group of CS4, the social role that can be identified is the "educational and social change agents," since they are key players in promoting positive changes in the education, health, and social environment of schools. However, conflicts might arise as a good parent makes sure his/her children have plenty of food that they like at their disposal but they might feel also the expectation to provide healthy food that his/her children might not like (injunctive norms). Children on the other hand, may leave the food item in the lunch-box because they saw other peer groups are not finishing their lunch-box (descriptive) but they might afraid with parents will be angry if they do not eat (injunctive).

Food waste in food banks' mediated supply chain (CS 5): in this CS the target group includes food retailers, food processors, HORECA establishments, and NGOs involved in food redistribution processes within the supply chain, including individuals or entities directly engaged in the decision-making process. The network of influence can be represented by other representative of these categories (food retailers, food processors, HORECA, and NGOs). They influence each other's behaviours and decisions related to food waste in the donation mechanism. For instance, a food retailer may look to other retailers for best practices, while a restaurant owner within HORECA may consider the actions of fellow restaurant's owners. The actions and decisions of businesses and organizations within the network of influence can influence the behaviour of the target group, which is directly responsible for handling surplus food within the food banks' mediated supply chain. Social norms are related to the acceptability of donating suboptimal food and also the good provider identity declined in the context of company identity. Potential conflicts might arise between individual believes and company strategy or for example between the potential risks for reputation for providing bad food and the pressure to donate food as a philanthropic action.

Food waste in relation to date marking and sustainable and smart food packaging (CS 6): in this CS, the target group comprises consumers, who play a pivotal role in making informed choices related to food products, including understanding date labelling and sustainable packaging. Consumers might use smart food packaging to provide a more sustainable image of themselves while being puzzle by increased prices. Also, consumers might feel the expectation to not waste food but do not feel comfortable in using products after the best before day passed. The network of influence would typically encompass other consumers, consumer advocacy organizations, environmental groups, and

educational institutions that influence and guide responsible consumer behaviours. It is important to highlight that the age and generational differences within families may affect how the responsible consumer norm is perceived. Younger members may be more influenced by their parents or older relatives in adopting sustainable food practices. In this setting, social norms are manly injunctive, as they are related to the perceptions about what other expect in terms of consuming food close or after the best before date, or preserved with innovative packaging.

5 POTENTIAL WHAT-IF SCENARIOS EMERGING FROM CSS

To identify potential interventions, and in particular in order to identify what-if scenarios for the computational modelling task, a co-design activity was carried out with CHORIZO case studies' partners. The aim of the activity was to discuss case-specific relationships among actors that have emerged in the case studies, with particular reference to social norms.

5.1 In-home settings

Household food waste on and off crisis periods: One example in the literature has shown how in family and friends dining settings negatively-framed messages targeting injunctive norms are more effective than positively framed messages targeting descriptive norms. Designing interventions targeting in-house behaviours is particularly difficult, as it requires intervening in a private setting. CS1 highlighted the fact that one of the main problems in household food waste is that family members lack awareness about the quantity of food wasted. A potential in-house intervention to steer behavioural change is thus a communication campaign using social norm-based messages via communication materials (e.g., brochures) sent to the households by mail or through virtual channels. Another way to target in-house behaviour is to design and implement out-of-house interventions that target a behaviour that will be later adopted at home (e.g., prompts in restaurants conveying messages about consuming take-away leftovers; messages within supermarkets promoting the social acceptability to buy and consume sub-optimal food). Building on the central role of children within households, as potential network of influence for the "good provider" social norm, other social norms' interventions could be implemented within school settings, with the final objective of employing children as role models within households.

Food waste in relation to date marking and sustainable and smart food packaging: in the context of CS6 several impactful behavioural interventions may be at disposal. One potential strategy involves leveraging negatively-framed messages targeting injunctive norms, found to be more effective in altering consumer behaviour than positively framed descriptive norms. Educational campaigns can enlighten consumers about date labelling's significance to prevent unnecessary food discarding. In-store messaging in supermarkets that promote the acceptability of consuming sub-optimal food and restaurant initiatives that encourage taking home leftovers can also alter consumer behaviour positively. Regarding these possible interventions, "What-If" scenarios can be designed to explore a significant shift in consumer perceptions and behaviours favouring sustainable practices, possibly catalysed by social media campaigns or industry endorsements. Government policies standardizing date labelling and ensuring consumer-friendly consistency could significantly impact consumer behaviour. Youth-led movements or educational initiatives in schools can effectively shape the behaviour of both younger and older family members. These interventions and scenarios have the potential to significantly influence consumer behaviour in making choices related to food products, thereby contributing to reducing food waste concerning date marking and smart food packaging.

5.2 Out-of-home settings

In this case, social norms influence behaviours among actors outside households, e.g., in food services and in the hospitality sector.

Hospitality food waste: from CS2 it emerged that the generation of food waste is related to the lack of social acceptability to reuse ingredients for other meals. A possible intervention to change the underlying social norm may be to specifically promote dishes cooked by reusing ingredients as a virtuous practice, thus framing it in a positive way in order to enhance its acceptability.

Food services food waste: a potential behavioural change intervention with regards to food services food waste is the adoption of an opt-out strategy for the use of doggy-bags: overturning the common

situation in which costumers are the one that need to ask for a doggy-bag, offering it as a default choice would enhance its acceptability, framing it as a normal thing to do, and promote its use by diminishing the customers' effort.

5.3 Alternative settings

School Food Waste and Its Relationship with Obesity and Malnutrition: to address prevailing social norms and promote positive changes within the context of CS4, targeted interventions may involve providing tools and resources that promote healthier educational and nutritional practices, to address the role of agency of the actors involved. For example, teachers can be encouraged to lead initiatives related to nutrition and physical activity. Parents can be engaged through parent-teacher associations, participating in the formulation of school policies concerning nutrition and education. Students can also participate in decision-making processes, such as the selection of healthy food options available in the school cafeteria, the unity among children, parents, and teachers. It is also crucial to set the interventions on data driven information on understanding what and how much food is wasted and on the relationship between obesity and malnutrition. Also, some programs about the interdependence among pupils, parents and teachers can be set as intervention to plan structural educational initiatives aiming to break down traditional barriers and promote a shared vision of education and nutrition. Possible "what-if scenario" can be related to what would happen if a nutrition education program was implemented in a school.

Food Waste in a Food Banks' Mediated Supply Chain: to address the prevailing social norms and promote positive changes in the CS5 context, different interventions addressing different stakeholder relations can be deployed. Some potential behavioural interventions, that may target social norms encompass various approaches. On the one hand, a possible intervention might be collective awareness campaigns to promote good practices; on the other hand, the establishment of standardized guidelines for safe food redistribution as well as programs rewarding businesses committed to waste reduction may have an impact on FW reduction. Some "What-if" scenarios encompass exploring the potential impact of collaboration among major retail chains about donation practices, assessing the influence of government legislation supporting donations, and examining the role of NGOs in developing and advocating for collaborative redistribution models. Each proposed intervention and scenario play a pivotal role in shaping behaviours and decisions within the supply chain, fostering a collective commitment to reduce food waste, and improving donation practices among the involved stakeholders.

6   CONCLUSIONS AND THE WAY FORWARD

As anticipated in Section 5, the concept of social roles needs to be taken into consideration when designing interventions, as their effectiveness could be influenced by the different social roles and the conflict within and between them.

Starting from the list of actions (den Broeder, 2023. CHORIZO D1.2 See Appendix), This work explored also the different profiles that individuals may have in relation to social norms; then, an overview about characteristics and examples from the literature of interventions directly addressing social norms was provided, followed by a categorization of interventions that can indirectly address social norms by adopting different behavioural change mechanisms. As a following step, interventions regarding the in-home and out-of-home settings will be selected. Building on the knowledge and expertise of CHORIZO's case studies, selected interventions will be discussed and additional interventions will potentially be identified. The co-creation process with CSs will revolve around and will lead to the definition of:

- The selection of potential interventions (directly or indirectly addressing social norms);
- The setting in which the potential interventions can be implemented;
- The different individual profiles in relation to the norm;
- The target group and the network of influence;
- The relevant social roles in the setting, for the intervention and the norm itself;
- The possible conflicts arising from the social roles.

This activity will be of specific relevance for the future development of agent-based models, in particular for the definition of agent characteristics and rules of behaviours.

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8   APPENDIX: LIST OF CHORIZO DELIVERABLES

Deliverable Number	Deliverable Title
D1.1	Data protocol
D1.2	Evidence-based analysis of FLW actions/tools
D2.1	Case studies' Strategic Plans
D3.1	Conceptual framework for behavioural change understanding

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