



Deliverable 1.3

**Food Loss and Food Waste (FLW)  
Index**



## D 1.3

## Food Loss and Food Waste (FLW) Index

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## Executive summary

In an effort to provide comparative insight into the applicability of particular actions in specific cases of food waste (FW) generation, this deliverable (D1.3) has introduced two composite indices to be utilized as a metric to help stakeholders rank the different actions identified in D1.2. The two indices allowed for adherence to the requirements of the Chorizo Grant Agreement, but also provided an opportunity to build upon the work of the European Commission (food waste hierarchy pyramid), and highlight actions which demonstrated drivers of behaviour towards food waste.

The first index relates to what the action is in terms of where (at what stage) it is situated on the food waste hierarchy pyramid, as well as indicating the drivers for each action in accordance with the MOA (Motivation, Opportunity, Ability) Framework and social norms (SNs). The objective is that stakeholders can see where an action “ranks” on the pyramid, but also gain insight into what norms are driving it. When combining the two criteria of the food waste hierarchy pyramid, as well as the MOA Framework (and social norms), 43 actions occupied the top two spots (i.e. ranking either in first or second place). There was no particular geographic concentration of these actions evident as they spanned multiple and diverse countries across the EU member states, but they were all “prevention” actions in accordance with the food waste hierarchy pyramid, were predominantly in the food services or households (consumption) stages of the supply chain, and often were interventions that included raising awareness and providing knowledge to segments of the community about food waste and its repercussions.

The second index focused more on how the action has/is taking place, by addressing the dimensions requested in the Grant Agreement: impacts (economic, environmental, social), implementation feasibility, investment costs, socio-economic & economic cost/benefit, and expected sustainability (continuation in time). A common thread among nearly all the interventions is that they were very strong on identifying implementation challenges and addressing them. Generally, the top-ranked actions demonstrated clear and positive economic, social, and environmental impacts, as well as reducing food waste levels, and project funding was secured either on an annual basis or for the entirety of the project, while project implementation was achieved with multiple partners.

The information provided in this deliverable is meant to complement European Union (EU) research and project initiatives in this field. It can be built upon as more knowledge about interventions is accumulated over time, and can serve to supply information which can be actively utilized during the planning of policy and implementation of new interventions to address food waste.

These indices are dependent upon the actions identified in D1.2, and for this reason it is important that stakeholders have access to and refer to D1.2 for more detailed information about each action if needed.

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## Abbreviations and Acronyms

Acronym	Description
CBA	Cost – Benefit Analysis
EEA	European Environment Agency
EU	European Union
FW	Food Waste
FLW	Food Loss and Food Waste
GA	Grant Agreement
MOA	Motivation, Opportunity, Ability Framework
NGO	Non-Government Organization
R & I	Research & Innovation
SDGs	Sustainable Development Goals
SN	Social Norm

# 1. Introduction

## 1.1 Chorizo project summary

The Chorizo Project (“**C**hanging practices and **H**abits through **O**pen, **R**esponsible, and social **I**nnovation towards **Z**er**O** 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. The subsequent goal is two-fold: firstly, that the acquired knowledge be utilised to increase the effectiveness of decision-making and engagement of food chain actors in changing social norms towards zero food waste, and secondly that the research results from this project are embedded into innovation products that can foster change when it comes to food waste-related social norms. Behavioural insight is the essence of the project.

The project outputs build upon the work of the European Commission, such as the Farm to Fork Strategy within the European Green Deal, to promote sustainability and within that address food waste. Additionally, results from Chorizo complement the on-going work of key platforms, such as the European Consumer Food Waste Forum (ECFWF) and the EU Platform on Food Loss and Food Waste (FLW), towards achievement of the United Nation’s Sustainable Development Goals (SDGs). This relates in particular to target 12.3, which aims to cut in half per capita global food waste at the retail and consumer level and reduce food loss along the production and supply chain by 2030.

In order to understand what FLW actions have been and are taking place, and their current impacts, the Chorizo project started with a comprehensive evidence-based analysis of past and current FLW prevention actions (interventions) across the EU member states.<sup>1</sup> Desktop research, as well as interviews, were conducted with a wide range of stakeholders - from the private and public sector, non-government organizations, civil society organizations, think-tanks, educational institutions, to national and international FLW-related platforms. The core objective was to identify at least 300 actions and determine for which a more detailed analysis could place, in the interest of better understanding not only the economic, environmental, and social impact, but also behaviours regarding FLW. Deliverable 1.2 resulted in the identification of 395 actions and in-depth interviews with 46 of them. In order to supplement and enrich this evidence, Chorizo utilizes 6 real-life case studies to provide first-hand, primary data on how more specifically social norms affect behaviour in relation to FLW at different stages along the supply chain. All of this information in turn will be included in the modelling and predictive analytics portion of the project, with the aim of uncovering key correlations between social norms and behaviour towards food loss and waste, and thus providing insights into how people behave when it comes to food waste - and importantly, why (i.e. what is guiding their behaviour). New, more engaging, and effective communication and education packages will be produced, along with efforts to upscale, as well as capacity-building activities to not only foster change in social norms and behaviours, but to help all actors along the food supply chain to continue their efforts towards zero FLW.

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<sup>1</sup> Throughout this document the terms “action” and “intervention” are used interchangeably – i.e. given the same meaning, referring to any activity “designed to reduce the amounts of food waste generated at any point of the food supply chain” as noted in Caldeira et al. 2019: 9).



## 1.2 Deliverable overview and report structure

In an effort to provide comparative insight into the applicability of particular actions in specific cases of FW generation (such as in households, or in the food services industry for example), this deliverable (D1.3) focuses upon establishing a composite index to be utilized as a metric to help stakeholders rank the different actions identified in D1.2. The Chorizo project Grant Agreement (GA) calls for the main dimensions of the index to be: “impacts (economic, environmental, social), implementation feasibility, investment costs, socio-economic & economic cost/benefit, and expected sustainability (continuation in time)”. (European Commission 2022: 76).<sup>2</sup>

In order to adhere to the requirements of the GA, but to also build upon the work of the European Commission (food waste hierarchy pyramid), and highlight the uncovered drivers of behaviour towards food waste, two indices have been developed for D1.3.

The first index relates to what the action is in terms of where (at what stage) it is situated on the food waste hierarchy pyramid, as well as indicating the drivers for each action in accordance with the MOA (Motivation, Opportunity, Ability) Framework and social norms (SNs). The objective is that stakeholders can see where an action “ranks” on the pyramid, but also gain insight into what norms are driving it. Meanwhile, the second index is focused more on how the action has/is taking place, by addressing impacts of the intervention, implementation feasibility, investment costs, economic cost/benefit, and expected sustainability (continuation in time).

Deliverable 1.3 has two main chapters, in addition to the Introduction and Conclusion. In the first chapter an overview is provided of the methodology utilized to develop both indices. The following chapter discusses the results of both indices, with the objective of identifying any patterns which might help stakeholders gain insights into the applicability of an action. The two indices are attached as appendices to this deliverable.

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<sup>2</sup> European Commission. (2022). “Grant Agreement Project CHORIZO.” European Commission, European Research Executive Agency, (May): 1- 178.

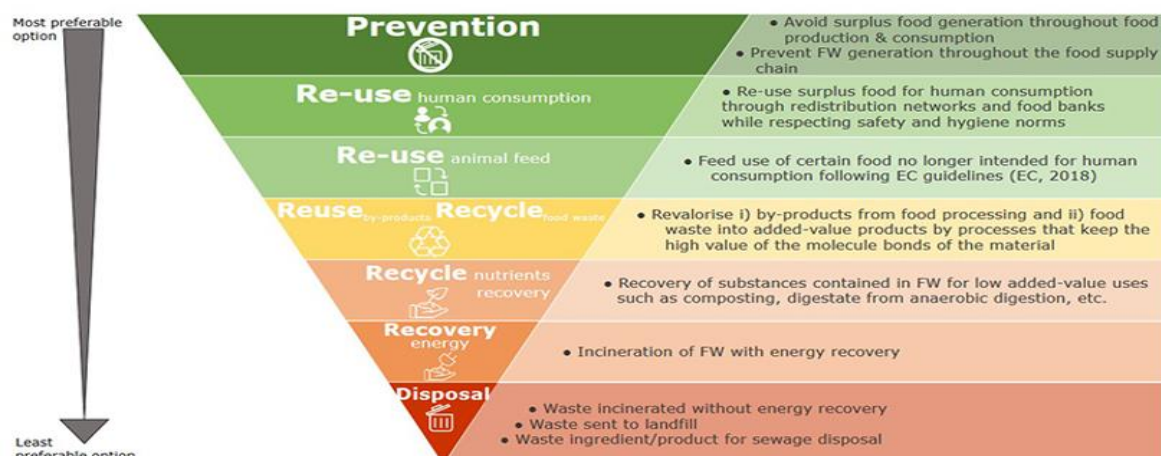
## 2. Index Methodology

### 2.1 Index 1: Food Waste Hierarchy, MOA and Social Norms

For the first index, the objective is to provide information that will allow stakeholders to see where an action addressing food waste “ranks” on the food waste hierarchy pyramid but also to what extent information is available about what determinants are driving it. This should help stakeholders determine how applicable a FW reduction action is to a specific context, and how pertinent it might be for themselves and their work – i.e. perhaps the action can be built upon, is a model to follow, or provides “lessons learned” in the sector when it comes to reducing FW and understanding what are the drivers of behaviour towards food waste.

The food waste hierarchy (Figure 1) is outlined in the European Commission’s 2020 Brief on Food Waste in the European Union, as well as DG Health and Food Safety (DG Sante).<sup>3</sup> The hierarchy necessitates a fundamental approach of prioritizing prevention and addressing food waste before it occurs, and if it is occurring, to address it then in the most resource-efficient manner. Those actions that ranked higher on the food waste hierarchy pyramid (i.e. prevention being the highest point), were awarded more points. The rationale being to acknowledge actions where the dominant approach is pro-active and measures are being put in place to avoid a particular situation (in this case food waste) from occurring, rather than a reactive approach of trying to find the best possible solution afterwards. Additionally, the index aims to establish a clear difference between what surplus food is intended for direct human use and what is not, and what must go through various stages (and therefore use resources) to create a new product that does not per se have a direct human destination. **The following point system was awarded: prevention (7 points), re-use for human consumption (5 points), re-use for animal feed (3 points), re-use of by-products and recycle of food waste (2 points), recycle for nutrient recovery (1 point), recovery for energy (0.5 points), and disposal (0 points).**

Figure 1: Food Waste Hierarchy Pyramid



Source: European Commission. (2020) *Brief on food waste in the European Union*. Brussels: The European Commission’s Knowledge Centre for Bioeconomy (page 8).

<sup>3</sup> DG Health and Food Safety website page:

[https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement\\_en](https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement_en)

The Motivation-Opportunity-Ability (MOA) framework considers food waste an unintended consequence of iterative decisions and behaviours driven both by internal (individual) and external (social and societal) factors (Vittuari et al. 2023). Initially designed for marketing research (MacInnis et al. 1991; Rothschild 1999), the MOA framework was proposed in 2016 within the EU Refresh project to systematically analyse drivers of consumer food waste behaviour (van Geffen et al. 2016) and progressively extended (Vittuari et al. 2021; Masotti et al. 2023). It is based on three theoretical constructs – motivation, opportunity, and ability (van Geffen et al. 2016). Motivation refers to what drives the individual to perform certain actions and is influenced by awareness of consequences, personal attitude, and social norms. Within this discussion there are two main types of social norms that impact motivation - injunctive and descriptive social norms. Injunctive norms refer to perceptions about normatively appropriate behaviour in a specific context and relies on the perception that an individual has about what kind of behaviour is approved or disapproved of by the reference group (Cialdini et al. 1991). Meanwhile, descriptive norms refer to an individual's perception about the likelihood that *others* engage in the normative behaviour, and the individual follows such behaviour because it is deemed effective and appropriate (Cialdini et al. 1991). It is based largely on observation of what is prevalent or common behaviour and is particularly relevant for new contexts and novel situations. Ability is the knowledge, skills, and capacity to change behavior, such as the capability of planning the purchase of food items, knowing how to prepare food, storing techniques, and being able to assess food safety via labeling. Opportunity refers to the availability and accessibility of materials and resources to change behavior such as time, technology, and infrastructure. **A straightforward point system was utilized for this portion of index one: motivation (1 point), opportunity (1 point), ability (1 point), injunctive or descriptive social norm (1 point).** As food waste is an unintended consequence of different drivers, it made sense to award actions that are built to address more than one cause. This point system rewards actions that address multiple different drivers of food waste.

## 2.2 Index 2: Impacts, Sustainability, Investment Costs, Cost-Benefit Analysis, Implementation Feasibility

In order to better understand how an action is being implemented, its' subsequent impacts, and projected sustainability over time, the second index is heavily based on the data obtained via in-depth interviews. It focuses on impacts (economic, environmental, social, food waste level), implementation feasibility, investment cost, economic cost/benefit, and expected sustainability (continuation in time).

For the impact category, 1 point was awarded each time a social, economic, and environment impact was taken into consideration and/or evident as a result of the action. An additional point was awarded each time there was more than one impact in each of these three categories. Another item included in the impact category was whether or not the action was able to lower the amount of food waste, with 1 point being awarded if this was the case.

Regarding sustainability (i.e. continuation in time) there is extensive literature on factors that ought to be considered in order to facilitate the longevity of a project - time management, budget, partnerships, are some examples (Khalifeh et al. 2020; Silvius and Schipper 2014). For

the purposes of index two, the factors that have been included in determining “sustainability” were dependent on literature review and where it aligned with the data obtained from interviews in D1.2, namely: timeframe of the action, financing, number of partners, and if the action included in its efforts baseline data, a monitoring system, and indicators to measure progress.<sup>4</sup> For the timeframe, there was broad scope in the number of years that an action was/is in operation, ranging from as little as a few weeks to 20 years. However, the majority of actions (30/46) had a range of over 3 years. Consequently, to ensure fairness in the point system, once an action was in operation for more than 3 years, it served as the cut-off point, with those actions receiving the maximum number of points – four (4) – and not more. For financing and partners, 1 point was awarded if there was financing, and if there was an implementing partner. An additional point was awarded if there was more than one source of financing and if there was more than one partner. For the baseline, monitoring system and accompanying indicators to measure progress, 1 point was awarded if there was utilization of a baseline, and a separate point if a monitoring system was put in place along with performance indicators. This builds upon the work of the European Commission (JRC report of 2019 on food waste prevention actions) where it was demonstrated that a baseline measurement is needed in order to know the current context of the proposed action, and to further ensure that advancement is being made during implementation, a systematic monitoring system measuring progress over time that includes performance indicators is optimal (Caldeira et al. 2019).

Before engaging in an intervention, the associated costs need to be taken into account. The availability of funding is key to ensuring that an intervention can be set-up and that it is maintained over a certain time-period. Preventing and addressing current food waste does entail a financial cost, and unless that cost can be compensated for in the future, it is unlikely that the intervention will last. For the purposes of this index, points were awarded in accordance with investment costs that were accounted for on either an initial (start of the action), annual, or whole project basis. The train of thought being if longer-term funding is foreseen and accounted for, it will help to ensure stability of the action.

The cost-benefit analysis (CBA) is a useful decision-making tool to help entities identify the financial costs and benefits associated with an intervention. The costs refer to the financial investment made to implement the action over a set period of time, while the benefits refer to the savings from avoided food waste treatment and savings from avoided food produced. The ideal value for the ratio is to equal or exceed 1.0, which would indicate that the expected profits equal or outweigh the costs, making the intervention financially feasible. If the ratio is less than 1.0 then the costs outweigh the benefits. Only those actions with a CBA of 1.0 or above were awarded 1 point.

To better understand implementation feasibility of an action, the challenges associated with implementation were utilized – first to determine if such challenges have been identified and if they are also being effectively addressed. One point was awarded for identification and another point for addressing the challenge. The ability to be aware of the challenge(s) is key, but as important is proactively addressing the challenge(s) so that the intervention can be successfully put in place.

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<sup>4</sup> Management of the economic, social, and environmental impacts are also key factors to determine sustainability, but these dimensions are already included in the index under “impact category”.

### 3. Results of the indices – any patterns?

#### 3.1 Index 1: Brief Overview

There were 43 actions which ranked either in first or second place based on where they were allocated on the food waste hierarchy pyramid, combined with if they were evident of motivation (including injunctive or descriptive social norms), opportunity, or ability to address food waste. There was **no particular geographic concentration** of these actions evident, as they spanned multiple and diverse countries. These interventions were predominantly in the **food services and households (consumption) stages combined (23)** of the supply chain, and often were interventions that included **raising awareness and providing knowledge to segments of the community about food waste and its repercussions**. Interestingly, all 43 interventions were **“prevention” actions** in accordance with the food waste hierarchy pyramid, and provided data in relation to MOA and social norms. Conversely, those actions which ranked among the lowest, were either re-use (by-products), recycle (food waste), recycle (nutrient recovery) or recovery (energy) allocated interventions, often falling into the processing and manufacturing (including valorisation) stage of the supply chain, providing limited information about the drivers of behaviour towards food waste, but also not subject to any particular geographic region.

**Table 1: Index 1 – Key characteristics of top-ranking actions (43)**

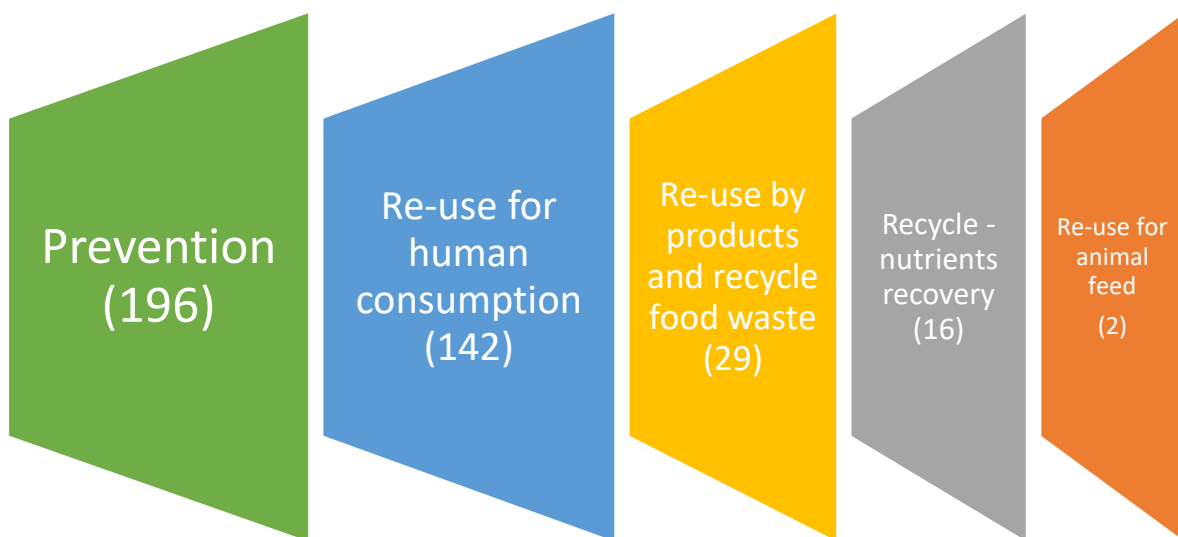
Food Waste Hierarchy Pyramid	Top Supply Chain Tiers	General Awareness Raising	Geographic Location	MOA and SN <sup>5</sup>
Prevention (43/43)	Food Services (15/43) Households (8/43)	General Awareness Raising Actions (12/43)	Denmark (7/43) Italy (5/43) Slovenia (4/43) Belgium (4/43) Spain (3/43) Germany (2/43) Portugal (2/43) EU-wide project (2/43) Poland (2) Finland (2) Croatia (1) Austria (1) Sweden (1) Malta (1) Luxembourg (1) France (1) Czech Republic (1) Hungary (1) Ireland (1)  National (23/43) Municipal (13/43) Regional (5/43) EU-wide (2/43)	M (43/43)  O (25/43)  A (35/43)  Descriptive SN (27/43)  Injunctive SN (3/43)

<sup>5</sup> It should be noted that more than one pillar of the MOA Framework may be indicative within a single action – i.e. possibility for all three facets to be evident, or only one or two. For SN there are instances where neither an injunctive or descriptive social norms was identified, based on the available data.

### 3.1.1 Food Waste Hierarchy

The actions identified by the Chorizo project reveal evidence of the hierarchy's implementation where from the 395 actions identified in D1.2, **approximately half of them (196 actions - i.e. 49%) were strictly "prevention" actions**, when classified in accordance with the food waste hierarchy. In terms of the other food waste hierarchy classifications, the second most prevalent classification in the actions identified was re-use for human consumption (142), followed by re-use by products and recycle food waste (29), recycle - nutrients recovery (16), recovery – energy (6), and re-use – animal feed (2).<sup>6</sup> None of the actions pertained to the disposal category. The figures indicate that the overall approach of these actions is that of being pro-active and measures are being put in place to avoid food waste from occurring, which is optimal.

**Figure 2: Index 1: Actions in accordance with the Food Waste Hierarchy Pyramid**



**Key message:** Approximately half (196) of the 395 actions identified were strictly “prevention” actions, when classified in accordance with the food waste hierarchy. This is important because it demonstrates a proactive approach in terms of preventing food waste from occurring in the first place, rather than addressing it afterwards.

<sup>6</sup> In addition to the afore mentioned, a few of the actions (4) fell into more than one category, namely:

- VALUEWASTE (Spain): re-use (by products from processing), recovery (energy) and re-use (animal feed)
- Lantmannen (Sweden): re-use (animal feed) and recovery (energy)
- Jardins Collectifs (France): prevention and recycle (nutrients recovery)
- Practical Guide on Food Cycle (Portugal): prevention and recycle (nutrients recovery).

For the purposes of the index however, regarding these actions, they received not multiple points, but rather were given points in accordance with their highest ranking on the pyramid. For example, for Jardins Collectifs, instead of being awarded points for both prevention and recycle (nutrients recovery), points were awarded in accordance with the highest category – i.e. prevention.

### 3.1.2 MOA Framework and Social Norms

Task 1.2 within the Chorizo project identified 395 actions within the EU that address food waste. These actions take place across the entire supply chain from primary production to consumption. Consequently, the ability to apply the MOA Framework and a social norm to all of these actions is not possible, since not all of the actions (or interventions) have been developed to try and change behaviour at an individual level. However, where identification was possible, of the three components within the MOA Framework, **opportunity was in fact identified the most frequently (240 actions – i.e. 60%), and was mainly concentrated in the primary production, redistribution, and retail stages of the supply chain.** When it came to opportunity, a common characteristic among the actions within these supply chain stages was the chance to provide **safe, surplus food to consumers** – whether that be via a food bank, charity organization, non-profit, on-line platform, directly from the farm, or ultimately a retailer, at a free or discounted price. When it came to social norms, **14 actions were deemed to be driven by injunctive social norms.** These actions involved either voluntary agreements, legislation, rewards, or punishments. There were **66 actions classified as driven by descriptive social norms.** Most of these actions took place within a **community context**, providing a common space to bring people together to eat, connect, learn new skills and reduce food waste. **Broader socio-environmental movements were also a common theme in actions driven by descriptive social norms, such as circular economy initiatives.**

Figure 3: Index 1 – Actions in accordance with the MOA Framework<sup>7</sup>



**Key message:** Opportunity was identified the most frequently (240 times) and was concentrated in the primary production, redistribution, and retail stages. A recurring characteristic within these stages was the chance to provide safe, surplus food to consumers at a free or discounted price. Descriptive social norms outnumbered injunctive ones, with community context / increased cohesion and broader socio-environmental movements being common themes.

<sup>7</sup> It should be noted that across the 395 actions, more than one pillar of the MOA Framework may be indicative within a single action – i.e. possibility for all three facets to be evident, or only one or two.

### 3.2 Index 2: Brief Overview

Four actions occupied the top two spots based on impacts, sustainability, investment costs, cost-benefit analysis, and implementation feasibility. These actions were **strong on ability to demonstrate economic, social, and environmental impacts**, as well as **reducing food waste levels**. Project **funding was secured either on an annual basis or for the entirety of the project**, while project implementation was achieved with **multiple partners**. Of these 4 actions, 3 were in the supply chain sector of redistribution. Conversely, for those actions ranking among the lowest, there was less information about impacts and reduction of food waste levels. These actions were not particular to a specific stage in the supply chain, but cut across several, including retail, food services, and households. **A common thread though among nearly all the interventions is that they were very strong on identifying implementation challenges and addressing them.**

**Table 2: Index 2 – Key characteristics of top-ranking actions (4)**

Geographic Location	Top Impacts	Food Waste	Financing and Partnerships	Investment Costs	Implementation Feasibility
Belgium (2/4) Finland (1/4) Hungary (1/4)	- Job creation - Safe food for those in need - Raising awareness about food waste - Increased community collaboration	Demonstrated reduction in food waste level (4/4)	Financing from more than 1 source (2/4)  More than 1 partner involved in the action (4/4)	Annual basis (3/4)  Whole project basis (1/4)	Implementation challenges identified and addressed (4/4)

#### 3.2.1 Impacts – Social, Economic, Environmental, Food Waste (FW)

From an economic perspective, food waste essentially equals lost money for all actors across the supply chain, including consumers. The food supply chain is a global, interconnected one with various actors working together to move a commodity through the supply chain. What occurs in one region of the world can affect the availability and price of the commodity in another part. Putting in place an intervention that complements and is part of an overall supply chain strategy to address food waste can **prevent monetary loss, in terms of production, storage, and distribution of the product**. In addition to this, common economic impacts across the interventions were **job creation (particularly in the circular economy), increased knowledge and skill sets, and the ability to innovate and sell new food products**.

The social impacts of the interventions were the **creation of jobs and skills, increasing awareness about food waste, enhancing community cohesiveness, and providing food to those most in need**. The additional jobs created due to the interventions were mainly in the sustainability and logistics sectors, while the skills acquired depended on the intervention itself, but ranged from marketing, logistics, purchasing, storage, and proficiency in software technology. The creation of new jobs and skills brought along as well an increased level of awareness about food waste, its repercussions, and how to prevent it. The ability to



redistribute food and thereby help people in need, was a common social impact among many of these actions. These actions not only helped people, but also created a more cohesive community as it necessitated, especially in the redistribution stage, the ability to work with different stakeholders.

Nearly all the interventions (40) in index 2 took into consideration and/or addressed environmental impacts as a result of the action. What these actions were overwhelming looking at was the **amount of greenhouse gas emissions (GHGs) prevented** due to addressing food waste in their initiative. However, by addressing food waste, this de facto already has positive environmental impacts including those outlined in the European Commission's Environmental Footprint Method. From the interviews conducted, there was a data gap when it came to comprehensive and systematic monitoring and evaluation of the environmental effects of an intervention. For the interventions where environmental data was not available, there were various reasons cited why this was the case, such as being a one-time event (a cooking class for example), but most often the reason noted was a **lack of resources to systematically include environmental indicators**.

Of the 46 actions for which interviews were conducted, **the majority of them (30) indicated that they were able to lower the amount of food waste via their intervention**. The interviews regarding actions in the retail, food services, redistribution, processing and manufacturing supply chain stages provided the most robust food waste information. Not all the interviews were able to obtain food waste prevention data. This was predominantly due to an initiative just getting underway (such as the Sprecometro app in Italy which started in 2023), or keeping in line with the overall objective of the Chorizo project of trying to better understand behaviour towards food waste – i.e. drivers, impediments, and opportunities to address it – some actions were not specifically geared towards measuring a reduction in food waste. Rather, they were geared towards raising awareness and knowledge about the issue and generate discussion as a starting point.

**Key message:** Positive socio-economic impacts via job creation, increasing awareness about food waste, enhanced community cohesiveness, and providing food to those in need. Majority of actions were able to lower amount of food waste via the intervention, leading to environmental benefits such as a reduction in greenhouse gas emissions, however, a continual challenge was comprehensive and systematic monitoring and evaluation of the environmental effects of an intervention.

### 3.2.2 Sustainability

All but 6 actions in index two scored at least a 7 out of 10 for sustainability. Key drivers of sustainability highlighted during the interviews were **funding and being embedded in an already established policy or project with other partners**. Similar to implementation challenges, ensuring adequate resources – whether it be financial or human resources – was the predominant answer in the interviews. While public – private funding, government funding, donations, or generating revenue via a business model within the intervention itself were all manners of obtaining necessary financial support, the need to have secure and steady

access to funding was paramount in order for the action to continue into the future. Emphasis was placed on securing funds early on during the planning and development phase of the action. Another important sustainability criteria was collaboration with an outside partner, and where possible, being part of a larger project or initiative – in essence aligning with and complementing those projects. Ultimately, funding was seen as the key ingredient to ensuring sustainability but building relationships with other stakeholders and complementing or building upon their work, provided the opportunity to become part of a larger effort or movement, increasing the relevance, visibility, and longevity of a project.

For nearly half (19) of the actions in the index **baseline data, implementation of a monitoring system and performance indicators to track progress was not available**. Interestingly, in several interviews when the issue was raised about baseline measurements and monitoring activities, it prompted a discussion, raising the interviewee's awareness about the importance of including such an approach and data. Wherever possible, establishing a baseline and effectively monitoring progress should be an essential part of an intervention. Such an approach helps to explain the social, economic and environmental context within which the action is operating, increases transparency about implementation, and provides valuable information for future interventions as well as policy design.

**Key message:** Funding is a key ingredient to ensure sustainability, but building relationships with other stakeholders and complementing or building upon their work, provided the opportunity for an initiative to become part of a larger effort or movement, increasing the relevance, visibility, and longevity of an intervention. Generally, more attention is needed though to ensure that interventions utilize a baseline and put in place a monitoring system with indicators to measure progress over time.

### 3.2.3 Investment Costs

Investment costs were retrieved for 20 of the actions. Of these 20 interventions, for 9 of them the investment costs are an average annual figure, while for 5 of them it relates to investment costs over the whole duration of the project, and for the remaining 6 actions it refers solely to the initial investment costs. The range of investment costs varied from EUR 270 per year (Budapest Bike Mafia in Hungary) to EUR 27.2 million over several years (2019 – 2026) for LIFE IP Care 4 Climate in Slovenia, reflecting the **vast diversity in the amount and duration of funding**. The amount of investment depends on an array of factors – timeframe of the intervention, necessary infrastructure, human resources, and technology costs to name a few examples.

**Key message:** The actions reflect a vast diversity in the amount and duration of the funding. However, from the investment costs retrieved, the majority of them were established for either an annual or whole project basis.

### 3.2.4 Cost-Benefit Analysis

From the pool of data accessed via interviews it was possible to calculate a cost benefit ratio for 5 interventions.<sup>8</sup> In order to run as precise as possible cost-benefit ratios, the investment costs time-period had to align directly with the timeframe for the amount of food waste prevented. Consequently, although food waste prevention amounts are available for more than these 5 interventions, if they are not in direct alignment with the investment cost timeframe, the cost-benefit ratio has not been calculated. Within the actions, all 5 of them were above the 1.0 threshold. Understandably, **the highest ratios belonged to actions which had minimal or no infrastructure costs and/or were volunteer-driven.**

**Key message:** The highest ratios (i.e. above the 1.0 threshold) belonged to actions which had minimal or no infrastructure costs and/or were volunteer-driven, allowing the benefits to outweigh the costs.

### 3.2.5 Implementation Feasibility

Several internal and external implementation challenges were evident – namely **funding, internal management and human resources, technology, quality standards, logistics, as well as effective collaboration with outside partners, Covid-19 pandemic, and rising inflation.** The technology challenges were most evident in the processing and manufacturing sector when it came to valorisation.<sup>9</sup> Closely linked to valorisation was the issue of quality standards for the new food products being produced and ensuring that there was staff with relevant expertise to help move the process forward. Technological impediments were also highlighted regarding several apps. The logistical challenges were most evident in the retail and redistribution sector, particularly with non-profit and civil society organizations where they were responsible for the transportation of food. Identifying what partners to work with, and at what stage of the distribution process was key to distribution success. Funding was often cited as a challenge, in particular with start-ups and the non-profit sector. Current inflation and the rise in energy costs also played a role in terms of being able to access and ensure adequate storage and transportation of food. The Covid-19 pandemic was cited several times with it either halting an intervention (such as the “Foodie Save” app in Ireland which suspended operations during the pandemic) or making it more difficult to accomplish objectives – in particular where person-to-person contact would normally have taken place.

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<sup>8</sup> Although data was available for the intervention Food Waste Fighters (Ireland), the data could not be run through the calculators because the total amount of food waste prevented was less than 1 kilogram, and the calculators require a minimum of either 1 kg (European Commission (JRC) Food Waste Prevention Calculator) or 1 tonne (Food Loss + Waste Protocol – FLW Value Calculator).

<sup>9</sup> Valorisation refers to any processing activity whereby food is transformed into a range of value-added products.  
European Commission. (2020). *Brief on food waste in the European Union*. Brussels: The European Commission’s Knowledge Centre for Bioeconomy (p. 1).

Interestingly, nearly all the interventions (exception of only 4 interventions) **performed strongly on implementation by identifying challenges and effectively addressing them.**

**Key message:** Implementation challenges included funding, internal management and human resources, technology, quality standards, logistics, effective collaboration with outside partners, the Covid-19 pandemic, and rising inflation and energy costs. Nearly all the interventions performed strongly on identifying challenges and effectively addressing them.

## 4. Conclusions

In an effort to provide comparative insight into the applicability of particular actions in specific cases of FW generation, this deliverable (D1.3) has introduced two composite indices to be utilized as a metric to help stakeholders rank the different actions identified in D1.2. The two indices allowed for adherence to the requirements of the GA, but also provided an opportunity to build upon the work of the European Commission (food waste hierarchy pyramid), and highlight actions which demonstrated drivers of behaviour towards food waste.

The first index helps stakeholders to see where an action “ranks” on the food waste hierarchy, while providing insights into what norms are driving it. There were 43 actions which ranked either in first or second place based on where they were allocated on the food waste hierarchy pyramid, combined with if they were evident of motivation (including injunctive or descriptive social norms), opportunity, or ability to address food waste. **These interventions were predominantly in the food services or households (consumption) stages** of the supply chain, and often were interventions that included **raising awareness and providing knowledge to segments of the community about food waste and its repercussions**. All 43 interventions were “**prevention**” actions in accordance with the food waste hierarchy pyramid - indicating a pro-active approach to address food waste before it occurs - and provided data in relation to MOA and social norms. **Opportunity was identified the most frequently (240 actions), 14 actions were driven by injunctive social norms, while a much larger number of actions (66) were driven by descriptive social norms**. A community context was often prevalent - providing a common space to bring people together to eat, connect, learn new skills and reduce food waste - while broader socio-environmental movements, such as circular economy initiatives, were also a common theme in actions driven by descriptive social norms.

The second index focused on impacts (economic, environmental, social), implementation feasibility, investment costs, socio-economic & economic cost/benefit, and expected sustainability (continuation in time). These actions were **strong on ability to demonstrate economic, social, and environmental impacts**, as well as **reducing food waste levels**. **Project funding was secured either on an annual basis or for the entirety of the project**, while **implementation was achieved with multiple partners**. It is apparent that longer-term funding and being embedded with a partner are key factors within implementation and sustainability feasibility.

There were two key areas however, where more attention needs to be given by implementers of actions, as well as public policy to support such measures. For nearly half of the actions in the second index, **information about baseline data accompanied by implementation of a monitoring system and performance indicators to track progress, was not available**. There are several reasons for this though which should be taken into account, such as projects that are only recently in operation, resources, or the data exists, but is not accessible enough (i.e. not readily available on a website for example). Wherever possible, establishing a baseline and effectively monitoring progress should be an essential part of any intervention in order to facilitate its’ success, but to also provide important information for future projects and policy. **Another evident gap was comprehensive and systematic tracking of environmental effects of an intervention**. There were various reasons cited why this was the case, such as

being a one-time event (a cooking class for example), but most often the reason noted was **lack of resources, such as funding, skill set, and technology to track environmental impacts.**

The indices have been formulated based on the criteria outlined in the GA, as well the food waste hierarchy and the crux of the Chorizo project – identifying and thereby gaining knowledge about the drivers of behaviour towards food waste. These indices, in particular index number two, have been calculated based on a minimum available dataset (i.e. the absolutely required data), and they can be expanded and improved upon in the future as additional data becomes available from action implementers and relevant stakeholders throughout the supply chain.

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## 6. Appendices

### APPENDIX 6.1 - Glossary of Terms

<u>FOOD CHAIN STAGE:</u>		<u>SOURCE:</u>
<b>Primary Production:</b> The production, rearing or growing of primary products, including harvesting.		Eurostat. (version of June 2022). Guidance on reporting of data on food waste and food waste prevention according to Commission Implementing Decision (EU) 2019/2000. Luxembourg: Publications Office of the European Union (p. 36).
<b>Processing and Manufacturing:</b> The first processing and manufacturing of food after the primary production and before the retail and other distribution stage of the food supply chain.		Ibid.
<b>Valorisation:</b> Any processing activity whereby food is transformed into a range of value-added products.		European Commission. (version 2020) Brief on food waste in the European Union. Brussels: The European Commission's Knowledge Centre for Bioeconomy (p. 1).
<b>Transportation:</b> The transportation of food at any stage in the supply chain.		CHORIZO Project WP 1: Glossary of Key Terms.
<b>Retail:</b> The handling of food and its storage at the point of sale or delivery to the final consumer - includes distribution terminals, shops, supermarkets distribution centres, wholesale outlets.		Eurostat. (version of June 2022). Guidance on reporting of data on food waste and food waste prevention according to Commission Implementing Decision (EU) 2019/2000. Luxembourg: Publications Office of the European Union (p. 36).
<b>Redistribution:</b> To redistribute surplus food fit for human consumption.		Caldeira, Carla, Valeria De Laurentiis, and Serenella Sala. (2019). <i>Joint Research Centre Technical Report: Assessment of food waste prevention actions.</i>

		Luxembourg: Publications Office of the European Union (page 12).
<b>Food Services:</b> Includes catering operations, factory and school canteens, institutional catering, restaurants, hotels, hospitals, cafes, and other similar food service operations.		Eurostat. (version of June 2022). Guidance on reporting of data on food waste and food waste prevention according to Commission Implementing Decision (EU) 2019/2000. Luxembourg: Publications Office of the European Union (p. 36).
<b>Households:</b> Consumption of food in the household or small residential facilities.		Ibid.
<b>General Awareness-Raising:</b> Focus on increasing overall, broad, awareness about food loss and waste - campaigns, forums, platforms, exchange of information / ideas.		CHORIZO Project WP 1: Glossary of Key Terms.
<b>Whole Supply Chain:</b> Address food loss and food waste along all stages of the supply chain.		CHORIZO Project WP 1: Glossary of Key Terms.

<u>FOOD WASTE HIERARCHY:</u>		<u>SOURCE:</u>
<b>Prevention:</b> Avoiding surplus food generation throughout food production & consumption. Prevent FW generation throughout the food supply chain.		European Commission. (2020) Brief on food waste in the European Union. Brussels: The European Commission's Knowledge Centre for Bioeconomy (page 8).
<b>Re-use (human consumption):</b> Re-use surplus food for human consumption through redistribution networks and food banks while respecting safety and hygiene norms.		Ibid.

<b>Re-use (animal feed):</b> Feed use of certain food no longer intended for human consumption following EC guidelines.		Ibid.
<b>Re-use (by-products) / Recycle (food waste):</b> Revalorise (i) by products form food processing and (ii) food waste into added-value products by processes that keep the high value of the molecule bonds of the material.		Ibid.
<b>Recycle (nutrients recovery):</b> Recovery of substances contained in FW for low added-value uses such as composting, digestate from anaerobic digestion.		Ibid.
<b>Recovery (energy):</b> Incineration of FW with energy recovery.		Ibid.
<b>Disposal:</b> Waste incinerated without energy recovery, waste sent to landfill, waste ingredient/product for sewage disposal.		Ibid.

<u>MOA FRAMEWORK:</u>		<u>SOURCE:</u>
<b>Motivation:</b> The intention of an individual to perform certain actions, as avoiding household food waste. It is influenced by the personal awareness of consequences of food waste, personal attitudes as well as injunctive and descriptive social norms. When social norms are in place, an individual who perceives themselves as a member of the norm's target		Vittuari, Matteo, Matteo Masotti, Elisa Iori, Luca Falasconi, Tullia Gallina Toschi, Andrea Segrè. (2021). "Does the COVID-19 external shock matter on household food waste? The impact of social distancing measures during the lockdown." <i>Resources, Conservation and Recycling</i> , Volume 174, pp. 1 – 11.  Vittuari, Matteo, Laura Garcia Herrero, Matteo Masotti, Elisa Iori, Carla Caldeira, Zhuang Qian, Hendrik Bruns, Erica van

<p>group feels that a certain action is expected from them as a group member.</p>		<p>Herpen, Gudrun Obersteiner, Gulbanu Kaptan, Gang Liu, Bent Egberg Mikkelsen, Richard Swannell, Gyula Kasza, Hannah Nohlen, Serenella Sala. (2023). "How to reduce consumer food waste at household level: A literature review on drivers and levers for behavioural change." <i>Sustainable Production and Consumption</i>, Volume 38, pp. 104 - 114.</p> <p>MOA Framework: Construct Definitions; internal document CHORIZO WP 3.</p>
<p><b>Ability:</b> The knowledge, skills, and individual capacities to solve the problems encountered when changing behaviour, including breaking well-formed habits and routines. In food waste domain it is related to the capability of planning the purchase and preparation of food, the proficiency with food preparation skills, the knowledge of storing techniques, the capacity to assess food safety (e.g., through the understanding of labelling), and more in general, to the personal level of food literacy.</p>		<p>Ibid.</p>
<p><b>Opportunity:</b> The availability and accessibility of materials and resources needed to change behaviour such as time, technology, and infrastructures that allow an individual to perform the intended. In the food domain it relates to the actual or perceived availability of time for grocery shopping, cooking, stocking capacity, kitchen tools, learning new food-related skills (non-material resources), access to grocery stores, and to purchase affordable and quality food in</p>		<p>Ibid.</p>

suitable packs and portions (material resources).		
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<u>SOCIAL NORMS:</u>		<u>SOURCE:</u>
<p><b>Social norms:</b> Rules/guides for actions perceived by individuals aspiring/belonging to the norm’s target group as expected by others. In reality, usually either the target in-group or out-group members (or both) accept the social norms as rules/guides and usually do expect the normative action.</p>		<p>MOA Framework: Construct Definitions; internal document CHORIZO WP 3.</p> <p>Bicchieri, C. (2006). <i>The Grammar of Society: The Nature and Dynamics of Social Norms</i>. Cambridge and New York: Cambridge University Press.</p> <p>Weber, M., &amp; Tribe, K. (2019). <i>Economy and Society: A New Translation</i>. Cambridge: Harvard University Press.</p>
<p><b>Descriptive social norm:</b> The normative action is followed by an individual as it is perceived to be effective in a given situation, rather than because of perceived expectations of others. Descriptive social norms refer to prevalent or common behaviour, and they reflect perceptions about the likelihood that others engage in the normative behaviour themselves.</p>		<p>MOA Framework: Construct Definitions; internal document CHORIZO WP 3.</p> <p>Cialdini, R. B., C.A. Kallgren, and R.R. Reno. (1991). “A Focus Theory of Normative Conduct: A Theoretical Refinement and Re-evaluation of the Role of Norms in Human Behaviour.” <i>Advances in Experimental Social Psychology</i>, Volume 24, pp. 201–234.</p>
<p><b>Injunctive social norm:</b> There exists a reinforcing mechanism through which (dis)approval of (non)conformity are expressed. Additionally, observing the members of the target group conforming to the norm (and possibly receiving a reward for conformity) or/and seeing the members of the target group punished for non-compliance provide validation that the norm exists. Injunctive social norms indicate perceptions about</p>		<p>MOA Framework: Construct Definitions; internal document CHORIZO WP 3.</p> <p>Cialdini, R. B., C.A. Kallgren, and R.R. Reno. (1991). “A Focus Theory of Normative Conduct: A Theoretical Refinement and Re-evaluation of the Role of Norms in Human Behaviour.” <i>Advances in Experimental Social Psychology</i>, Volume 24, pp. 201–234.</p>

normatively appropriate behaviour in a specific context.		
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<u>OTHER:</u>		<u>SOURCE:</u>
<b>Food or Foodstuff:</b> “Any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans.” <sup>10</sup>		Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety (OJ L 31, 1.2.2002, p. 7). <sup>11</sup>
<b>Waste:</b> “Any substance or object which the holder discards or intends to, or is required to discard.”		Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, p. 3). <sup>12</sup>
<b>Food Waste (FW):</b> All food as defined in Article 2 of Regulation (EC) No 178/2002 of the European Parliament and of the Council that has become waste.		Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, p. 4, point 4a).
<b>Food Waste (FW) Action:</b> Any activity designated to reduce the amount of food waste generated at any point in the food supply chain.		Caldeira, Carla, Valeria De Laurentiis, and Serenella Sala. (2019). <i>Joint Research Centre Technical Report: Assessment of food waste prevention actions</i> . Luxembourg: Publications Office of the European Union (p. 9). <sup>13</sup>
<b>Greenhouse Gas:</b> A gas that contributes to the natural		Directive 2003/87/EC of the European Parliament and of the Council of 13

<sup>10</sup> Please refer to legislation for what is not considered food - generally: feed, live animals (unless they are prepared for placing on the market for human consumption), plants prior to harvesting, medicinal products, cosmetics, tobacco and tobacco products, narcotic or psychotropic substances, residues or contaminants.

<sup>11</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002R0178&from=EN>

<sup>12</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008L0098-20180705&from=EN>

<sup>13</sup> <https://publications.jrc.ec.europa.eu/repository/handle/JRC118276>



<p>greenhouse effect – i.e. trapping heat within the atmosphere.<sup>14</sup></p>		<p>October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, p. 34 and 43).<sup>15</sup>  <a href="https://www.eea.europa.eu/help/glossary/eea-glossary/greenhouse-gas">https://www.eea.europa.eu/help/glossary/eea-glossary/greenhouse-gas</a>          (The European Environment Agency)</p>
<p><b>Climate Change:</b> All inputs and outputs that result in greenhouse gas emissions (GHGs). The consequences include increased average global temperatures and sudden regional climatic changes.</p> <p>(Indicator: Radiative forcing as Global Warming Potential (GWP100))</p> <p>(Unit of Measurement: kg CO2 eq.)</p>		<p>Caldeira, Carla, Valeria De Laurentiis, and Serenella Sala. (2019). <i>Joint Research Centre Technical Report: Assessment of food waste prevention actions</i>. Luxembourg: Publications Office of the European Union (page 92).</p> <p>EUR-Lex. (2021). “European Commission Recommendation on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (C/2021/9332 Final)” (Annex 1, page 8).</p>
<p><b>Land Use:</b> Use (occupation) and conversion (transformation) of land area by activities such as agriculture, forestry, roads, housing, mining, etc.</p> <p>(Indicator: Soil quality index)</p> <p>(Unit of Measurement: Pt)</p>		<p>EUR-Lex. (2021). “European Commission Recommendation on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (C/2021/9332 Final)” (Annex 1, page 10).</p>
<p><b>Water Use:</b> Represents the relative available water remaining per area in a watershed, after demand from humans and aquatic ecosystems has been met.</p>		<p>EUR-Lex. (2021). “European Commission Recommendation on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (C/2021/9332 Final)” (Annex 1, page 15).</p>

<sup>14</sup> The EU abides by seven specific gases in this category, in alignment with the U.N. Kyoto Protocol: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, nitrogen trifluoride. Emissions of these gases taken together are to be measured in terms of carbon dioxide equivalents on the basis of the gases' global warming potential.

<sup>15</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0087&from=EN>

<p>(Indicator: User deprivation potential (deprivation weighted water consumption)</p> <p>(Unit of Measurement: m<sup>3</sup> world eq. deprived)</p>		
<p><b>Eutrophication (freshwater):</b> Refers to the loss of biodiversity due to the accelerated growth of algae and other vegetation in freshwater and marine water This accelerated growth is due to nutrients (mainly nitrogen and phosphorus) from food waste.</p> <p>(Indicator: Fraction of nutrients reaching freshwater end compartment (P)</p> <p>(Unit of measurement: kg P eq.)</p>		<p>EUR-Lex. (2021). “European Commission Recommendation on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (C/2021/9332 Final)” (Annex 1, page 9).</p>
<p><b>Eutrophication (marine water)</b> Refers to the loss of biodiversity due to the accelerated growth of algae and other vegetation in freshwater and marine water This accelerated growth is due to nutrients (mainly nitrogen and phosphorus) from food waste.</p> <p>(Indicator: Fraction of nutrients reaching marine end compartment (N)</p> <p>(Unit of measurement: kg N eq.)</p>		<p>EUR-Lex. (2021). “European Commission Recommendation on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (C/2021/9332 Final)” (Annex 1, page 9).</p>

## **APPENDIX 6.2 – Index 1: Food Waste Hierarchy, MOA Framework and Social Norms**

- Please refer to attached excel document “CHORIZO\_D1.3\_INDEX ONE\_FINAL\_29.09.2023”, which can be found on our website: [www.chorizoproject.eu](http://www.chorizoproject.eu).

## **APPENDIX 6.3 – Index 2: Impacts, Sustainability, Investment Costs, Cost-Benefit Analysis, Implementation Feasibility**

- Please refer to attached excel document “CHORIZO\_D1.3\_INDEX TWO\_FINAL\_29.09.2023”, which can be found on our website: [www.chorizoproject.eu](http://www.chorizoproject.eu).

# CHORIZO PROJECT

