CHORIZO PROJECT

Deliverable 1.2

Evidence-based Analysis of Food Loss and Food Waste (FLW) Prevention Actions

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D 1.2

Evidence-based Analysis of Food Loss and Food Waste (FLW) Prevention Actions

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Executive summary

The CHORIZO project aims to improve the **understanding** about how **social norms** (rules and expectations that are socially enforced) influence behaviour related to food waste generation. In order to understand what food loss and food waste (FLW) actions have and are taking place, and their current impacts, the project started by undertaking a comprehensive evidence-based analysis of actions addressing FLW.

This report provides a **comprehensive overview of past and current FLW prevention actions identified across EU member states** within task 1.2 of the CHORIZO project. The analysis explores various facets of the actions, including food waste prevention levels, implementation challenges, the broader social, economic, and environmental impacts, gender considerations, and to what extent the interventions illuminate social norms at play that affect behaviour towards food waste.

The report is accompanied by a series of **appendices** including a complete list of all the interventions identified in task 1.2, several other lists in accordance with subjects discussed in the report, datasets identified, and summaries of conducted interviews.

To facilitate utilization of this report the following is highlighted for stakeholders:

Introductory chapter and chapter 2: An overview of the CHORIZO project, followed by explanation about the **methodology** and timeline in respect to the work executed, outlining data collection and data analyses techniques, as well as risks and mitigation measures.

Chapter 3: Dedicated to discussing the **actions identified** during desktop research. Includes classification in accordance with the **food waste hierarchy**.

Chapter 4: More in-depth analysis of selected actions via interviews, providing key data and discussion about implementation challenges, sustainability, **level of food waste** addressed, the **nutritional, economic, environmental,** and **social impacts.**

Chapter 5: Analysis using the **Motivation** (including **social norms**), **Opportunity**, and **Ability** Framework, and what the application of that framework has meant in terms of drivers of behaviour towards food waste.

Chapter 6: Dedicated to gender in light of what role **gender relations** have in the social and economic context that shape the functioning of food value chains and behaviour towards food waste.

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 and implementation of new interventions to address food waste.

Table of Contents

Horizon Europe

List of Tables

Horizon Europe

List of Figures

Horizon Europe

Abbreviations and Acronyms

Acronym	Description
CBA	Cost – Benefit Analysis
EEA	European Environment Agency
EU	European Union
FAO	Food and Agriculture Organization
FW	Food Waste
FLW	Food Loss and Food Waste
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). In particular this relates 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.[1] The evidence-based analysis explored FLW prevention levels, as well as the broader social, economic, and environmental impacts of the actions. In order to supplement and

[1] 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).

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.

1.2 Deliverable overview and report structure

In the interest of understanding which FLW interventions have been and are currently taking place, and their existing impacts, the project began by undertaking a comprehensive evidence-based analysis of actions addressing FLW (Deliverable 1.2). 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.

This deliverable has five chapters, in addition to the Introduction and the Conclusion. An overview is first provided of the methodology and timeline in respect of the work done for this deliverable, outlining data collection and data analyses techniques, as well as risks and mitigation measures. Two chapters are dedicated specifically to the actions identified. The first of those (chapter three) provides an overview of all the actions, while the other (chapter four) is a more in-depth analysis of selected actions providing key data and discussion about, but not limited to, the level of food waste addressed, the

economic, environmental and social impacts, sustainability, and implementation feasibility. Chapter five focuses on the Motivation (including social norms), Opportunity, and Ability (MOA) Framework, and what the application of that framework has meant in terms of drivers of behaviour towards food waste. The penultimate chapter is dedicated to gender, in light of the role gender relations have in the social and economic context that shapes the functioning of food value chains and food waste.

2. Framework of the assessment

2.1 Methodology and timeline

In order to provide a broader context of what interventions have and are taking place in the EU to address FLW, and further build upon previous and current EU research and projects initiatives in this sector, for Deliverable 1.2, over the course of seven months (January 2023-July 2023) the Chorizo project set out to: i) identify at least 300 actions that address FLW across the EU-27 member states, and (ii) to collect where possible, the FLW datasets pertaining to these actions. In order to achieve these objectives, 10 partners within the Chorizo project consortium participated in the task. The Chorizo Grant Agreement (GA) outlined 14 points of information to be obtained for actions after "a first assessment of all gathered information was performed" and a determination made regarding which actions were deemed most relevant for more in-depth analysis (European Commission 2022: 112).[2] All activities and their results were to be reported in an Evidence Search Plan.

The 14 points were as follows:

1. Name of the action
2. Food chain stage
3. Country
4. Action duration
5. Actors involved
6. Goals and objectives
7. Role of the action
8. Overall impacts of the action
9. Investment and pay-back period
10. Social norms and behavioural aspects impacted
11. Sustainability of the action
12. Available datasets

[2] European Commission. (2022). "Grant Agreement Project CHORIZO." European Commission, European Research Executive Agency, (May): 1- 178.

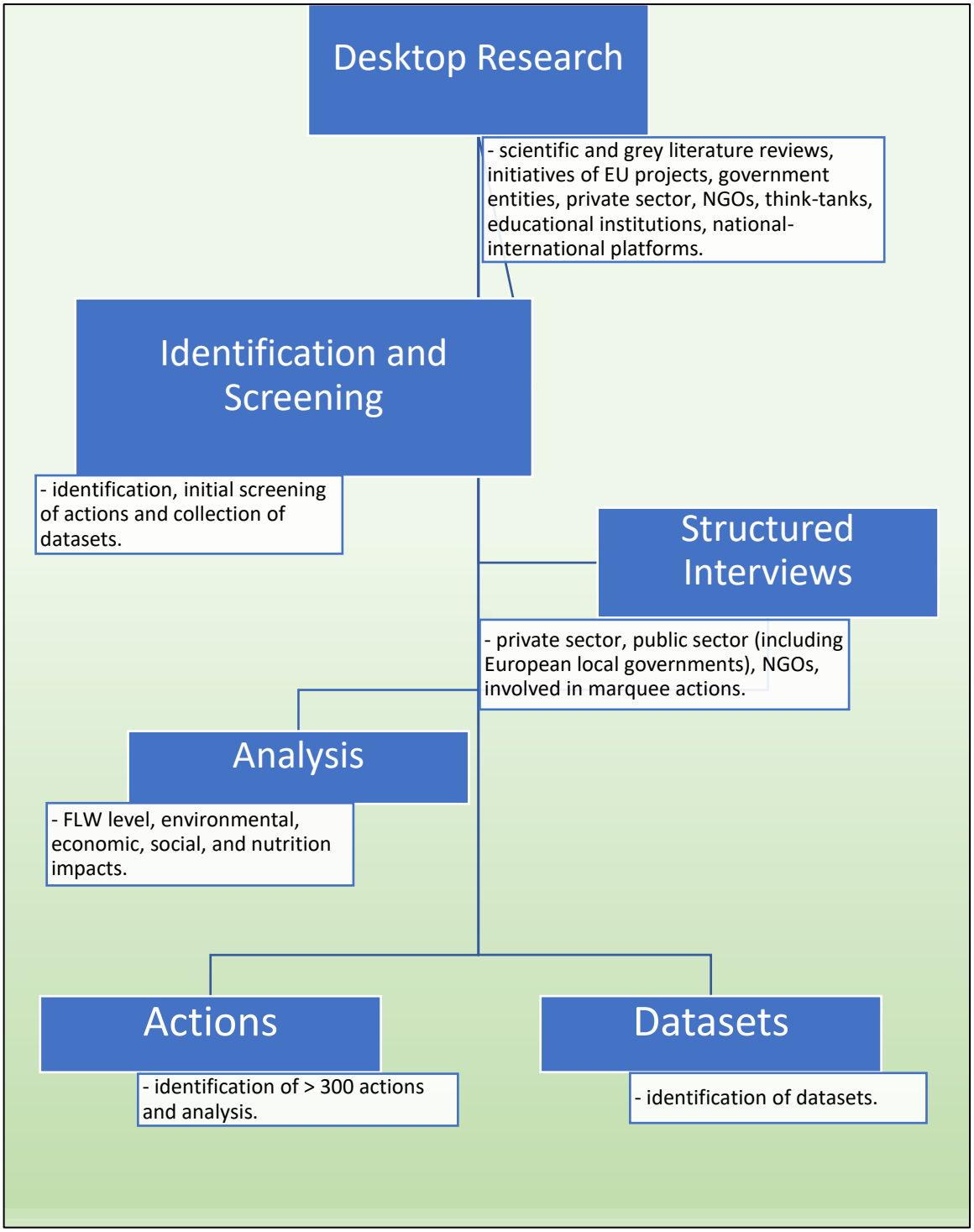
13. Identified research and innovation (R&I) hotspots

14. Concluding statement that includes assessment of the quality, validity, and consistency of the evidence.

To achieve both objectives and obtain the afore-mentioned 14 points of information, the task was divided into three main parts – desktop research, thereafter structured interviews, and finally analysis. Throughout the process an Evidence Search Plan was utilized providing an overview of each stage of the work, dividing it further into separate phases, and results were correspondingly reported in the accompanying Standardized Reporting Template (excel document).[3]

[3] Both the Evidence Search Plan and the Standardized Reporting Template are available in the Appendices of this deliverable.

Figure 1: Overview of Chorizo Task 1.2 - Evidence-based analysis of FLW actions and identification of datasets



2.1.1 Data collection: research and interviews

Data collection consisted of both desktop research and in-depth, structured interviews. The desktop research was not limited to, but did include scientific and grey literature reviews, as well as exploration of FLW-related work and initiatives done by EU projects, municipal, regional and national governments, the private sector, non-government organizations (NGOs), think-tanks, educational institutions, and national-international platforms. Research took place during the first two months (January and February 2023) of the task, and was divided geographically – i.e. partners initiated their research based on where they were located. The rationale was to encourage minimal over-lap with other partners, as well as provide easier access if needed to the actors responsible for an action. The task aimed to have a good overview of actions right across Europe, and so this distributed approach was taken in order to utilise local language and knowledge of context to best identify initiatives across countries. Project partners were given a guidance document outlining the approximate time-period to research (from at least 2015 onwards), the importance of focusing on the entire supply chain (all stages), as well as a cross-section of actors in the food chain, across all EU member states. Guidance also included possible sources for the literature review (i.e. on-line sources, journals), keyword searches, and key European Commission websites. Results of the research phase were recorded in the Standardized Reporting Template.

Once the research phase was completed, based on the results, a first assessment (screening) was done to determine which of the actions identified would be eligible for further investigation in the form of in-depth, structured interviews. The following criteria were initially used to determine if an interview should take place in regards to an action: (i) If the action utilised baseline data; (ii) targets and objectives were specified to take place within a certain time period; (iii) a monitoring system was put in place of track progress in achieving the targets and objectives; (iv) appropriate Key Performance

Indicators (KPIs) were put in place, tailored to the action.[4] However, **in practice it was difficult to obtain all of this information based only on desktop research**. Consequently, the decision of which actions merited an interview also took into account: (i) ensuring coverage across the supply chain, actors in the food chain, and EU member states; (ii) partners' resources, knowledge of / expertise about marquee actions that could provide rich data about what drives behaviour in regards to food waste.

The Chorizo project was also aware that other similar European Commission projects were taking place on FLW. In an effort to not duplicate those efforts, project representatives reached out to the European Commission to ask which food waste prevention actions were already being looked into and were generously provided with information of on-going efforts of the Joint Research Centre (JRC) and the European Consumer Food Waste Forum (ECFWF). As the list of actions identified and assessed in Chorizo progressed, regular checks were taken to ensure, to the best extent possible, that there was no duplication of efforts.[5]

Interviews took place in month three and four (March and April 2023) of the task. **In total 43 number of interviews took place, across 14 EU member states, in each stage of the supply chain, with the exception of transportation.**[6] Several necessary documents were finalized in early March before commencing interviews. Among these documents were the Interview Protocol, as well as the interview questions.[7] Since the

[4] The task was in essence trying to build on the JRC 2019 Technical Report on "Assessment of Food Waste Prevention Actions" where it was made evident that in order to effectively investigate the impacts of an action, this criteria is important; pages 7 and 18).
Caldeira, Carla, Valeria De Laurentiis, and Serenella Sala. (2019). *Joint Research Centre Technical Report: Assessment of food waste prevention actions.* Luxembourg: Publications Office of the European Union.

[5] The duplication of efforts refers specifically to work of the European Consumer Food Waste Forum (ECFWF) and the full supply chain research (2023) of the Joint Research Centre (JRC).

[6] Stages of the supply chain referring here to primary production, processing and manufacturing (including valorisation), transportation, retail, redistribution, food services, households, general awareness-raising, whole supply chain.

[7] The Interview Protocol and the Interview Questions are both available int the Appendices of the deliverable.

start of the task (January 2023) partners had started on initial drafts of the questions, continuing revisions on what interview questions should be asked, keeping in mind at all times the 14 points of information that needed to be addressed, in accordance with the Grant Agreement. In addition, an EU General Data Protection (GDPR) compliant Participant Information Sheet and Consent Form were finalized in early March, both being in alignment with the other corresponding deliverables in the project addressing data protection and ethics. Since the interviews did involve the acquisition of personal data, abiding by EU GDPR as well as the European Commission's Ethics Self-Assessment Guidelines was paramount and mandatory.[8]

Before analysis of the interviews could commence, all actions for which there was a corresponding Chorizo project interview, underwent a quality, validity, and consistency check. For evidence quality, the following questions were asked: (i) If the over-arching research question/main objective of the action was clearly stated? (ii) If the goals, scope, context, and approach were clear; and (iii) if the impacts were clear and justified. Validity was assessed utilizing the 4-level food waste hierarchy, with level 1 being the most stringent level of research and level 4 the least stringent - mainly explorative in nature utilizing largely secondary data.[9] Consistency was determined by looking into if the action had been replicated in other contexts with similar results. A summary of the answers to the questions, as well as the quality, validity, and consistency review was recorded in the Standardized Reporting Template for each interview.

[8] The European Commission's Ethics Self-Assessment Guidelines are available at: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/how-to-complete-your-ethics-self-assessment_en.pdf
More information about the EU GDPR is available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02016R0679-20160504&qid=1532348683434

[9] For a detailed description of the 4-level hierarchy, please refer to the following article (page 6): Vizzoto, Felipe, Francesco Testa, and Fabio Iraldo. (2021). "Strategies to reduce food waste in the foodservices sector: A systematic review." *International Journal of Hospitality Management*, 95, (April): 1-10.

2.1.2 Data analyses

The desktop research and the interviews provided both quantitative and qualitative data. In pursuance of systematically examining the data, 3 main tools were used during analysis. These tools were the qualitative analysis software Quirkos, the European Commission (JRC) Food Waste Prevention Calculator, and the Food Loss + Waste Protocol FLW Value Calculator. The qualitative data was expected to dispense information about the social impacts, as well as the motivations, opportunities, and abilities (MOA Framework) and social norms that affect behaviour towards food waste. Meanwhile, the quantitative data brought forth specific data on the economic impacts such as the cost-benefit analysis, investment costs, the total amount of FLW being addressed by the actions and was also utilized to uncover environmental impacts.

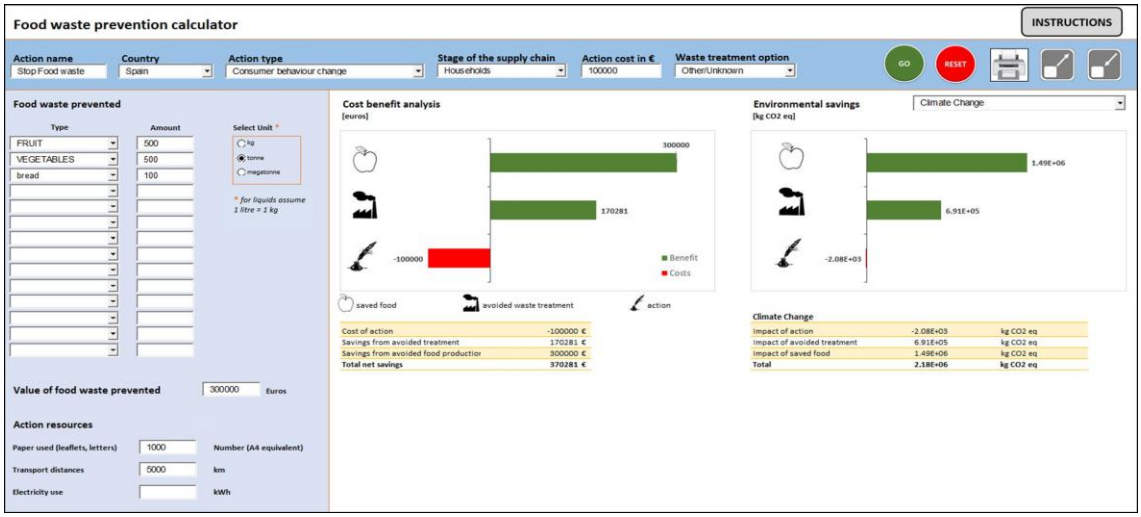
The thought process and method of analysis utilised for deciphering the qualitative data was Template Analysis.[10] The method refers to organizing text by themes. It requires a coding template which summarizes themes that have been identified by the researcher as important and organizes them in a meaningful and useful manner for analysis. Once a theme is defined, the first step of the analysis is to read through the data, marking in some way (highlighting for example) segments of text (i.e. answers to interview questions) that appear to tell the researcher something of relevance in relation to the theme. Some of themes may be defined "a priori" (i.e. in advance of starting the coding, such as if there are already broad themes that the researcher knows need to be addressed), but may also be modified as the coding takes place (i.e. as the researcher reads text and allocates it to a new theme). The final coding template serves as the basis for analysis. Several themes were already evident due to the 14 points of information about an action requested in the Grant Agreement (referred to above in section 2.1) – namely "social impacts", "social norms" including therewithin "motivation",

[10] More information about Template Analysis is available at: https://sk.sagepub.com/books/essential-guide-to-qualitative-methods-in-organizational-research/n21.xml
King, Nigel. (2004). "Using Templates in the Thematic Analysis of Text." In Essential Guide to Qualitative Methods in Organizational Research, edited by Catherine Cassell and Gillian Symon, 256-270. London: SAGE Publications Ltd.

"opportunity", "ability". However, qualitative analysis software Quirkos was used to help produce the coding template and generate any additional themes.[11] The aggregate information was then included in the overall analysis for this deliverable.

To perform the quantitative analysis, just as was the case with the qualitative assessment, several themes were already evident due to the 14 points of information about an action requested in the Grant Agreement (referred to above in section 2.1). As regards economic information, what was requested was primarily "investment cost" figures and a standardized "cost-benefit" analysis (within the point: "overall impacts"). While information about investment costs depended on responses from the interviewee (and if needed on-line financial information about the action), the cost-benefit assessment was accomplished utilizing not only responses from the interviewee, but also the European Commission (JRC) Food Waste Prevention Calculator. The data points needed to run such an analysis (cost of action implementation, value of avoided food waste produced, value of avoided food waste treatment, amount of food waste prevented) were obtained via the interview questions as well as the proxy data embedded in the calculator.

Figure 2: User interface of the European Commission (JRC) Food Waste Prevention Calculator

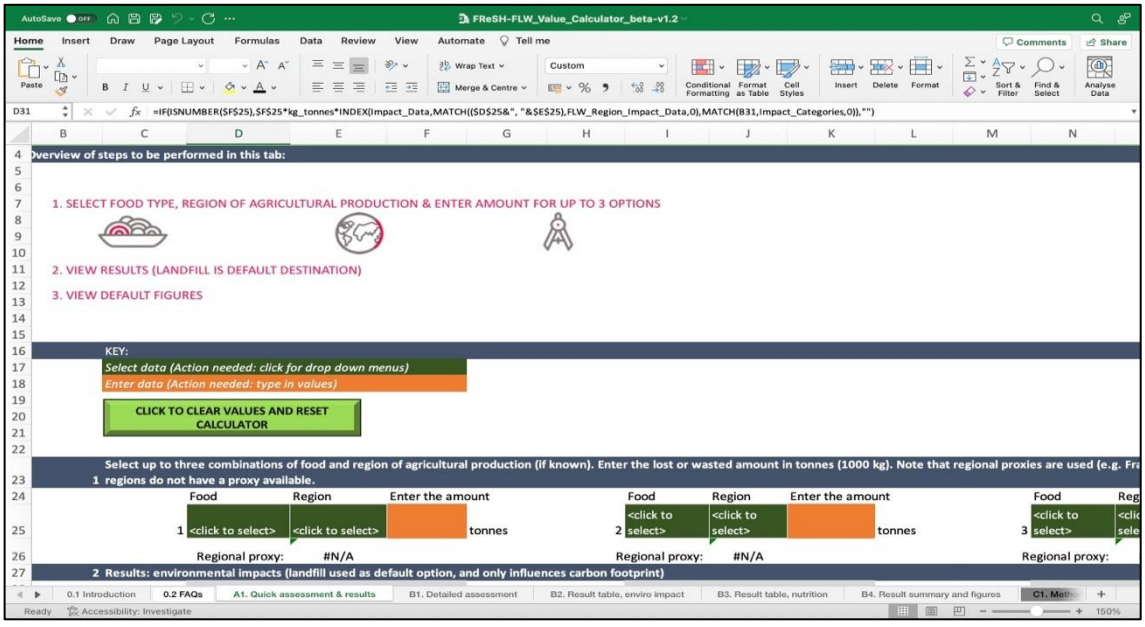


Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

[11] Quirkos homepage:
https://www.quirkos.com

Quantitative data was also used to uncover information about the environmental impacts of an action. Here too, the European Commission (JRC) Food Waste Prevention Calculator was used to uncover intelligence about several key environmental impacts, in accordance with the European Commission Environmental Footprint Method.[12] In total five different environmental impact categories were explored: climate change, land use, water use, freshwater and marine eutrophication. The overarching objective of the environmental data produced via the calculator, was to provide information about as many of the environmental impact categories in the European Commission's Environmental Footprint Method as possible, and thereby build upon current discussions among stakeholders regarding the effects that food waste is having on our planet's climate and natural resources. Finally, the Food Loss + Waste Protocol FLW Value calculator was utilised to provide nutritional information in relation to the amount of food waste.

Figure 3: User interface of the Food Loss + Waste Protocol FLW Value Calculator



Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

[12] 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): https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:C(2021)9332

The analysis portion of this deliverable depended in part on the desktop research, but also to a large extent on the interviews, as well as three key tools: (i) Quirkos qualitative analysis software; (ii) the European Commission (JRC) Food Waste Prevention Calculator; and (iii) the FLW Value Calculator of the Food Loss + Waste Protocol. The aim was to provide analysis that was as thorough as possible based on the information obtained, well-grounded, and able to be traced back if needed. Every effort was made to ensure that the tools were reputable, transparent, accessible, and from reliable sources to ensure that the best quality data possible was used for analysis.

2.1.3 Risks and mitigation measures

As in every research project, undoubtedly risks emerge and necessary mitigation measures need to be thought out and put in place to address them. As work was being carried out, any risks that would arise were noted in the Evidence Search Plan and a corresponding mitigation measure was proposed. There emerged two main risks: (i) **consistency of quantitative data collection** possibly affecting quality of analysis; and (ii) **expansive amount of data** needed to complete task 1.2.

The Grant Agreement outlined 14 main points of information to be included in the deliverable. Depending on the nature of the action, in particular those pertaining to general awareness-raising, there was the risk that not all the necessary data could be obtained. This in turn would affect the quality of analysis. Examples include “value of avoided food waste produced” and “value of avoided food waste treatment” - needed to run a cost-benefit analysis - which were at times difficult to locate. To mitigate such gaps in information, it was important to either identify proxy data and establish standard conversion factors, or to utilize reputable, on-line calculators with already-embedded proxy data. The latter option was utilized by incorporating in the analysis the European Commission (JRC) Food Waste Prevention Calculator. A similar situation was experienced when it came to obtaining the required environmental data. The answers to direct questions about climate change, land and water use, and eutrophication, were not obvious for the majority of interviewees unless they had a level of expertise already

in that field. Thus, instead of asking those specific questions, here too the European Commission (JRC) Food Waste Prevention Calculator was used to facilitate calculation of the environmental impacts based on the amount of food waste, country where the action was occurring, proxy data on food categories and the final treatment process for the food.

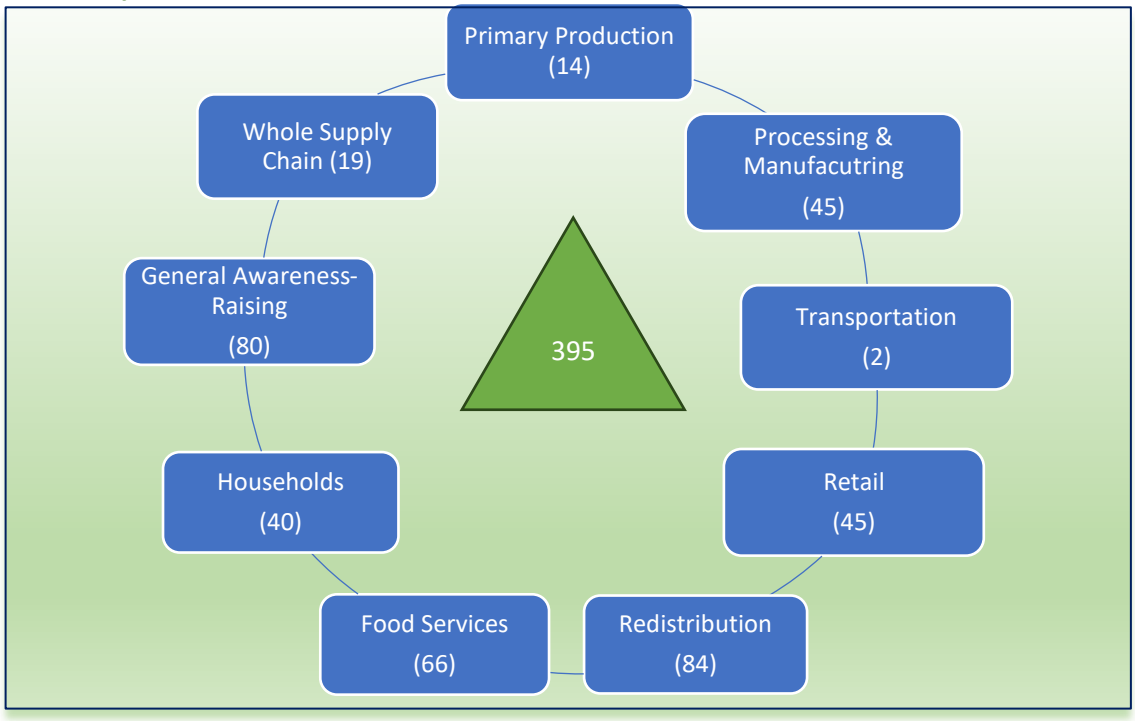
There was a substantial amount of information that had to be produced about the actions (i.e. the 14 points of information). In order to achieve this, there were initially 34 interview questions. However, work was sectionalized so that as much as possible, answers to the "general information" questions could be obtained via desktop research. Partners participating in research were encouraged to make every effort to obtain as much information as possible via effective research so that those particular questions could already be answered before starting the interview phase. Project partners were given a guidance document (appendix 9.3) with suggestions on how to conduct the desktop research, where to locate sources of information, which included the guidance (data attainability plan) provided in the Grant Agreement (Annex 1, Part B, page 18, figure 6). In terms of the interview questions, they were not only sectionalized, but it was also conveyed to partners by the task lead, which questions were deemed "priority" in order to obtain the necessary data for analysis. Partners were encouraged to see if the interviewee would welcome receiving some of the questions (in particular the quantitative ones) in advance. This would not only allow the interviewee to prepare oneself but could save time in the interview itself to allow for more time to discuss the more open-ended qualitative questions.

3. Overview – Food loss & waste reduction actions identified in Chorizo

3.1 Food supply chain – Where do the actions take place?

In total 395 actions were identified via desktop research. These actions covered initiatives from the initial primary production stage all the way to the end-user. Each action was categorized into one of the following categories: primary production, processing and manufacturing, transportation, retail, redistribution, food services, households, general awareness-raising, and whole supply chain. The majority of interventions identified belonged to actions where the objective was to redistribute surplus food fit for human consumption (84), followed by general awareness raising initiatives (80) focusing on increasing overall awareness about food loss and food waste in the form of campaigns, forums, or platforms for example. The least number of interventions identified were within the supply chain stage of transportation (2).

Figure 4: Number of actions in accordance with the supply chain stage (desktop research)



In the supply chain stages where most of the actions were identified – redistribution and general awareness-raising, there were some common characteristics amongst the

actions. In redistribution, key actors always involved representatives from either the primary production, food services, or retail sector, working in close collaboration with local food banks, charity organizations or non-profits. This allowed for a better understanding and appreciation among these actors about the different stages of the supply chain. It was also not uncommon (i.e. with 18 of the actions) to work in conjunction with the local government to implement the action. In the case of general awareness-raising actions, these were often broad, overarching campaigns aimed at the general public, in the form of regional or national campaigns, platforms or forums to exchange ideas, voluntary agreements and charters, educational projects, yearly events, cooking classes, and community gardening / composting initiatives.

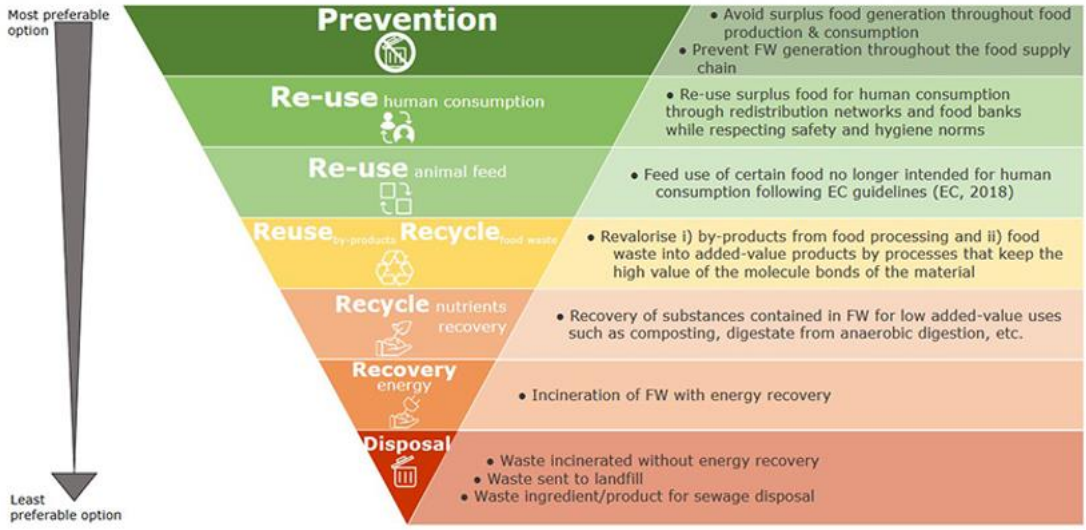
3.2 Technology and innovation playing a prominent role

The U.N. Food Systems Summit in 2021 highlighted innovation as paramount to determining how food can be transformed and re-produced in the battle against food waste, with green and digital technologies leading the way (UNEP 2022). Technology and innovation played a prominent role in the actions, with 100 of them linked to technology or an app. It was most common in the processing and manufacturing sector, where out of the 45 actions identified as pertaining to this stage, 41 of them involved technology to ensure that food waste or by product from food processing was valorised into new products. Within the list of actions identified in task 1.2 there were not only examples of valorisation, but also other scientific developments, such as new solutions in the field of temperature monitoring for transport logistics (“Foodsense” / SISTERS project), or for example Chr-Hansen’s efforts in Denmark to utilize food cultures to delay food spoilage in dairy products such as yogurt. There were also several apps and on-line platforms aimed at redistribution of food, serving as the “middleman” connecting, via a mobile application, retailers or food service providers to consumers when it came to surplus food. The surplus food could then be sold via the app or platform to consumers at a discounted rate. The “Foodsi” app in Poland and the “Foodie Save” app in Ireland are two such examples.

3.3 Food waste hierarchy – Does a prioritisation take place?

The food waste hierarchy (Figure 5) 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).[13] 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. **The actions identified by the Chorizo project reveal evidence of the hierarchy's implementation:** Of the 395 actions identified in the task, half of them (196) were "prevention" actions, when classified in accordance with the food waste hierarchy (Figure 5). This is key because it sheds light on an important aspect of behaviour in that 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.

Figure 5: Food waste hierarchy



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

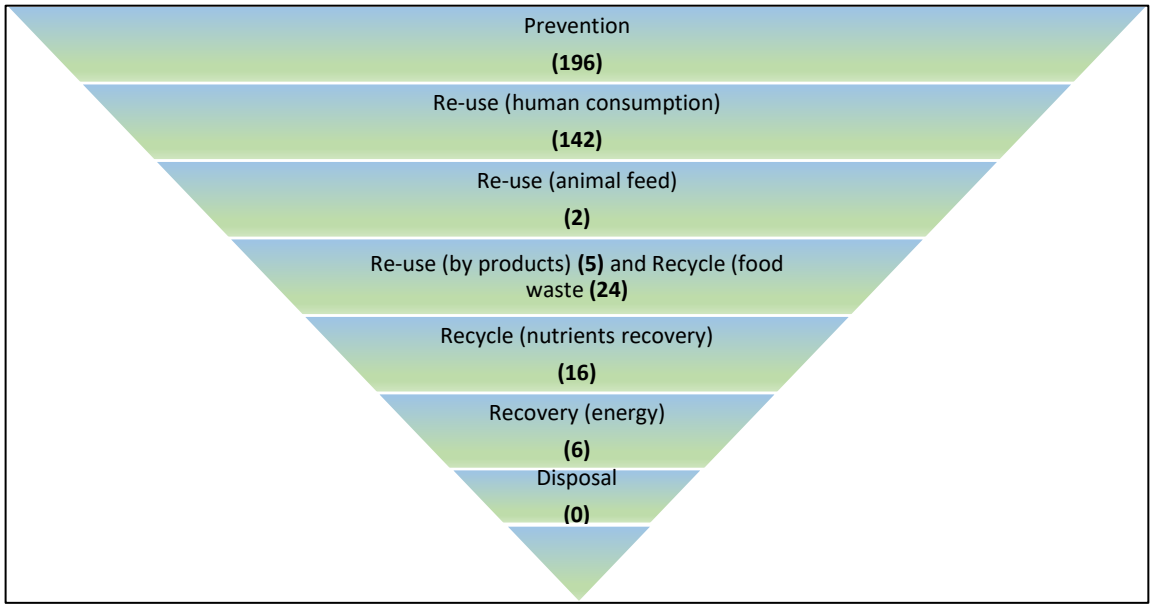
In terms of the other food waste hierarchy classifications, the second most prevalent classification in the actions identified was re-use for human consumption (142), followed by re-use by products and recycle food waste (29) (i.e. re-use by products included 5

[13] DG Health and Food Safety website page: https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement_en

actions and recycle food waste 24 actions), recycle - nutrients recovery (16), recovery – energy (6), and re-use – animal feed (2). None of the actions pertained to the disposal category. A few of the actions (4), fell into more than one classification. For example, VALUEWASTE in Spain works to convert biowaste into bioproducts (fertilizers, foodstuff / feed ingredients, and biogas), and therefore falls into several categories: re-use food waste, recovery – energy, and re-use - animal feed. Figure 6 below provides a breakdown of the food hierarchy categorizations for the actions identified in task 1.2. For clarity purposes however, the figure does not include the 4 actions mentioned here which fall under more than one category.

- VALUEWASTE (Spain): re-use (food waste), 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).

Figure 6: Task 1.2 actions in accordance with the food waste hierarchy – single categorization (desktop research)[14]



[14] "Single identification" meaning that this figure only includes those actions that fall into one category and not multiple categories. The total tally in Figure 6 is 389 and not 393 because it does not include those 4 actions.

Prevention vs. Reduction

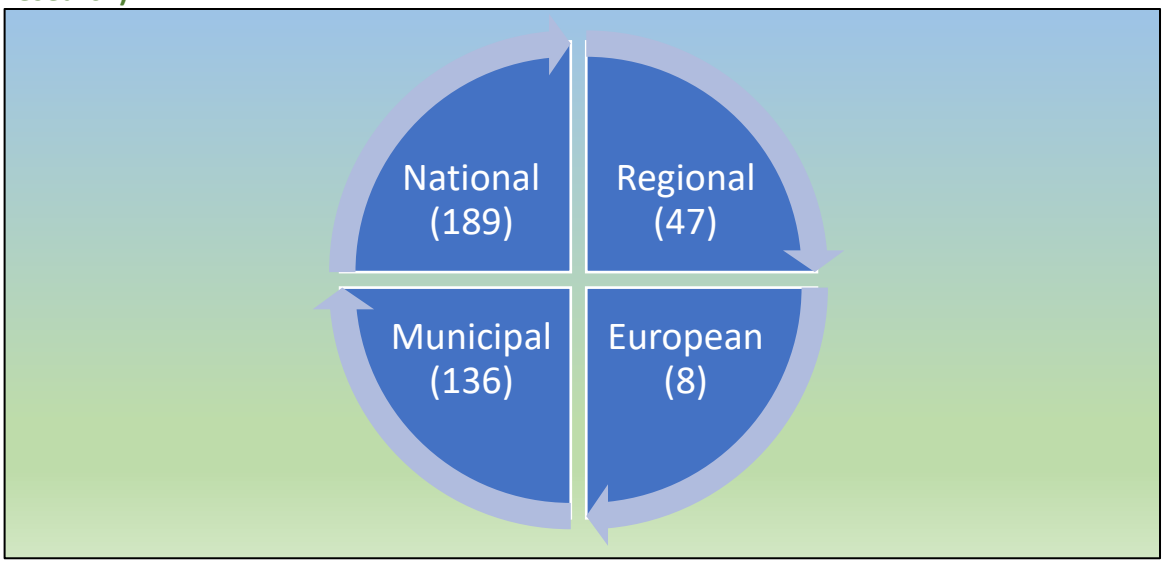
While most of the actions in task 1.2 do fall into the prevention, redistribution for human consumption, and valorisation (i.e. re-use by products or recycle food waste) categories, the remaining food requires handling, which often occurs either via nutrient recovery such as composting, or recovery of energy. There were 17 actions that focused on composting – mainly directed at households and the larger community - such as Kokoza, a social enterprise in the Czech Republic bringing communities together by building awareness and educating society, businesses, and public administration on how to compost as well as build and maintain community gardens. Treating food waste in order to extract energy, was also identified several times. A prime example is the municipality of Vaxjo, Sweden where the municipal government and the regional waste management company transform food waste into biogas for city buses and passenger cars. Driven by sustainability and the circular economy, these initiatives are positive in the sense that surplus food is being managed, however, some precaution must be taken to ensure that prevention is still the ultimate goal when it comes to food waste. Within the context of a growing organic waste management industry driven by the circular economy, there is the possibility that the business opportunities associated with such management outstrip the focus on prevention (UNEP 2022).

At the individual and community level it is a challenge finding a realistic balance of what initiatives will propel individuals and communities to think about food waste and address it within their every-day lives. A case-by-case assessment is needed to prioritise further interventions to address food loss and food waste. The distinction must be made, as well as a subsequent discussion take place in communities between the pros and cons of preventing food waste to happen in the first place versus recycling nutrients into compost or some type of energy. Active dissemination and explanation of the food waste hierarchy would be a step in that direction.

3.4 Geographical coverage

In terms of geographical coverage, the actions took place in all EU-27 member states, the United Kingdom, and Norway. They ranged from actions that were being implemented at the international, EU, national, regional, and municipal level. There was overlap in terms of geographic coverage with instances of municipal actions extending regionally as well as some national actions extending EU-wide and even internationally. **The national level was the most pervasive category of geographical coverage (189 actions), then the municipal level (136 actions),** followed by the regional level (47 actions) and 8 actions operating in more than one European country. There were 15 actions that operated in various combinations of these geographical scopes. For clarity purposes Figure 7 does not include these 15 actions.[15]

Figure 7: Geographical coverage of task 1.2 actions – single categorization (desktop research)



[15] The 15 actions are: Restevenn, United Against Food Waste, Feeding the 5000, Home & Neighbourhood Composting, Waste Watcher International Observatory, Waste Watch, FLAVOUR, Food for Soul, Too Good To Go, Linkee, Perfectly Imperfect, Valorisation Technologies of the Estonian University of Life Sciences, and anti-food waste initiative of Unilever, Glanbia, and the European Food Banks Association. For a full overview of all the actions and their geographical coverage, please refer to appendix 9.8.

3.5 Baseline, monitoring system and key performance indicators (KPIs)

To better measure the impact of an action, research suggests to optimally take a baseline measurement in order to know the current context of the proposed action. To further ensure that advancement is being made during implementation, a systematic monitoring system measuring progress that includes key performance indicators (KPIs) is optimal (Caldeira et al. 2019).

Of the total 395 actions identified, Chorizo project partners were able to identify 55 actions where a baseline was obtained and a monitoring system with indicators was put in place to track progress. Due to the methodology chosen, being based only on desktop research and 43 interviews, it is not per se indicative that the other actions were not utilizing a baseline, monitoring system and key performance indicators. To effectively obtain all of this information, direct contact with each of the nearly 400 actions would have had to take place, which was beyond the resources of task 1.2. 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.

Where this approach was rarely found was within the general awareness raising category of actions. These actions often took the form of platform discussions, educational campaigns, presentations, and food service events for the public such as "Disco Soup" in Mechelen where the community comes together to cook with their leftover food and enjoy the meal together. These actions were mainly set-up to raise awareness about food loss and food waste and consciousness about the issue.

<u>Recommendation for baselines and monitoring</u>

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.

Horizon Europe

4. Specific questions investigated via in-depth interviews

Of the 395 actions identified, there were 43 interviews that took place to find our more detailed information about actions. The aim of the interviews was to investigate in more detail the specifics about an intervention (such as food waste levels prevented for example), in order to obtain a better picture about their implementation, challenges, and impacts. Previously explained in chapter 2 under "methodology", the original aim in task 1.2 was to interview only those actions that abided by the following criteria: (i) established and utilized baseline data; (ii) targets and objectives were specified to take place within a certain time period; (iii) a monitoring system was put in place of track progress in achieving the targets and objectives; and (iv) appropriate Key Performance Indicators (KPIs) were put in place, tailored to the action.[16] However, in practice it was difficult to obtain all of this information based only on desktop research. Consequently, to overcome the challenges with the earlier criteria, the decision of which actions merited an interview also took into account: (i) ensuring coverage across the supply chain, actors in the food chain, and EU member states; (ii) partners' resources, knowledge of / expertise about marquee actions that could provide rich data about what drives food waste behaviour.

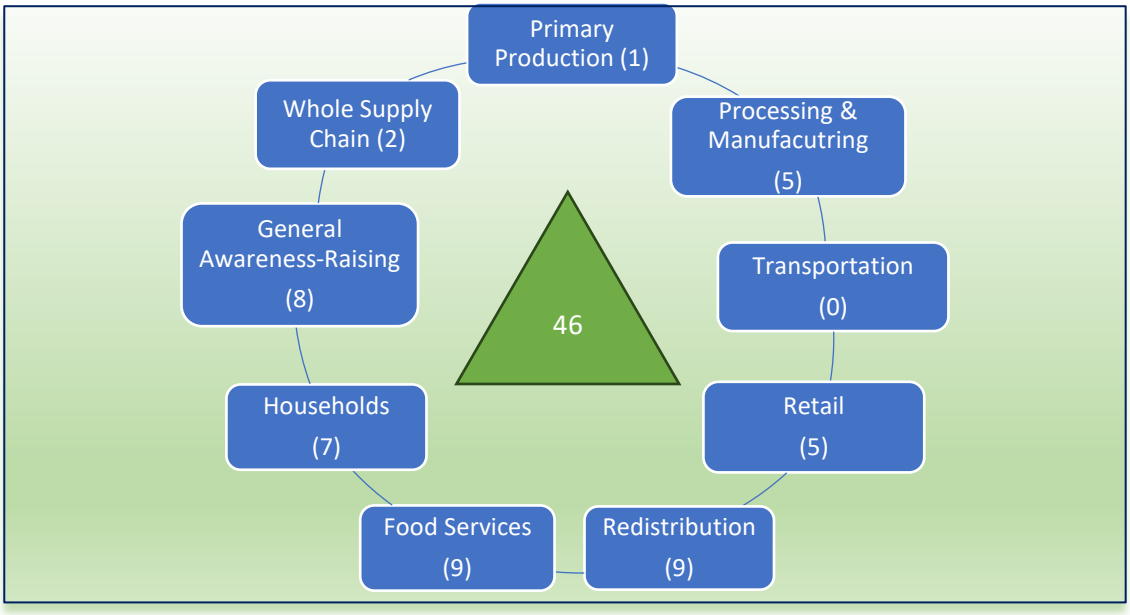
4.1 Food supply chain

The actions discussed in the interviews covered the entire food supply chain from primary production to the end-user, with the exception of transportation. It should be noted that the total number of interventions discussed in these interviews was 46, because in two cases a single interview covered more than one intervention. The majority of interventions pertained to the food services and redistribution sectors, with 9 actions in each category. This was closely followed by 8 general awareness-raising

[16] The task was in essence trying to build on the JRC 2019 Technical Report on "Assessment of Food Waste Prevention Actions" where it was made evident that in order to effectively investigate the impacts of an action, this criteria is important; pages 7 and 18).
Caldeira, Carla, Valeria De Laurentiis, and Serenella Sala. (2019). *Joint Research Centre Technical Report: Assessment of food waste prevention actions.* Luxembourg: Publications Office of the European Union.

interventions, 7 actions pertaining to the household sector, 5 actions in retail as well as 5 actions in processing and manufacturing, 2 actions covering the whole supply chain, and 1 action in primary production.

Figure 8: Number of actions in accordance with the supply chain stage (interviews)

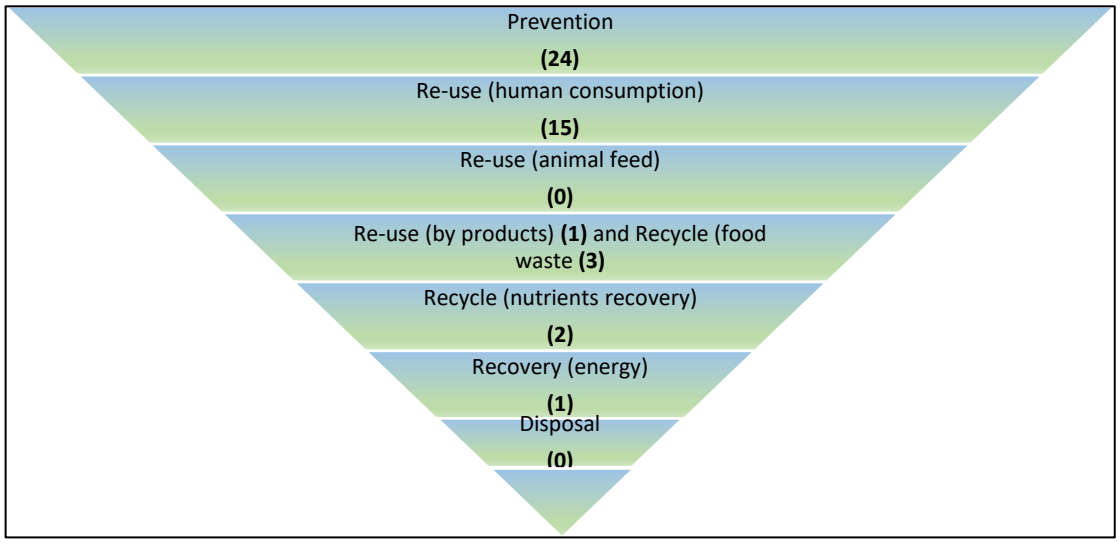


4.2 Geographical coverage and food waste hierarchy

Of the 46 interventions that underwent interviews, implementation of them took place across 14 EU member states. Nearly half of the interventions took place at the municipal level (22) while the rest were at the national level (24). There was distribution across the food waste hierarchy, with the exception of re-use (animal feed) and disposal. The dominant classification was prevention, which aligns with the overall list of actions identified in the task via desktop research where nearly half of the 395 actions fell into the same category. The second most dominant classification was re-use for human consumption (15), followed by recycle of food waste (3), recycle of nutrient recovery (2), re-use of by-products for processing (1), and recovery for energy with 1 intervention. The prevention actions were not specific to any one sector of the supply chain but were most concentrated in the household (7) and food services (8) categories, which complements prevailing literature that most food waste in developed countries occurs

at the consumption stage (Pandey 2021; Vizzoto et al. 2021; Hartmann et al. 2021; Graham-Rowe et al. 2014).

Figure 9: Actions in accordance with the food waste hierarchy (interviews)



4.3 Implementation feasibility – Challenges experienced

Several internal and external implementation challenges were expressed during interviews – 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.[17] 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. One such example is with the action "Best of Waste" processing juice from surplus fruit, where it had to be assured that juice composition was free from specific micro-particles such as mold, or endogenous particles such as leaves. 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

[17] 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).

transportation of food. Identifying what partners to work with, and at what stage of the distribution process was key to distribution success. Funding was most 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. Examples include educational workshops and the food services industry.

4.4 Sustainability – How to ensure success?

Key drivers of sustainability highlighted during the interviews were funding, advance planning, and being embedded in an already established policy or project. 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 according to the interviewees 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. For example, the "LaRISo" project (Italy), a participatory working table with the overall objective of improving integrated sustainability in food services and in particular school food services, is due to come out with guidelines regarding nutrition, the environmental and social dimensions. These guidelines are due to be incorporated at the regional level and will come into effect at the end of the project but are expected to guide implementation of future school catering activities. 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.

4.5 Cities are unique - Actions at the municipal level

According to the United Nations Environment Programme (UNEP) and International Resource Report, the proportion of the global population living in cities is expected to rise from 54% in 2015 to 66% by 2050, meaning that the urban population will grow by 2.4 billion people (IRP and UNEP 2018: 21). This will undoubtedly result in an expansion of current cities, and the construction of new urban areas. There are numerous actors and processes that shape a city and its longevity, including available resources, such as food and energy. The terminology “urban metabolism” - the connected processes that shape a city - can be used as an approach through which to study the urban environment and bring about a better understanding about how to utilize those resources in the most resource-efficient manner (Castán Broto et al. 2012). Resource efficiency is paramount if cities and its’ residents are to thrive. In this respect, preventing food waste and actively addressing food waste that is produced, are central components in that endeavour.

The European Commission’s regional and urban development policy is an acknowledgement of how an integrated approach involving strong partnerships across the supply chain - with residents, industry, civil society organizations, and government - is necessary to ensure resilient and sustainable cities across the EU. Between 2014 and 2020 the European Regional Development Fund (ERDF) invested just over EUR 115 billion into urban areas (900 cities) with a focus on sustainable urban development, and for the 2021-2027 period it is looking to continue to invest in projects with stakeholders across the supply chain to bring to fruition low carbon, resilient, locally-led investments.[18] The European Urban Initiative (EUI) of 2021-2027 is set to finance actions

[18] European Commission: https://ec.europa.eu/regional_policy/policy/themes/urban-development_en

that provide pioneering solutions to urban challenges, such as food waste, with the aim of further developing them to be transferable and scalable.[19]

Nexus position allows for playing a prominent role

Cities are unique in terms of their potential to address food waste because they are at the nexus of where the majority of food waste is generated across the supply chain. According to the European Commission and recent statistics from Eurostat, in 2020 around 131 kilograms (kg) of food waste per inhabitant was generated in the EU (Eurostat 2023).[20] Of the 131kg, households generated 70kg, food services 12kg, and retail 9kg – all sectors which are embedded in city-living.[21] The expected leap in urbanization places local governments in a unique position to play an active and prominent role in ensuring the sustainability of cities.

Broad portfolio of municipal food waste actions

The negative effects of food waste are numerous - from the environmental repercussions (loss of water, land, and energy resources used to produce the food that is not consumed), to compounding food insecurity and reducing access to nutritious food among urban residents. Due to the multifaceted nature of cities, stakeholders such as local government can tackle the issue from a variety of angles – either directly or indirectly. **Of the 136 actions addressing food waste at the municipal level that were identified in task 1.2, the methods utilized for tackling food waste varied – from the more indirect approach of general awareness-raising campaigns to the more direct**

[19] European Urban Initiative: https://www.urban-initiative.eu/what-european-urban-initiative

[20] Eurostat: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates#Amounts_of_food_waste_at_EU_level

[21] Ibid.

interventions of public procurement for initiatives.[22] Identification of the actions in the task also demonstrated that addressing food waste is not only good in terms of tackling environmental and social concerns such as the carbon footprint of commodities or food insecurity, but it can also be used by local government and stakeholders to create new sources of revenue, with redistribution and valorisation being key examples. **Nearly three-quarters of the municipal actions identified were related to food redistribution, food services, and retail.** In this respect, surplus food fit for human consumption is being redistributed to people, either through established networks such as food banks and non-profits, but also via restaurants, retailers, and newly established "apps" (applications) and on-line platforms connecting consumers to surplus food at a discounted price.

Gaining further insight by interviewing 22 municipal actions

Within task 1.2, after initial desktop research, a set of interviews were conducted to obtain more detailed information about the actions. Of these interviews, 22 municipal actions were examined in greater detail. A variety of issues were discussed in the interviews – namely implementation challenges, sustainability, transferability, environmental, social, and economic impacts, food waste reduction levels, as well as behaviour towards food waste.

Table 1: Actions operating at the municipal level (interviews)

ACTION	DESCRIPTION
Let's Save Food! (Ghent, Belgium)	Let's Save Food vending machines sell products that otherwise would be wasted. Non-profit organization volunteers refill the vending machine several times a day with bread, biscuits, freeze-dried fruit for example. In this way, everything in the machine is saved from going to waste.
Waste Watch (Brussels, Belgium)	An innovative digital solution by Sodexo, which decreased food waste by 50% in its restaurants by 2022. The program covered 180 industrial kitchens

[22] For a full list of the actions taking place at the municipal level, please refer to appendix 9.8.

	from different sectors; from a hospital, school, residential care centre, army base, and various companies, to its own headquarters.
Voedselhub Mechelen (Mechelen, Belgium)	The Food Hub Together with Ecoso created the first food hub in Mechelen. Through FoodSavers collects food surpluses from supermarkets, and safe, local traders. This food is then distributed to poverty organizations and schools in Mechelen.
Budapest Bike Maffia (Budapest, Hungary)	An ad hoc food rescue organization operated by volunteers delivering surplus food to charities.
LIPOR[23] (Horta a Porta, Terra a Terra, and Dose Certa) (Porto, Portugal)	Promotion of several initiatives to address food waste at the household and food services levels – from vegetable gardens, composting, guides, and initiatives for restaurants and canteens.
Sustainable Acquisition of Foodstuff (school canteens) (Umea, Sweden)	Green public procurement criteria for acquisition of foodstuff, including menu planning.
Aprofita (Valencia, Spain)	Initiative set up by the Food Council of the Municipality of Valencia, where volunteers collect surplus food and deliver it to those in need.
Food Winners Brugge (Bruges, Belgium)	Project where participating households (5,000) weighed their food waste for seven days in a row for both solid waste and liquid waste (soup, water, coffee, etc.) with the aim of reaching 30% reduction in food waste.
Valorisation of Biowaste Biogas Production (Vaxjo, Sweden)	The Municipality of Vaxjo and the regional waste management company (SSAM) transform food waste into biogas for city buses and passenger cars. There is a local gas station that lets people fill their cars with locally generated biogas. The remaining sludge is diverted to arable lands to be used as fertilizer.
Yhteinen Poyta (Vantaa, Finland)	Sets up a surplus food terminal, “Shared Table”, connecting food factories, wholesalers, and retailers to a large network of food aid distributors.
Foodsavers Antwerp (Antwerp, Belgium)	Foodsavers is an initiative of the city of Antwerp that collects food surpluses free of charge and redistributes them to aid organizations that are committed to food distribution.

[23] In the case of LIPOR, one interview was conducted, but it includes data and information about several initiatives regarding sustainability, circularity, and addressing food waste, undertaken by LIPOR. Information from that interview which has been used by task 1.2 in this deliverable, is for the following projects: Horta a Porta, Terra a Terra, and Dose Certa. The only exceptions are for the following quantitative datasets: amount of food waste prevented, total cost of avoided food production, environmental impact calculations, and nutritional impact calculations - in these cases, the overall consolidated data provided by LIPOR is utilized which also includes the projects Fruta Feia and Embrulha.

Invendus Pas Perdus (Schaerbeek, Belgium)	Since December 2017, a municipality representative collects unsold products from several partner supermarkets and brings them to associations such as the Red Cross, or the social grocery store. Schaerbeek is the first municipality to have set up a large-scale circuit and recently has passed the milestone of 100 tonnes of redistributed, previously unsold food.
Plan Alimentation Durable 2016-2021 (Paris, France)	Reducing food waste through public procurement of sustainable food and shorter supply chains. The plan goes beyond food waste - it is an integral food policy plan.
SmartMat Hbg (Helsingborg, Sweden)	Local initiative with the aim to halve food waste and increase the proportion of climate-smart food in 40 municipal schools.
Food Waste Mitigation Strategy (Copenhagen, Denmark)	This food waste mitigation intervention is part of the municipality's ambition to cut food waste on the public plate and is part of the city's urban food strategy. It is targeted at the municipal food service industry and is an active intervention including food waste mitigation counselling, awareness raising, and training for kitchen staff.
Hub di Quartiere contro lo Spreco Alimentare (Milan, Italy)	Since 2015, Milan has created Local Food Waste Hubs to recover food surpluses from local supermarkets and canteens and redistribute it to people in need through local neighbourhood networks. The Municipality allocated city-owned buildings for stocking and redistribution of recovered food and implemented a tax reduction measure that rewards businesses that donate food with a 20% reduction on the waste tax.
Foodsharing Tartu (Tartu, Estonia)	Foodsharing Tartu is a movement that saves and distributes leftover food in Tartu, cooperating with individuals, retailers, companies and food producers.
Less Food Waste – More ecology and climate-friendly food (Ballerup, Denmark)	Short, entertaining presentation that prepares students for a sustainable future in the kitchen with a focus on the role that food waste plays globally, ecology, how to choose climate-friendly food, and how it all connects to less food waste and the UN's Sustainable Development Goals.
Madvaerkstedet Madspild (Silkeborg, Denmark)	A cooking-related teaching course to provide insight into the understanding of and experience with how food waste can be reduced through teaching courses to school pupils.

Madspilskolen (Copenhagen, Aarhus, Odense, Alborg, Korsor, Denmark)	A camp-type of food4class, during the school holiday (winter – week 7), summer (July), National-Food-waste-day (week 36), and Autumn (week 42 - holiday). It is mostly outreach-based education. Students spend time to learn about food, food-waste, and its' impacts.

Source: Descriptions are based on desktop research and interviews Chorizo project partners had with implementers of the action.

Implementation challenges

A common challenge was resources – funding, access to necessary infrastructure and equipment, and acquiring staff with expertise. These challenges were particularly acute when it came to redistribution of surplus food and where the action started small, working primarily with volunteers, and slowly expanded over time. Maintaining food safety between collecting surplus food and re-distributing was another common theme that emerged from the interviews and reverted back to necessary access to adequate infrastructure (refrigeration, storage space, trucks), but also experienced staff. More public funding and tax breaks to help start-ups was mentioned in several of the interviews.

Sustainability of the actions

Ensuring adequate resources also affected the sustainability of the action. Sustainability was not foreseen as difficult though in those cases where funding was assured – and in these 22 municipal actions, often that took the form of local government financial support. Political support for an initiative from local governments was also mentioned in several interviews as vital to ensure stability. However, establishing partnerships with stakeholders across the supply chain - industry, civil society organizations, residents - was what was seen as paramount for sustainability. Such partnerships were not only important within the city itself, but also across cities. In this respect transferability (i.e. the action is taking place in another city) and scalability (action is growing in size) help to ensure the action survives the test of time in that it has proven to be effective and merits replication or at least growth. Of the municipal actions that underwent

interviews, 13 of them noted that the action has either grown, been transferred, or at least a very similar action is taking place in another city, reinforcing coordination among local governments across different cities.

Impacts of municipal actions

The impacts of these actions varied, but generally they were positive in terms of addressing food waste and environmental concerns, redistributing food (especially to those in need), providing additional skills and employment for people, raising general awareness about food waste, and generating knowledge about how to possibly address it. Based on the interviews, 16 were able to provide information about the amount of food waste addressed via the intervention.[24] From those 16 actions, a total of 90,801 tonnes of food was "rescued" from becoming waste over the course of an average year, resulting in a savings of 532,634.2kg CO2 equivalent (greenhouse gas emissions - GHG) based on interview data and the resulting calculations from the European Commission (JRC) Food Waste Prevention Calculator.[25] Putting it into an EU context, according to Eurostat, at the EU level 59 million tonnes of food was wasted in 2020 and according to the European Environment Agency (EEA) 3,700.3 million tonnes of GHG emissions in CO2 equivalent (Eurostat 2023, EEA 2022: 69)[26] The actions brought about additional jobs (largely in the sustainability domain) and imparted skills - in storage and logistics (such as with redistribution networks) - but also at the food services and individual consumer

[24] For LIPOR, this includes consolidated data for the following five projects: Horta a Porta, Terra a Terra, Dose Certa, Embrulha, and Fruta Feia.

[25] For specific food waste and subsequent environmental impact data per action, please refer to appendix 9.13 (interview summaries). The tool that was used is the European Commission (JRC) Food Waste Prevention Calculator: https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

[26] Eurostat:
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates#Amounts_of_food_waste_at_EU_level
European Environment Agency (EEA):
https://www.eea.europa.eu/publications/annual-european-union-greenhouse-gas-1

level regarding meal planning (shopping, storage, and cooking). Predominantly, the interviews reflected a firm belief that the action had increased people's awareness about food waste and its consequences. Consequences of food waste generation, such as increased greenhouse gas emissions or even food insecurity for example, were not per se self-evident for every-day residents. Food is thrown away and what happens to it afterwards, and its' effects, are not foremost on people's minds. Although more research would be needed to determine what effect raising awareness has on individuals' actual behaviour, some interviews highlighted that the increased awareness may have a strong correlation with increased engagement in organic and regenerative farming, composting, the overall theme of circularity, streamlining processes to promote sustainability, and in that respect finding ways to give "new life" to surplus food products. Another positive impact mentioned repeatedly in interviews was the perceived strengthened community spirit that evolved from putting in place actions. The actions necessitated not only collaboration with a variety of stakeholders (producers, retailers, food service industry, redistributors, government, schools, consumers), but also at times required building relationships with the most vulnerable groups in society, or at least their representatives via charity organizations and non-profits, particularly when it came to food redistribution.

Collaboration benefits

There are concrete possibilities for municipal governments and actors at the local level to be front-runners in the fight against food waste - from awareness raising campaigns, to redistribution efforts, or providing specific training to household members regarding meal planning for example. This is due to the multifaceted nature of cities and the consequent opportunity to address the issue from a variety of angles. However, local governments do not operate in a vacuum and are dependent to an extent on higher levels of government in terms of resources and legislation. Such dependence can affect the ambition to develop and actively engage in projects. In this respect collaboration with local partners, such as industry and civil society is vital to ensure resources, but also

to ascertain that the issue of food waste is addressed as holistically as possible across the supply chain with multiple partners, and thereby hopefully ensure its' longevity.

4.6 Level of food waste – To what extent did the actions reduce food waste?

Food waste is a global challenge for all countries, including EU member states. The year 2020 was the first reporting year for EU-wide monitoring of food waste levels in accordance with European Commission Decision 2019/1597. The results show that at the EU level, the total food waste in 2020 reached nearly 59 million tonnes of fresh mass, which translates to approximately 131 kilogrammes (kg) of food waste per inhabitant in the EU.[27] The European Union is one of the world's largest emitters of food waste, although ironically wasting more food than it imports – importing cumulatively 138 million tonnes of agricultural products in 2021 worth €150 billion, while wasting 153.5 million tonnes of food (Eurostat 2022b). These food waste levels are occurring within the context of growing food insecurity (33 million people in the EU) and international efforts (Intergovernmental Panel on Climate Change (IPCC), comprised of 195 countries) striving to combat global warming by limiting world-wide rise in temperature to 1.5 degrees Celsius above pre-industrial levels. Closely aligned with the IPCC efforts are the UN's Sustainable Development Goals of halving food waste by 2030 (Eurostat 2020).[28]

The European Commission has issued a legislative proposal on July 5, 2023 to establish legally binding food waste reduction targets which are to be achieved by EU member states by 2030.[29] This proposal for a Directive is part of the overall revision of the EU Waste Framework Directive. The reduction targets are set against a baseline for EU food

[27] Eurostat: Food waste and food waste prevention estimates available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates#Amounts_of_food_waste_at_EU_level

[28] United Nations Sustainable Development Goals: https://sdgs.un.org/goals

[29] European Commission: https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-reduction-targets_en

waste levels stemming from the first EU-wide monitoring of food waste levels carried out in 2020. The monitoring in turn was based on the common EU methodology to measure food waste which entered into force in 2019.[30] According to this most recent proposed legislation, across the EU food waste levels in the processing and manufacturing sector are to be reduced by 10%, and by 30% in retail and consumption combined. This recent legislative initiative changes what were previously largely voluntary efforts, and which varied across member states, to legally-binding, more cohesive, accountable, and complementary food waste reduction targets across the EU.

Within the 43 interviews conducted for task 1.2, **the majority of them (27) were able to provide the amount of food waste prevented within a defined period of time.** 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 of 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. One such example is Madvaerkstedet Madspild, a cooking course in Demark, for children (grades 6-8), where students learn about food waste, its' environmental impact, and how to utilize leftovers. A summary of each interview, along with the amount of food waste prevented is provided in appendix 9.13.

Table 2: Amount of food waste prevented (interviews)

ACTION	FOOD WASTE PREVENTED
Best of Waste	160 tonnes (June-September 2022 / high season)

[30] European Commission: https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement_en

Budapest Bike Maffia	8 tonnes (2022)
Direct Food Surplus	8,000 tonnes (2022)
Etelmento	3.5-4 tonnes (2023 projected)
Foodello	1,000 tonnes (per year on average)
Foodsavers Antwerp	1.11 tonnes (2021)
Foodsharing Tartu	47 tonnes (2022)
Food Waste Fighters	225.69 grams per participant (August 7-29, 2021)
Food Waste Mitigation Strategy	3,173 tonnes (2021)
Food Winners Brugge	44.4 tonnes (2022)
Foodie Save	7 tonnes (July 2022 – May 2023)
Hub di Quartiere contro lo Spreco Alimentare	297 tonnes (2022)
IKEA / UAW	374 tonnes (April – December 2021)
Invendus pas Perdus	308 tonnes (2018 – April 2023)
JoteKonyha	1 tonne (per year on average)
Krut	6-12 tonnes (per year on average)
Let's Save Food	192 tonnes (per year on average)
LIPOR[31]	15,177 tonnes (2022)
SmartMat Hbg	37 grams per meal (comparing 2018 to 2020 figures)
Sustainable Acquisition of Foodstuff (school canteens)	96 tonnes (2022)
Valorisation of chicory	8 tonnes (November 2019-May 2023)
Valorisation of Biowaste for Biogas Production	70,230 tonnes (2022)
Voedselhub Mechelen	384 tonnes (per year on average)
VollCorner	0.6 tonnes (12 weeks – Q1 2021)
Waste Watch	352 tonnes (2022)

[31] Data for LIPOR refers to consolidated data for the following projects: Horta a Porta, Terra a Terra, Dose Certa, Fruta Feia, and Embrulha.

Yhteinen Poyta	500 tonnes (2022)

Source: Interviews Chorizo project partners had with implementers of the action.

4.7 Nutrition – Effects of food waste

Closely associated with the amount of food waste generated, is the issue of nutritional deficiencies due to inconsistent access to food (food insecurity).[32] There are approximately 33 million people in the EU experiencing food insecurity and therefore suffering nutritional deficiencies (Eurostat 2020). A balanced diet requires sufficient amounts of nutrients for an individual's health. Key nutrients are proteins, carbohydrates, fats and vitamins. Although the amount of nutrients needed varies from person to person, depending on an array of factors such as age and level of physical activity, for example, there are scientifically established dietary reference values (DRVs) for nutrients established by the public health sector in countries. These DRVs are used by policy makers and the public health sector to issue recommendations on nutrient intake (i.e. dietary guidelines) as well as serving as the basis for food labelling information on products.[33]

The nutrients consumed provide the basis for the amount of energy that is derived from the food, and that in turn is used for overall maintenance of physiological functions (Simona et al. 2020). The United Nations Food and Agricultural Organization (FAO) defines "energy requirement" as "the amount of food energy needed to balance energy expenditure in order to maintain body size, body composition and a level of necessary and desirable physical activity consistent with long-term good health." (FAO 2021: 4). According to FAO the average energy requirement per person per day for an adult male (30-59.9 years) ranges from 2,100 – 2,750 kcal depending on weight (50-90kg) and for adult females of the same age it ranges from 1,750 – 2,250 kcal depending on weight as

[32] The United Nations Food and Agricultural Organization (FAO) defines food insecurity as: "A person is food insecure when they lack regular access to enough safe and nutritious food for normal growth and development and an active and healthy life."
https://www.fao.org/hunger/en/

[33] European Food Safety Authority:
https://www.efsa.europa.eu/en/topics/topic/dietary-reference-values

well. (FAO 2021: 42 and 45). Within the actions identified in task 1.2, where it was possible to obtain information about the amount of food waste prevented, **all but two actions provided data where the amount of food waste prevented provided the energy requirement for a person in a single day within the FAO range (1,750 – 2,750 kcal) or exceeded it.**[34] It should be noted that the amount of food waste prevented does not include specific composition of the food waste. Rather, when using the calculator to calculate nutritional impact, proxy data embedded in the calculator was used since often food waste is not a single food group, but rather an amalgamation of different food groups, particularly at the food services and household level. For a more precise assessment of the food energy, disaggregated data is needed about the composition of food, as well as the nutrient concentrations for each part making up that composition.

Food waste along the supply chain entails not just waste, but what is also lost at a nutritional level. If wastage is addressed along the supply chain and food surplus redirected to those who are in need of meals, it could help feed and provide nutrition to millions of people throughout the EU that experience food insecurity. Rather than increasing demand on food production due, effectively consuming the food that is available and addressing food waste is an essential step in the battle against food insecurity and nutritional deficiencies.

4.8 Economic Impacts - Investment costs and cost-benefit analysis

Before engaging in an intervention, all actors need to take into account the associated costs, as well as the projected returns on investment. As noted in earlier sections about implementation and sustainability, 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. The majority of interventions take into account not only the investment costs, but also what they will financially earn in return in order to maintain operational. Financial

[34] For nutritional information per action, please refer to appendix 9.13 (interview summaries).

revenue or savings due to a specific intervention made can also serve as a strong motivator for stakeholders. In this respect the actions identified in task 1.2 included start-ups, particularly when it came to apps and on-line platforms, which have found an opening in the market in terms of selling surplus food at a discounted rate. This section will look at the key economic aspects associated with the 46 actions that underwent interviews: investment costs, and cost-benefit analysis.

While information about investment costs depended on responses that came from desktop research as well as the interviews, the cost-benefit assessment was accomplished utilizing the European Commission Food Waste Prevention Calculator.[35] The data points needed to run such an analysis (cost of action implementation, value of avoided food waste produced, value of avoided food waste treatment, and amount of food waste prevented) were obtained via the relevant interview questions as well as the proxy data embedded in the calculator. It is important to highlight that the data for cost-benefit analysis has been standardized in that the calculation has been run based on an average annual cost. It is not uncommon within interventions for the majority of costs to occur in the first year and to decline thereafter – especially with innovation technology and scientific projects, such as developing apps, software, or cultivation techniques for example.

Based on the interviews, 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 Maffia 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 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.

[35] European Commission (JRC) Food Waste Prevention Calculator: https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

Table 3: Investment Costs (interviews)

ACTION	INVESTMENT COST (Euro)	TIMEFRAME (annual, initial, whole project)
Elelmiszer Ertek Forum (Food Value Forum)	2,700	annual
Budapest Bike Maffia	270	annual
Direct Food Surplus	110,000-200,000	annual
Voedselhub Mechelen	250,000	annual
Best of Waste	60,000	annual
Yhteinen Poyta	650,000	annual
Waste Watcher International Observatory	10,000-15,000	annual
Campagna SprecoZero	200,000	annual
Aprofita	22,000	annual
Project Hrana ni odpadek	80,000	initial
Foodello	20 million	initial
JoteKonyha	100,000	initial
Valorisation of chicory (chicory croquettes)	40,000	initial
Plan-eet App	40,000	initial
Foodie Save	160,000	Initial
Life IP Care4Climate	27.2 million	whole project
Invendus Pas Perdus	547,000	whole project
Food Winners Brugge	180,911	whole project
Leaf No Waste	2 million	whole project
Food Waste Fighters	1,500	whole project

Source: Interviews Chorizo project partners had with implementers 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 – and therefore necessitate data on the amount of food waste prevented by the intervention over a set period of time. **From the pool of data accessed via interviews it was possible to calculate a cost benefit ratio for 6 interventions**.[36] In

[36] 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).

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, (please see appendix 9.13 for individual summaries of the interviews), if they are not in direct alignment with the investment cost timeframe, the cost-benefit ratio has not been calculated. The ideal value for the ratio is to equal 1.0, which would indicate that the expected profits equal the costs and therefore the intervention is financially feasible. If the ratio is less than 1.0 then the costs outweigh the benefits. 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.

Table 4: Cost-Benefit ratio for actions (interviews)

ACTION	TOTAL COST (EURO)[37]	TOTAL BENEFITS (EURO)[38] S = Savings from avoided treatment P = Savings from avoided food production	COST-BENEFIT RATIO
Budapest Bike Maffia	270	1,348 (S) + 8,690 (P) = 10,038	37.1
Direct Food Surplus	200,000	1,348,085 (S) + 300,000 (P) = 1,648,085	8.2
Voedselhub Mechelen	250,000	64,708 (S) + 509,135 (P) = 573,843	2.29
Best of Waste[39]	60,000	26,962 (S) + 182,428 (P) = 209,390	3.48

[37] Based on information / data obtain from interviews with implementers of actions addressing food waste. Cost is over an average annual period, with the exception of VollCorner, where it is cost over a single quarter (Q1 – 12 weeks) in 2021.

[38] Based on calculations from the JRC on-line food waste prevention calculator: https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859 For JRC calculator figures used in Table 4, please refer to the Interview Summaries in Appendix 9.13.

[39] For Best of Waste, the amount of savings refers to food waste prevention figures during the "high season" of June-September in a given year.

Yhteinen Poyta	650,000	84,255 (S) + 882,882 (P) = 967,137	1.48

Source: Total cost data based on interviews that Chorizo project partners had with implementers of the action, and total benefits based on calculations coming out of the JRC on-line food waste prevention calculator.

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 this respect the total investment costs and a cost-benefit analysis is necessary for planning purposes.** However, there are more factors at play than economic return on investment, such as environmental and social impacts of the intervention, which will be discussed in the subsequent sections.

4.9 Environmental impacts

At the EU level, the European Commission's Environmental Footprint Method of 2013 is the cornerstone of assessing environmental impacts.[40] The fundamental principles of the method is based on the Life Cycle Assessment (LCA), which evaluates the release of emissions associated with all stages of a commodity, from production to end of life. There are 16 different impact categories presented in the methodology. The Recommendation was recently revised in 2021, to include the insights of a pilot phase (2013-2018) where the method was tested with more than 300 companies and 2000 stakeholders in different sectors, including food and feed. The core principles of the revised Recommendation are still based on the LCA, with largely only methodological

[40] European Commission Recommendation (EU) of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (2013/179/EU): https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013H0179

changes being introduced.[41] Section 4.9 looks at 5 of the impact categories – climate change, land use, water use, and eutrophication (freshwater and marine water). More detailed environmental information per intervention that underwent an interview, is available in appendix 9.13.

Table 5: Environmental Footprint Method

Impact Category	Indicator	Unit of Measurement
Climate change	Radiative forcing as Global Warming Potential (GWP100)	kg CO2 eq.
Land use	Soil quality index	Pt
Water use	User deprivation potential (deprivation weighted water consumption)	m^3 world eq. deprived
Eutrophication (freshwater)	Fraction of nutrients reaching freshwater end compartment (P)	kg P eq.
Eutrophication (marine water)	Fraction of nutrients reaching marine end compartment (N)	kg N eq.

Source: Caldeira, Carla, Valeria De Laurentiis, and Serenella Sala. (2019). *Joint Research Centre Technical Report: Assessment of food waste prevention actions.* Luxembourg: Publications Office of the European Union (page 92).

Climate change: greenhouse gas emissions, land use, water use, eutrophication

The food system plays a critical role in the battle to mitigate the effects of climate change. From "2010-2016 global food loss and waste equalled 8-10% of global

[41] European Commission Recommendation (EU) 2021/2279 of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (C/2021/9332)**:** https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32021H2279

greenhouse gas (GHG) emissions" (IPCC 2022: 492). Within the European Union (EU), it is estimated that food waste accounts for at least 6% of its total emissions (Feedback EU 2022: 4). The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment report of February 2022 outlined the necessary steps required to reduce emissions and keep global warming below 1.5 degrees Celsius - and in this respect reducing food loss and food waste is paramount. Such reduction across the food supply chain will depend on prevention measures as well as effective management of unavoidable food waste via recycling and recovery (such as energy production from waste).

The European Commission's Environmental Footprint Method defines climate change as "all inputs and outputs that result in greenhouse gas emissions (GHGs). The consequences include increased average global temperatures and sudden regional climatic changes." (EUR-Lex 2021 Annex 1: 8). The category is measured in "kilograms carbon dioxide equivalent" (kg CO2 eq.). It differs from the sole carbon dioxide measurement (CO2), in that it includes not only carbon dioxide, but all other greenhouse gases such as methane and nitrous oxide. The EU abides by seven gases in this category, in alignment with the U.N. Kyoto Protocol: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, and 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.

The total amount of GHGs emitted throughout a product's lifecycle is also known as its' carbon footprint (FAO 2015). Different commodities emit different levels of GHGs based on varying cultivation methods and how the product moves through the supply chain. According to the FAO, the food category with the highest carbon footprint is cereals followed by vegetables, meat, milk, fruits, starchy roots, fish and seafood, and oil crops and pulses (FAO 2015). Accordingly, to have a more accurate indication of GHGs emitted, the amount of food waste should be disaggregated into separate food categories. However, this is a challenge because food waste - especially at the consumption level (food services, households) – often does not belong to one food category, but rather several categories.

Land and water use are vital in agriculture – both are necessary to cultivate food and are resources that are commonly measured when discussing the effects of food waste on the environment and its natural resources. According to the European Commission, land use refers to the "use (occupation) and conversion (transformation) of land area by activities such as agriculture, forestry, roads, housing, mining, etc." (EUR-Lex 2021 Annex 1: 10). According to the FAO, world-wide food waste occupies nearly 1.4 billion hectares, which is equal to 28% of the world's agricultural land area (Pandey 2021: 18). It is an impact category that takes into consideration the effects of land use including the amount used, for how long, and what land transformation (particularly effects on soil) is taking place due to agriculture. The indicator used to assess this is the soil quality index, which establishes soil health by the encompassing physical, chemical, and biological properties of the soil (Lenka et al. 2022). The structure of soil is vital in terms of the nutrients and the amount of water needed for plant growth. If land (soil) is cultivated repeatedly, without being given time to replenish, it gets depleted of its' natural nutrients and moisture, with the end-result affecting the yield and quality of crops. Water use represents the "relative available water remaining per area in a watershed, after demand from humans and aquatic ecosystems has been met." (EUR-Lex 2021 Annex 1: 15). It helps to provide valuable insight into the potential for water deprivation - to humans and the ecosystem. The total volume of water that is utilized to produce the commodity is presented as a "water scarcity footprint". A water footprint has 3 main categories – blue water (irrigation water from the ground or surface water), green water (rainwater) and grey water (theoretical volume of water required to dilute pollutants) (Pandey 2021: 18).

With the exception of 14 interventions, all actions that underwent interviews in task 1.2, specifically **included environmental considerations in the development, implementation, and monitoring 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.** The calculations in this report are based on data obtained during interviews and by using the European Commission (JRC) Food Waste Prevention Calculator. The valorization of biowaste for the production of biogas in Vaxjo, Sweden, addressed the most amount of GHGs (221

million kg CO2 equivalent) in comparison to the other interventions, with 70,230 tons of biowaste treated in 2022 to generate biogas. An example of a circular economic activity, this biogas is used for transportation - city buses and cars – with a local gas station providing the generated biogas. However, the calculation is based on biowaste which is not only food waste, but can include any waste that is biodegradable, including plant and garden waste. If adhering solely to food waste as part of the calculation, then the intervention with the highest impact for avoiding GHG emissions, is Direct Food Surplus in Hungary, with just over 28 million kg CO2 equivalent (28,300,000 kg CO2 eq.).[42] Regarding water usage, besides the biowaste initiative in Vaxjo, the Food Waste Mitigation Strategy in Denmark, targeting all municipal food service units by training kitchen staff, ranked highest in terms of water conserved (just over 26 million cubic meters). In a similar vein, the Food Waste Mitigation Strategy also came out on top in regards to eutrophication, by fending off high amounts of nitrogen and phosphorous from entering freshwater and marine water. Eutrophication refers to the loss of biodiversity due to the accelerated growth of algae and other vegetation in freshwater and marine water (EUR-Lex 2021 Annex 1: 9). This accelerated growth is due to nutrients (mainly nitrogen and phosphorus) from food waste. The increased growth of algae can lead to fast growing toxic algae and vegetation, affecting species survival. Food waste thus indirectly causes eutrophication and loss of wildlife diversity, in particular in marine environments.

Although environmental impacts commence already at the starting point of cultivation, when a food commodity is produced, it will accrue environmental impacts as it moves along the supply chain. The reason for this is that each stage "inherits" the environmental effects of the previous one – from primary production until consumption – be it GHGs, water and land use, or eutrophication. For this reason, although it is important to address food waste at all stages, if it can be prevented, or addressed to an extent already at the primary production phase, it is optimal. From the interviews conducted, **there was a data gap when it came to comprehensive and systematic**

[42] The interview with LIPOR actually provides data citing more GHG emissions prevention, however LIPOR data consolidates several of its interventions and not just one intervention.

monitoring and evaluation of the environmental effects of an intervention. For example, among those measuring GHGs, different references and calculators were utilised for calculations, and while the primary focus was GHGs when determining environmental impacts, none of the interventions indicated that they also measured other environmental indicators such as land and water use. 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.

Table 6: Environmental impacts of the actions (interviews)

	Impact Category	**Climate Change** (kg CO2 eq.)	**Land Use** (Pt)	**Water Use** (m^3 world eq. deprived)	**Freshwater Eutrophication** (kg P eq.)	**Marine Eutrophication** (kg N eq.)
Action						
Best of Waste		1.70E+05	6.78E+06	1.00E+06	2.93E+01	4.13E+02
Valorisation of biowaste for biogas production		2.21E+08	2.28E+10	3.86E+08	9.72E+08	1.23E+06
Budapest Bike Maffia		2.83E+04	2.61E+06	4.50E+04	5.37E+00	1.46E+02
Valorisation of chicory		4.00E+03	2.10E+05	2.52E+03	1.73E+00	1.54E+01
Direct Food Surplus Redistribution		2.83E+07	2.61E+09	4.50E+07	5.37E+03	1.46E+05
Etelmento		1.32E+04	1.30E+06	2.20E+04	2.67E+00	7.20E+01
Food Waste Mitigation Strategy		1.32E+07	1.24E+09	2.65E+07	3.55E+03	8.54E+04
Food Winners Brugge		1.84E+05	1.74E+07	3.71E+05	4.99E+01	1.19E+03
Foodello		3.37E+06	3.27E+08	5.63E+06	6.97E+02	1.78E+04
Foodsavers Antwerp		3.37E+03	3.27E+05	5.63E+03	6.97E-01	1.78E+01
Foodsharing Tartu		1.67E+05	1.54E+07	2.64E+05	3.33E+01	8.52E+02
IKEA / United Against Food Waste		1.25E+06	1.22E+08	2.11E+06	2.57E+02	6.65E+03

Invendus pas Perdus		1.04E+06	1.01E+08	1.73E+06	2.15E+02	5.48E+03
JoteKonyha		4.74E+03	3.92E+05	8.33E+03	1.10E+00	2.83E+01
Krut		2.67E+03	1.55E+05	1.95E+03	1.16E+00	1.14E+01
Let's Save Food		6.47E+05	6.27E+07	1.08E+06	1.34E+02	3.41E+03
LIPOR[43]		7.05E+07	5.95E+09	1.26E+08	1.69E+04	4.25E+05
Hub di Quartiere contro lo Spreco Alimentare		1.02E+06	9.71E+07	1.67E+06	2.61E+02	5.29E+03
Sustainable Acquisition of Foodstuff (school canteens)		3.99E+05	3.76E+07	8.02E+05	1.08E+02	2.58E+03
Voedselhub Mechelen		1.29E+06	1.25E+08	2.16E+06	2.68E+02	6.83E+02
Vollcorner		3.65E+02	1.69E+04	2.10E+02	1.30E-01	1.30E+00
Waste Watch		1.46E+06	1.38E+08	2.94E+06	3.95E+02	9.46E+03
Yhteinen Poyta		1.77E+06	1.63E+08	2.81E+06	3.41E+02	9.12E+03
Foodie Save		2.49E+04	2.29E+06	3.93E+04	4.92E+00	1.27E+02

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

4.10 Social impacts

The **social impacts of the interventions reviewed in task 1.2 were predominantly positive – 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. This increased awareness gives rise to a number of positive ramifications, including strengthened relationships among actors. One such example is Jótékonyha, a social enterprise of the Hungarian Foodbank, offering waste-free food catering services. Via the events,

[43] LIPOR calculations are based on consolidated food waste prevented data for the following projects: Dose Certa, Horta a Porta, Terra a Terra, Fruta Feia, and Embrulha.

Jotekonyha's customers gain insights about food waste and learn about the Food Bank, with many applying thereafter to volunteer as helpers and / or donate money. Another positive effect of increased awareness is more economic-oriented, in that actors, in particular at the household level, realize the financial benefits of preventing food waste and thereby are encouraged not to waste their bought food. Meanwhile, at the retail and food services level it can allow for a whole new product line to be sold, such as is evident with the intervention supported by VollCorner regarding the marketing and sale of optically imperfect carrots.

Another positive social impact was the ability to redistribute the food and thereby help people in need – it was a strong motivator for people, as evidenced by the responses in the interviews. 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. Supply chain actors had to communicate effectively and thereby were able to also learn from each other, understanding the challenges and opportunities within the redistribution system as a whole. In a similar vein, raising awareness also helped increase knowledge about the relationship between food and climate (via workshops, forums, educational campaigns), allowing communities to come together to support common environmental causes, such as the benefits of composting.

5. The Motivation, Opportunity, Ability Framework – An outlook to Chorizo's work on social norms

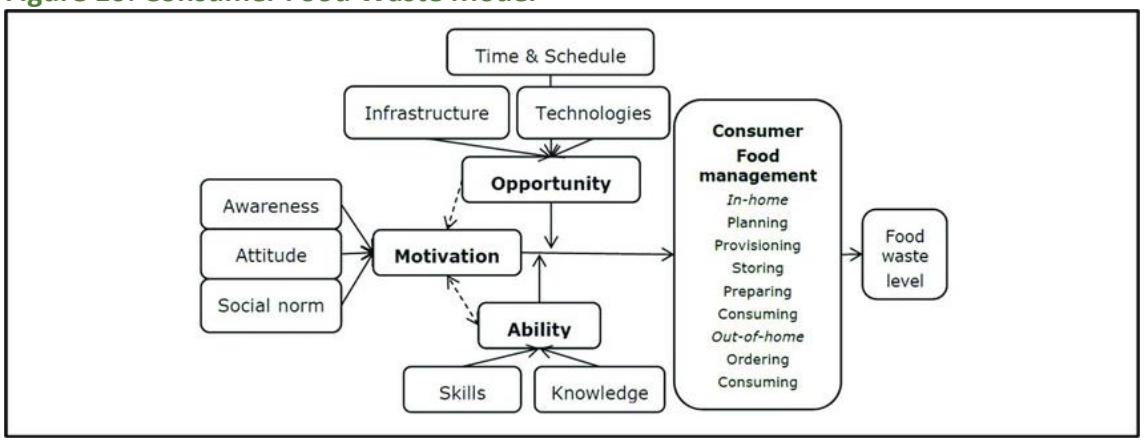
Disclosing the mechanisms and the driving forces behind behaviours that lead to intended and unintended generation of food waste is essential to reach the desired outcomes in terms of food waste reduction and preventions. From 2010 onwards, a considerable amount of literature was written on what drives food waste, from complex socio-economic contexts, daily habits, or even the mere ability and opportunity to address it (Parfitt et al. 2010; van Geffen et al. 2016; Barker et al. 2021; Hartmann et al. 2021; Vittuari et al. 2023). From this literature, food waste is recognized as a complex result of multiple and interconnected behaviours taking place at different moments and stages of the food supply chain (van Geffen et al. 2016). Several theoretical and conceptual frameworks were developed to understand this complexity and this work builds on a revised version of the Motivation-Opportunity-Ability one. Within the Chorizo project, this revised theoretical framework is fully introduced and discussed in Deliverable 3.1.

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).

The MOA Framework 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. 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. The aim of this chapter of

the deliverable is to see to what extent the MOA framework (including social norms) is evident within the actions identified in task 1.2 of the project.

Figure 10: Consumer Food Waste Model



Source: Van Geffen, Lisanne, Erica van Herpen, and Hans van Trijp. (2016). *Causes & Determinants of Consumer Food Waste: A Theoretical Framework.* EU Horizon 2020 Research and Innovation project REFRESH (page 22).

5.1 Motivation

Motivation is driven by an individual's awareness and attitude about food waste.[44] Becoming aware about food waste refers to becoming aware about the *problem* of food waste and therefore the social, economic, and environmental impacts are often the focus. It is not uncommon for an individual to underestimate their role in food waste production. For example, according to a Eurobarometer report of 2014, 86% of survey respondents reported that they believed they wasted "relatively little" amounts of food in their household, while recent statistics from Eurostat highlight that in 2020 around 131 kg of food waste per inhabitant was generated in the EU, and of this 131 kg, households generated 70 kg (Eurobarometer 2014: 28; Eurostat 2023).[45] In order to

[44] For a more thorough overview about motivation, please refer to Deliverable 3.1 which establishes and discusses the theoretical framework.

[45] Eurobarometer:
https://op.europa.eu/en/publication-detail/-/publication/e3932343-3c82-4a5f-8a1a-e22eafd050a6
The wording "relatively little" meaning no more than 15 percent of food in the home.

Eurostat:
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates#Amounts_of_food_waste_at_EU_level

increase awareness, the subject matter has to be made visible, but visible in terms of what it means for the individual. While some consequences (particularly the environmental ones) may be somewhat removed from the everyday lives of people, the economic impacts are often not – in particular the amount of money that is in essence "lost" when throwing out food that could still be safely consumed. An example from within the actions identified in Chorizo task 1.2 aimed to raise this level of awareness was the "Food Waste Fighters" program implemented by Airfield (Ireland). The program focused on households, highlighting to families not only how much money is lost by throwing out food, but how much money could be saved by using leftovers. How problematic an individual deems food waste to be, may affect their attitude towards the issue and play a role in their motivation to address it.

5.2 Motivation – Social Norms

Motivation cannot be fully understood without also examining the role of social norms. Within this discussion there are two main types of social norms that impact motivation - injunctive and descriptive social norms. Per the work done in the Chorizo project, and specifically outlined in work package 3 (deliverable 3.1), social norms are defined as the rules / guides for actions perceived by individuals aspiring / belonging to the norm's target group as expected by others (Bicchieri 2006). In the literature, a common differentiation among social norms is to distinguish injunctive social norms from descriptive social norms, and this distinction has been used in this chapter to classify the identified actions. Injunctive norms refer to perceptions about normatively appropriate behaviour in a specific context (Cialdini et al. 1991). It relies on the perception that an individual has about what kind of behaviour is approved or disapproved of by the reference group.[46] Often there are reinforcing mechanisms (rewards or punishments) through which such approval or disapproval is expressed. 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

[46] Reference group refers to a grouping of people or social network that an individual looks towards to help him or herself determine their own behaviour.

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.

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 a social norm to all of these actions is not possible, since not all of the actions (or interventions) were developed to try and change behaviour at an individual level. For example, the science and innovation actions fall into this category, such as "Apeel technology", which entails adding a protective, edible coating (made of plant materials) onto fruits and vegetables in to extend their shelf-life and thereby reduce food waste. Within the list of actions identified in task 1.2, **there were only 14 actions deemed to be driven by injunctive social norms**.[47] These actions involved either voluntary agreements, legislation (such as the mandated bio-waste collection for energy production law in France), rewards (example of Froodly's mobile app in Finland rewarding consumers with credits towards free coffee for reporting still-fresh discounted products in their local stores), or punishments (being charged for any leftover food at buffet restaurants for example). By contrast, **there were 66 actions classified as driven by descriptive social norms**. Most of these actions took place within a community context such as the "Community Fridges" implemented by Hubbub in the United Kingdom, providing a common space to bring people together to eat, connect, learn new skills and reduce food waste. Fridges are run by community groups in shared spaces such as schools and community centres. Or the action "Déifferdenger Pléckerten" in Differdingen, Luxembourg where the young and old come together to pick fruit and prevent it from rotting. Broader socio-environmental movements were also a common theme in actions driven by descriptive social norms, such as circular economy initiatives.

The Chorizo project also identified via literature review in work package 2, four social norms specific to food waste (ICF et al. 2018; Stangherlin et al. 2020; Graham-Rowe et

[47] For a list of the actions in accordance with injunctive or descriptive social norms, please refer to appendix 9.9.

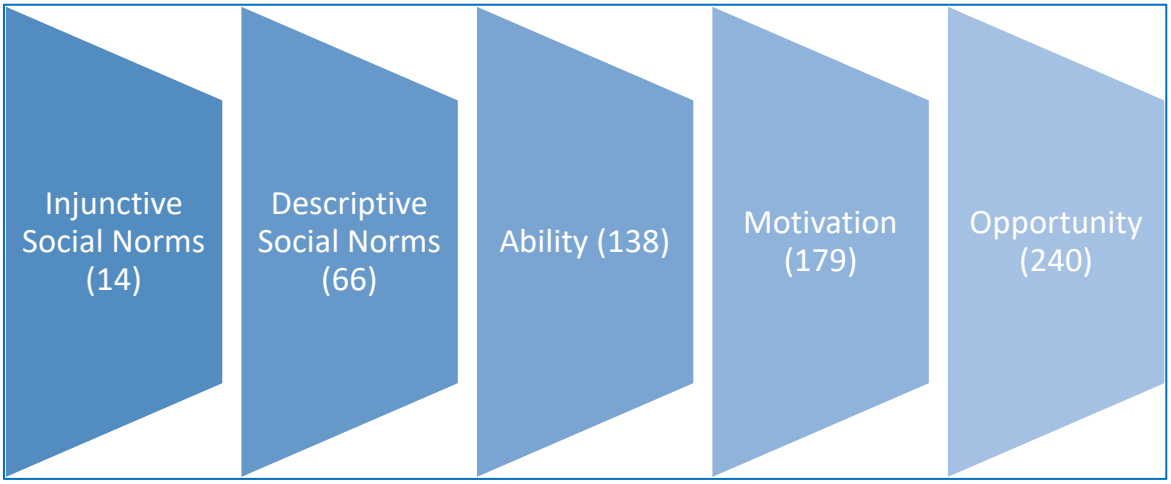
al. 2014; Versluis and Papies, 2016; Zhao et al. 2019; and Middleton et al. 2018). These norms are: sub-optimal food / undesirable food quality, good provider identity, portion size and food affluence, and associations between food waste behaviour and socio-economic status. These four social norms could be found in the list of actions identified in task 1.2. There were 80 actions classified under "general awareness-raising" meaning that they are actions which focus on increasing overall, broad, general awareness about food loss and food waste - in the form of campaigns, forums, platforms, guides, and educational workshops. Consequently, they are actions which may address to a certain extent any of the four food waste-related social norms.[48] Examples include the 'I Am Ready' campaign in the Czech Republic aimed at raising awareness about aesthetic standards on fruits and vegetables. A petition signed by more than 10,000 people, gave impetus to stores such as Penny Market and Tesco to sell "wonky" (i.e. not aesthetically pleasing but still safe to eat) fruits and vegetables. Or the action "Noi Con Mente" in Italy (Puglia region), where the focus is on the ethical value of food and promoting a culture of conscious consumption, thus falling into the "portion size" social norm. However, there was one food-related social norm which appeared more frequently than the others and was most often found under the retail supply chain (33 actions out of the total 45) – "suboptimal food / undesirable food quality". However, the norm could also be found within other categories (primary production, processing and manufacturing, food services, households, whole supply chain) and in particular the redistribution sector. The commercialization of suboptimal food is a key mechanism for tackling food waste, with the retail sector perhaps having the most influence in terms of being at the nexus of the relationship between the primary sector (production) and consumers (consumption), and thereby being able to influence – directly (advertising campaigns for example) or indirectly (such as reward programs for buying certain foods) – purchase choices (Hartmann 2021).

[48] For a full list of all the actions addressing food waste identified in task 1.3, please refer to appendix 9.8.

5.3 Ability and Opportunity

Both ability and opportunity are necessary to provide the support needed to bring about a change in food waste behaviour. Ability refers to skills and knowledge. Key components are accurate planning of food purchase and meal preparation (including with leftovers), knowledge about proper storage, and the capacity to assess food safety via labeling. Without ability, regardless of the amount of motivation, an individual is unable to effectively generate behaviour to ensure less food waste. Interventions that address ability usually include some type of "hands-on" training about the purchase, preparation, and storage of food. The 'Future Kitchen Essen' project is an example where training is given by the municipality and local nutrition council to canteen centers and caterers on utilizing sustainable and local food. Within task 1.2, **bringing forth ability was identified in 138 actions.** It was evident most often (59 times) within the food services and households supply chain stages combined. This is understandable since both these stages necessitate purchase, preparation, and storage of food. Opportunity refers to the availability and accessibility of materials and resources to change behavior, such as time, technology, storage equipment, access to stores, and the possibility to purchase affordable and quality food in suitable portions. The 'Whywaste Semafor Deli' app in Sweden is an example where food services staff are given access to technology to better track potential food waste. The system alerts personnel if there are any products on the counter being at risk of becoming waste so that the personnel can take necessary measures to address it. Within task 1.2, **promotion of opportunity was identified in 240 actions**. **Of the three components within the MOA Framework, opportunity was in fact identified the most frequently**, and was mainly concentrated in the primary production, processing and manufacturing, redistribution, and retail stages of the supply chain. When it came to opportunity, a common characteristic amongst 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.

Figure 11: Number of actions in accordance with the MOA Framework and social norms[49]



5.4 The interwoven nature of the MOA Framework

The MOA Framework model necessitates all three components of motivation, opportunity, and ability in order to affect behaviour. Each component on its own is insufficient since they interact and influence each other. Motivation, albeit important to spur behaviour, on its own cannot ensure that a particular behaviour will indeed take place. The ability and opportunity components are particularly important in terms of not only providing the broader substructure and support needed to bring about change in behaviour, but they are also key in helping to identify where there are barriers to ensuring behaviour that effectively addresses food waste. Via skills and knowledge, abilities help an individual to specifically act in a manner that supports food waste prevention, while opportunities provide the broader framework and support needed to bring those abilities to fruition – such as for example the knowledge about optimal frozen temperature to store meat and for how long, but needing as well the physical infrastructure to do so (i.e. a freezer). **Utilizing the model sheds light on how interventions may shape behaviour towards food waste. However, it is important to keep in mind that in the case of task 1.2, a cross-section of actions were identified with the objective of obtaining a broad overview of actions addressing food waste in the EU, and not per se focusing only on those actions implemented to address food waste**

[49] Individual actions / interventions do not pertain to only one category per se, but can cover more than one category of MOA and social norms.

behaviour. The science and innovation actions identified are an example. **There were only 24 instances in which all three of the components could be identified in an action.** A determination of systematic behavioural change, however, necessitates a separate in-depth study outlining how the behaviour has or has not changed over time, with a focus solely on actions geared towards that objective. The MOA Framework is a crucial first step in that endeavour.

6. Gender and food waste

Reasons for a gender-based analysis

The Chorizo project aims to better understand the relationship between social norms and behaviour towards food waste. Key to obtaining such an understanding is including in research and analysis the gender dimension - i.e. gender norms. Cislaghi and Heise (2020) define gender norms as "social rules and expectations that keep the gender system intact" (Cislaghi and Heise 2020: 410). The authors explain that gender norms are in essence social norms defining what are acceptable actions for women and men in a given group, and these norms are embedded in formal, informal institutions, and the mindset, while being produced and enforced via social interaction. To fully understand what role gender plays, not only should inquiry take place in terms of determining expectations and appropriate behaviour for genders, but how those expectations and behaviour are re-enforced by institutions and power relations should be investigated as well.

In all societies there are systematic gender differences regarding the production and consumption of food (Korsvik and Rustad, 2018). The United Nations Food and Agriculture Organization (FAO) notes that gender relations are key factors in shaping food value chains as well as power relations between men and women, influencing division of labour, roles, and responsibilities, with all of these having an impact on the entire food chain including food loss and food waste. "Including a gender-based analysis thus provides critical information and entry points for the identification of efficient and culturally acceptable solutions to food loss and waste." (FAO 2018: ix).

Researched actions do not systematically incorporate the gender dimension

There were nearly 400 actions addressing food waste identified during task 1.2 within the Chorizo project. However, **based on desktop research none of the actions were specifically geared to systematically incorporating the gender dimension in order to address food waste.** When it came to targeting segments of society, the actions were developed to address food waste, but to also tackle socio-economic inequality –

regardless of the gender. In particular, the actions that involved redistribution of food were targeting a strata of society that was struggling economically and where surplus food was ultimately donated to charitable organizations such as food banks and community kitchens for example. Even in the retail and food services sector when surplus food was being re-sold on the market – it was usually at a reduced price, which tends to reach (although perhaps not specifically targeted at) the lower-income strata of society, as those are the people most often checking and comparing the prices of food products. Not even for actions addressing household food waste, was there systematic incorporation of the gender dimension in order to address food waste. This is striking considering that the purchase of food and preparation of meals in the home has historically fallen mainly to women (Bowers 2000, Langard and Caraher 2001, Korsvik and Rustad 2018, Bowen et al. 2019). However, societal patterns in this respect are changing with not only more women entering the workforce, but evolving gender roles taking place within the household itself, including buying, preparing, and cooking meals. Langard and Caraher (2001) refer to it as "culinary transition", meaning "the process in which cultures experience fundamental shifts in the pattern and kind of skills required to get food onto tables" (Langard and Caraher 2021: 2). Wolfson et al. (2021) highlight that in EU countries with the least disparity in cooking frequency between genders in the home (i.e. Denmark, Sweden and Finland), these same countries have "robust policies that support family leave for new parents (both men and women) and other supportive social policies that may encourage gender equity in household tasks such as cooking" (Wolfson et al. 2021: 6). Such societal changes may be one of the reasons why the actions identified in task 1.2 of the Chorizo project are not geared specifically to gender – i.e. gender norms are evolving and therefore in flux.

<u>Interviews reveal secondary benefits for a particular gender</u>

In the in-depth interviews (43) conducted within Task 1.2 with representatives (implementers) of the actions, it became visible that although gender was not being specifically addressed within the actions themselves, there were **cases where a particular gender benefitted from the action**. One such example is the food app "Foodie Save", where the company's research has noticed that the app (to buy surplus food at a

discounted price) is particularly popular among single mothers. Or the action "Invendus pas Perdus" (redistribution) in Belgium, where it was noted that the project works with several associations, and among them an association (Maison des Femmes) which is geared solely to the welfare of women in need. It was incidentally the only interview where a link was being made with societal gender norms when it came to food, with the interviewee stating, "Generally speaking I think this project helps women, as they are often the ones associated with food and cooking meals." Some actions identified are in the early stages of implementation, and thus possibly still have an opportunity to focus more in the future on gender. For example, the "Leaf No Waste" project in Ireland, which is looking into the use of the bio-stimulant silicic acid to keep salad leaves fresh as long as possible (i.e. the bio-stimulant does not extend the life of the plant, but rather is more of a natural fortification / stimulant), is doing consumer perception research, looking into buying power with gender impact on that being part of that analysis. Overall though, **if the effects on and benefits for a particular gender derived from the actions, it happened without having been systematically included in the actions themselves.**

Based on the interviews conducted, **socially in-grained gender roles were more visible though when it came to implementation of the action.** For example, with the redistribution action "Aprofita" (Valencia, Spain), it was noted in the interview that most of the voluntary workers carrying out the gleaning were women. With the app "Plan-eet" (Belgium), most of the workshops given to households about food waste (recipes for leftovers or storing food for example), were given by female volunteers and teachers, whereas the workshops on composting were more often given by men. Implementation of an action does require the participation of all genders, but optimally it should be balanced participation in order to obtain the unique points of view of all gender identities when it comes to project design, implementation, monitoring, and evaluation.

<u>Recommendation for the future: Food waste actions should incorporate gender norms</u>

Incorporating a gender perspective into food waste prevention actions from conception to evaluation is key to improving the overall quality and validity of the actions. Understanding and addressing gender norms throughout the food supply chain, particularly when it comes to food purchase and preparation, is fundamental to

achieving sustained and lasting impacts to reduce food waste. Studies to this effect are being done (Flagg et al. 2013, Cantaragiu 2019, Hartmann et al. 2021, Bryan et al. 2023) and can be utilized as a catalyst for complimentary interventions and projects. In order to effectively combat food waste, future actions tackling the issue need to incorporate gender norms – to better understand it and thereby better equipped to address what role gender norms play in terms of producing or not producing food waste across different contexts and social structures. When looking to deepen our understanding about the role that gender norms have on food waste, where possible, the crucial role of gender needs to be systematically incorporated into project development, monitoring plans, and ultimately analysis.

7. Conclusions

To combat food waste, a diversity of actors across the supply chain, from the public and private sector, civil society, non-profit organizations, and research entities, need to collaborate to effectively address this challenge. Future population growth is expected to rise 8.5 billion by 2030 (OECD 2020: 24). While improved farming techniques pre-supposes that yields will increase, in certain countries – particularly the high-income ones such as in the EU – output growth is affected by a variety of policies such as food safety standards and environmental concerns (OECD 2020: 43). The growing population necessitates more food, while stretching natural resources such as water and land to cultivate it. Balancing a growing population's food needs with environmental impacts is a pervasive challenge. Add to this another complexity of nearly 800 million people world-wide (33 million in the EU) experiencing food insecurity and consequently suffering nutritional deficiencies (Chen et al. 2020: 1; Eurostat 2020). It quickly becomes clear that within this context, addressing food waste is imperative.

Government plays a crucial role via financial support, setting targets, providing guidelines, and even enacting legislation. However, **collaboration with local partners, such as industry and civil society is vital** to ascertain that food waste is addressed as holistically as possible, across the supply chain with multiple partners, and thereby hopefully ensure any intervention's longevity. To ensure progress to meet the international United Nations Sustainable Development Goals and target 12.3 - to halve per capital global food waste at the retail and consumer levels and reduce losses along the production and supply chains, including post-harvest losses - the European Commission recently proposed new legislation.[50] It has issued a proposal on July 5, 2023 to set legally binding food waste reduction targets which are to be achieved by EU member states by 2030.[51] According to the proposal, across the EU food waste levels in

[50] United Nations Sustainable Development Goals: https://sdgs.un.org/goals

[51] European Commission: https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-reduction-targets_en

the processing and manufacturing sector are to be reduced by 10%, and 30% in retail and consumption combined. These target percentages align with the Eurostat findings from the first EU-wide monitoring of food waste levels carried out in 2020, which highlighted the generation of 131 kilograms (kg) of food waste per inhabitant in the EU, of which households generated 70kg, food services 12kg, and retail 9kg (Eurostat 2023).[52] This initiative from the European Commission should help bolster complementary national, regional and municipal level government initiatives combatting food waste.

Research and interviews in task 1.2 highlighted a wide array of actions that have been and are currently taking place across the supply chain in order to address food waste. **Technology and innovation played a prominent role** in the actions identified, with 100 of them linked to technology or an app. It was most common in the processing and manufacturing sector via valorisation, but also notable in the retail and redistribution sectors via apps, on-line platforms, and software. The actions covered all the stages of the supply chain from primary production to end-user consumption. The largest number of actions belong to the redistribution sector, with surplus food redistributed to consumers, often at a discounted price. The majority of actions, when classifying them according to the food waste hierarchy, were **prevention actions**. This aligns with European Commission efforts to first and foremost prevent food waste so that it does not take place, rather than address it once it has already been created in the supply chain.

The research and interviews also demonstrated **two main areas which necessitate more attention in the future during the development stage of interventions: monitoring of the action's progress and gender.** Project partners were able to identify only about an eighth of the total number of actions where a baseline had been established as well as a monitoring system including key indicators to track progress of the action over time.

[52] Eurostat: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates#Amounts_of_food_waste_at_EU_level

Task 1.2 partners had to work within a specific set of resources and in order to provide a more holistic overview of how many actions did indeed establish a baseline and utilize a monitoring system with performance indicators, more in-depth research and direct contact with implementers of the interventions is required. Additionally, there were numerous actions set-up solely to raise awareness about food loss and food waste; raise consciousness about the issue. But generally, establishing a baseline and effectively monitoring progress is an essential part of an intervention. It helps in understanding the social, economic, and environmental context within which the action is operating, increases transparency about implementation, and provides valuable information for future interventions and policy design. Regarding gender, incorporating a gender perspective into food waste prevention actions from conception to evaluation is key to improving the overall quality and validity of an action. The actions identified in Chorizo task 1.2 did not however systematically include gender. Considering that the purchase of food and preparation of meals in the home has historically fallen largely to women, and in light of changing societal patterns and evolving gender roles, to effectively combat food waste, future actions tackling the issue need to systematically incorporate a gender perspective. This will allow for a better understanding and thereby being better equipped to address what role gender norms play in terms of producing or not producing food waste across different contexts and social structures.

The MOA Framework model was incorporated into the analysis of this report with the aim of assessing how the identified interventions may have shaped behaviour towards food waste. The model necessitates all three components of motivation, opportunity, and ability in order to affect behaviour. Each component on its own is insufficient since they interact and influence each other. In the case of task 1.2, a cross-section of actions were identified with the objective of obtaining a broad overview of actions addressing food waste in the EU, and not per se focusing only on those actions implemented to address behaviour. There were only 24 instances in which all three of the MOA Framework components could be identified in an action. A determination of systematic behavioural change necessitates a separate in-depth study outlining how the behaviour has or has not changed over time. **The MOA Framework is a crucial first step** in that process.

Even though the results of this report are subject to data limitations, it serves to provide a broad overview of what interventions are currently addressing food waste across the EU, and where possible, to expand upon how and to what extent food waste is being addressed. Within the Chorizo project, the data will be utilised to inform work in subsequent work packages, such as the modelling efforts in work package 3, and the datasets about the interventions will be made available in the project's datahub. It is **data that can be built upon** as more knowledge about current interventions is accumulated over time, as well as **supply information which can be actively utilized during the planning and implementation of new interventions** to address food waste.

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9. Appendices

APPENDIX 9.1 - Evidence Search Plan

Evidence Search Plan (Methodology) for Task 1.2
(Task 1.2: Multi-source evidence collection, analysis, and interpretation)

Timeframe:
Start Date – Month 4 (January 2023)
End Date – Month 10 (July 2023)
Internal review and submission = M 10 (July 2023)

Objectives of T1.2 to achieve Deliverable 1.2:
(Reference: Grant Agreement – Annex 1, Part A, page 6, 16, 19 and Part B, pages 9-10.)

a) To **identify and assess at least 300 actions** that address food loss and food waste (FLW), building on the work of the JRC in support of the EU Platform on Food Loss and Food Waste, and
b) To collect **FLW-related datasets** from previous and on-going actions and sources.

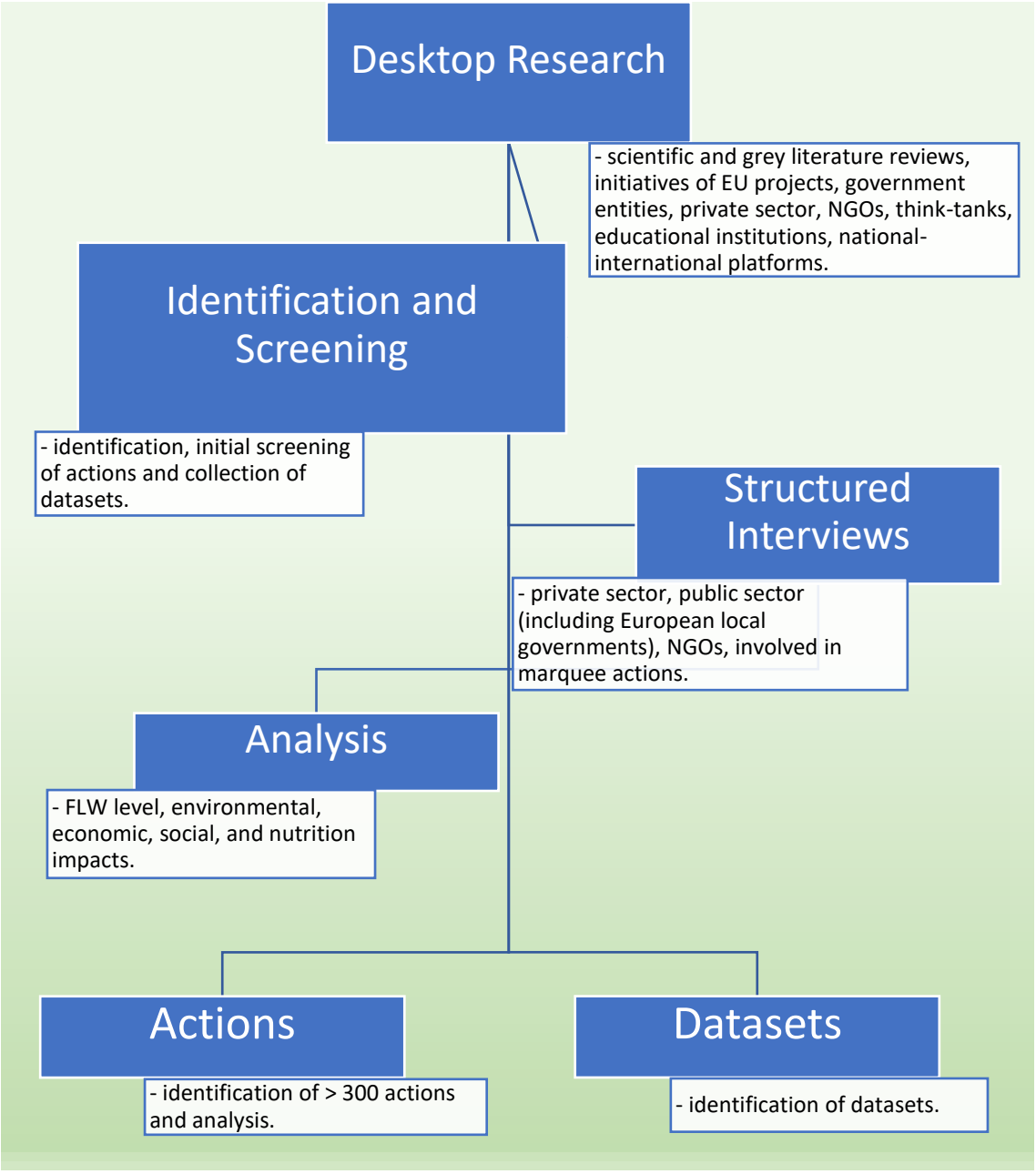
These objectives will be accomplished via:
1. Desktop research
2. Structured interviews

Main Research Questions:
(Reference: Grant Agreement – Annex 1, Part A, page 6 and Part B, page 9.)

1. What actions have there been to date that address food loss and food waste?
2. What impact have these actions had – economic, environmental, and social effects?
3. What FLW-related datasets exist from previous actions and sources?

Mapping of Task 1.2

(Reference: Grant Agreement (GA) – Annex 1, Part A, page 6, 19 and Part B, pages 9-10.)



Deliverable 1.2:
(Reference: Grant Agreement – Annex 1, Part A, page 6, 19 and Part B, pages 9-10.)

Dissemination Level: PU- Public
Type: R-Document, report

1. Name of the action
2. Food chain stage
3. Country
4. Action duration
5. Actors involved
6. Goals and objectives
7. Role of the action
8. Overall impacts of the action
9. Investment and pay-back period
10. Social norms and behavioural aspects impacted
11. Sustainability of the action
12. Available datasets
13. Identified R&I hotspots.
14. Concluding statement that includes assessment of the quality, validity and consistency of the evidence

Overall Timeline:

- PHASE 1: Desktop Research: January 1, 2023 - February 24, 2023

- PHASE 2: Taking Stock of Actions/Datasets to Date: February 27, 2023 – March 3, 2023

- PHASE 3: Corresponding Interviews: March 6, 2023 - April 21, 2023

- PHASE 4: Quality, Validity, Consistency Review: April 24, 2023 – April 28, 2023

- PHASE 5: Summary of Assessment: May 1, 2023 – May 12, 2023

- PHASE 6: Review Information: May 15, 2023 – May 19, 2023

- Submission for Internal Review: July 6, 2023

- Submission of Deliverable: By end of July 2023

PHASE 1: Desktop Research

Timeframe:

⇒ January 1, 2023 - February 24, 2023

Document to complete:

⇒ Standardized Reporting Template
(Standardized Reporting Template Sheets 1A and 1B – excel)

Desktop Research:
(Reference: Grant Agreement – Annex 1, Part A, page 6 and Part B, pages 9-10.)

During the desktop research phase, partners are requested to:
a) identify **actions** addressing FLW
b) locate any available **datasets** related to FLW

A.) Identification of Actions
- For each action identified, the following information is needed:

General Information:

1. Name of the action

2. Food chain stage

3. Country

4. Action duration

5. Actors involved

6. Goals / Objectives

7. Role of the action
(Was the action preventive or corrective – in accordance with the food waste hierarchy)[53]

B.) Identification of Datasets
- Identify available datasets/data protocols found during desktop research related to addressing FLW.

⇒ Name
⇒ A few sentences description including if quantitative or qualitative
⇒ Source (Internet link, journal)

[53] DG Health and Food Safety website page:
https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement_en

PHASE 2: Taking Stock of Actions/Datasets to Date

Timeframe:

⇒ February 27, 2023 – March 3, 2023

Document to complete:

⇒ Standardized Reporting Template
(Standardized Reporting Template Sheet 1C – excel)

- Once an action has been identified and the list of information in Phase 1 obtained, partners will **take stock** of where we are in terms of total number of actions identified thus far, information about them, and datasets obtained.

- It is the intention that at this point we stop looking for new actions, but rather work with what we have – some actions we will not be able to take forward for more in-depth analysis (due to insufficient data, etc.) and others we move forward with to assess their impacts.

- To determine which actions should be taken forward for further analysis, answers to the questions below will be utilized in this process, taking into account as well Chorizo project partners' resources and expertise. Generally, as a guideline (but not always per se), an affirmative "yes" for each question is needed in order to move forward with interviews and more in-depth analysis of the action.

(Rationale: To build upon the JRC 2019 Technical Report on "Assessment of Food Waste Prevention Actions" where it was made evident that in order to do an effective impact assessment of an action, the criteria outlined here below is required; pages 7 and 18.)

a. Did the action utilize baseline data? (Yes/No)

b. Were targets/objectives specified and were they specified to take place within a certain time period? (Yes/No)

c. Was a monitoring system in place? (Yes/No)

d. Were appropriate Key Performance Indicators (KPIs) tailored to the intervention? (Yes/No)

e. Is the action completed? (Yes/No)

f. Brief explanation why the action should or should not be assessed more in-depth.

Horizon Europe

PHASE 3: Corresponding Interviews

Timeframe:

⇒ March 6, 2023 - April 21, 2023

Document to complete:

⇒ Standardized Reporting Template
(Standardized Reporting Template Sheets 2A and 2B – excel)

Corresponding Interviews:
(Rationale / Reference: Trying to build on the work that the EC has already done – in particular the JRC 2019 Technical Report on "Assessment of Food Waste Prevention Actions", and to be in accordance with the information requested in the Grant Agreement - Annex 1, Part B, Page 10.)

- Those actions that are brought forward for further analysis will undergo more detailed assessment. The focus will be on determining the economic, environmental, and social, food waste, and nutrition impacts.

A.) Interview Questions

- For each action identified, the following information is needed:

General Information (continuation):

- What was the need/incentive that triggered the action? Who took the initiative to start the action?

Food Loss/Waste:

- What was the amount and main composition of the food waste prevented, and over the course of what time period?
(Metric tons of fresh mass / Cereal-based products, fruits, vegetables, dairy, meat, eggs, fish, other / Time period)

- Generally (not in-depth), how was the amount of the food waste prevented calculated?

Economic and Environmental Aspects:

- What was the total cost of the avoided food production?
(Euros)

- Had food waste been generated, what would be the treatment process?
(landfill, composting, incineration, anaerobic digestions, other, unknown)

- Have environmental indicators been included to assess the action? If yes, which indicators and if no, why not?

- What was the total cost of the action implementation and envisioned pay-back period?
  (Euros and time)

Sustainability

- Have measures (such as continued monitoring plans, additional funding and/or resources allocated, new infrastructure, etc.) been put in place to ensure the long-term sustainability of the action? If yes, what measure(s)? If no, why not?

Implementation

- What were the challenges in implementing the action, and how and by whom were they addressed?

Social Aspects:

- Have social indicators been included to assess the action? If yes, which indicators and if no, why not?
- Did the action lead to the creation of any additional jobs and/or skills? If yes, which skills and jobs?
- Was implementation of the action tailored to gender or other segments of society within the targeted audience? If yes, how?
- Were there impacts of the action that exacerbated or diminished gender inequities?
- In instances of food re-distribution, how many people were reached?
  (Number of people)

Social Norms / Behaviour:

- Did the action address relationships among different actors which leads to FLW? If yes, how?
- In what way has the action affected stakeholders' awareness and knowledge about FLW and its consequences?
- How has the action affected stakeholders' ability (via new skills - such as food planning, food storage, usage of technological tools/apps, etc.) to address FLW?
- Did the action address opportunities/constraints to address FLW (such as time and schedule constraints, insufficient access to necessary equipment such as bins, etc.)? If yes, please describe how the action promoted strategies to address opportunities/constraints.
- How has the action influenced stakeholders' attitude towards FLW?

- Did any behavioural change occur among actors? Did the participants change their expectations about their own or other's behaviour with respect to food waste?

FLW Datasets/Data Protocols:

- What FLW-related data protocols and/or datasets were utilized by/are a result of the action?

If possible / there are no time constraints, please ask remaining questions:

- Besides addressing FLW, what were other positive impacts of this action?
- Were there any negative impacts of this action?
- Was the action transferred to another location/context? If yes, how? If no, why not?
- How was the assessment done to determine if the need was addressed – i.e. how was the success/failure of the action assessed?

B.) Identification of Datasets

FLW Datasets:

- What FLW-related datasets were utilized by/are a result of the action?
  - ⇒ Name
  - ⇒ A few sentences description including if quantitative or qualitative.
  - ⇒ Source (Internet link, journal)

PHASE 4: Quality, Validity, Consistency Review

Timeframe:

⇒ April 24, 2023 – April 28, 2023

Document to complete:

⇒ Standardized Reporting Template
(Standardized Reporting Template Sheet 3 – excel)

Quality, Validity, Consistency Review
(Reference: Grant Agreement – Annex 1, Part B, page 10.)

- After assessing the impacts, the actions will undergo a quality, validity, and consistency check.

a) Evidence Quality

- Is the research question clearly stated?
- Are the goals, scope, context, and approach clear?
- Are impacts clear and justified?

b) Evidence Validity (utilizing the 4-level hierarchy outlined in Vizzoto et al. 2021):[54]

Level I: Highest possible level. Studies that show causation using experimental (randomized controlled trials) or quasi-experimental designs and use food waste (or a proxy) as a dependent variable.
Level II: Studies to show a correlation using cross-sectional designs, using inferential statistics and feature food waste (or a proxy) as a dependent variable.
Level III: Includes large sample quantitative studies or mixed method studies that show neither causation nor correlation. They do not use inferential statistics and, consequently, do not have food waste (or a proxy) as a dependent variable.
Level IV: Small sample quantitative studies, conceptual and qualitative research that is essentially exploratory. The methods generally consist of interviews, focus groups, and secondary data extraction (from websites, company archives, etc.).

c) Evidence Consistency – comparing evidence:

- Where possible, compare evidence of the same action but in different geographical or implementation settings / contexts, and from industry practitioner vs. academic/research staff perspectives.

[54] Please refer to the following article: Vizzoto, Felipe, Francesco Testa, and Fabio Iraldo. (2021). "Strategies to reduce food waste in the foodservices sector: A systematic review." *International Journal of Hospitality Management*, 95, (April): 1-10 (page 6).

PHASE 5: Summary of Assessment

Timeframe:

⇒ May 1, 2023 – May 12, 2023

Document to complete:

⇒ Standardized Reporting Template
(Standardized Reporting Template Sheet 4 – excel)

Summary of Assessment:
(Reference: Grant Agreement – Annex 1, Part B, page 10.)

- No additional research or interviews are needed, rather information from Sheets 1B, 2A, 2B, and 3 will be used to answer the following questions:

- Overall impacts of the action (brief explanation including environmental, economic and social impacts)
- Investment and pay-back period (Euros and estimated time frame of payback period)
- Social norms and behavioural aspects impacted (brief explanation)
- Sustainability of the action (brief explanation)
- Available datasets
- Identified R&I hotspots
- Concluding statement that includes assessment of the quality, validity, and consistency of the evidence.

PHASE 6: Review Information

Timeframe:

⇒ May 15, 2023 – May 19, 2023

- Review information in all sheets of the Standardized Reporting Template.
(Reference: Grant Agreement – Annex 1, Part B, page 10.)

1. Name of the action
2. Food chain stage
3. Country
4. Action duration
5. Actors involved
6. Goals and objectives
7. Role of the action
8. Overall impacts of the action
9. Investment and pay-back period
10. Social norms and behavioural aspects impacted
11. Sustainability of the action
12. Available datasets and data protocols
13. Identified R&I hotspots
14. Concluding statement that includes assessment of the quality, validity, and consistency of the evidence

⇒ Internal review and submission for Task 1.2 = M 10 - i.e. July 2023)

Division of Work:

⇒ Recommendation is to start research **geographically** – i.e. based on the country in which the partner is located and/or where are active due to expertise. Rationale for this is that hopefully it will encourage minimal over-lap with other partners, as well as provide easier access to the actors responsible for implementing the identified action.

- ICLEI: European cities, UrbanWINS
- CSCP: Germany, Austria, Luxembourg, REFRESH, VALUMICS
- ITC: Slovenia, Croatia
- ILVO: Belgium (Flanders)
- FIAB: France, Spain, Portugal
- CTIC-CITA: Spain, SISTERS
- HFBA: Hungary
- UNIBO: Italy, Estonia
- VLTN: Ireland, The Netherlands, Sweden, Cyprus, Malta, Latvia, Lithuania, Slovakia
- UCPH: Denmark

⇒ Recommendation is to start all research **from 2015 to the present-day**. The rationale for this is that the Sustainable Development Goals (SDGs) were adopted in 2015, including target 12.3, which should have given impetus to concrete actions thereafter.

⇒ The focus is on FLW datasets and actions from a **cross-sector of actors** (public sector, private sector, non-government organizations, civil society organizations, educational institutions, think tanks, EU and national platforms) as well as **throughout the entire supply chain** (from primary production all the way to the consumer).

APPENDIX 9.2 - Standardized Reporting Template

- Please refer to attached excel document “CHORIZO D1.2 Standardized Reporting Template”.

APPENDIX 9.3 - Research Guidance

CHORIZO Project Research Guidance for Task 1.2

*(*Lists and links here below are by no means exhaustive, but only a starting point for research. Additionally, each member state will have pertinent think tanks, associations, research institutions, journals, websites, etc. for food loss and food waste information.)*

How far back to research?
Recommendation is to start all research from **2015 to the present-day**. The rationale for this is that the Sustainable Development Goals (SDGs) were adopted in 2015, including target 12.3, which should have given impetus to concrete actions thereafter.

What stage of the supply chain to focus on?
Recommendation to research for food loss and food waste (FLW) actions and datasets across the **entire supply chain** (from primary production all the way to the consumer).

Which actors in the supply chain to focus on?
Recommendation is to focus is on FLW datasets and actions from a **cross-sector of actors** (public sector, private sector, non-government organizations, civil society organizations, educational institutions, think tanks, EU and national platforms, etc).

Literature review:
Scientific and grey literature (reports of government agencies, think tanks, industry associations, etc.).

Directory of Open Access Journals
https://doaj.org

OpenAire Journals
https://explore.openaire.eu/search/journals

Elsevier (Scopus)
https://www.elsevier.com/solutions/scopus
https://www.elsevier.com/search-results?query=food%20waste

ScienceDirect
https://www.sciencedirect.com/#life-sciences

Google Scholar
https://scholar.google.com

European Council LibGuides
https://consilium-europa.libguides.com

European Parliamentary Research Service
https://epthinktank.eu

European Think Tanks Group
https://ettg.eu/about/

Institute for European Environmental Policy
https://ieep.eu

European Food Information Council
https://www.eufic.org/en/who-we-are

Ecologic Institute
https://www.ecologic.eu/about

FoodDrinkEurope
https://www.fooddrinkeurope.eu/policy-area/food-waste/

Food Navigator
https://www.foodnavigator.com

Euractive
https://www.euractiv.com/sections/agriculture-food/

The European Files
https://www.europeanfiles.eu

European Environment Agency
https://www.eea.europa.eu

Some key journals:
Resources, Conservation, and Recycling
Appetite
Food Quality and Preference
Journal of Cleaner Production
Journal of Consumer Behaviour
Journal of Food Products Marketing
International Journal of Consumer Studies
Waste Management
The Sociological Review
Sustainability
Food Research International
Food Quality and Preference
Food Policy
British Food Journal
Food Reviews International
Global Food Security
Foods
Journal of Environmental Management
Waste Management and Research
International Journal of Recycling and Organic Waste in Agriculture
International Journal of Environmental Studies
International Journal of Interdisciplinary Environmental Studies

Examples of some possible keyword searches:

- "food waste/food loss" and supply chain stage (i.e. "households", "redistribution", "farming", "restaurants", etc.) and geographic location
- "food waste" and "consumers"
- "social norms" and "food waste/loss"
- "behaviour, attitude, understanding about food waste/loss"
- "food waste/loss" and "data"
- "food waste/loss" and "environment"
- "women/men" and "food waste/loss"
- "imperfect food" and "food waste/loss"
- "nutrition" and "food waste/loss"
- "date-marking" and "food waste/loss"
- "labelling" and "food waste/loss"
- "packaging" and "food waste/loss"
- "left-overs" and "food waste/loss"
- "socio-economic status" and "food waste"
- "food banks" and "food waste"
- "logistics" and "food waste/loss"
- "mobile applications" and "food waste/loss"
- "reduction" and "food waste/loss"
- "prevention" and "food waste/loss"
- "valorisation" and "food waste/loss"

Some key European Commission sites:

https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste/platform-members_en

https://ec.europa.eu/newsroom/sante/newsletter-archives/view/service/1826

https://food.ec.europa.eu/safety/food-waste/resources-library_en

https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resources

https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/eu-member-states

https://ec.europa.eu/eurostat

To keep in mind when researching:

ECFWF and JRC 2023 lists of interventions:

- The European Consumer Food Waste Forum (ECFWF) and the JRC have both provided CHORIZO partners with a list of interventions addressing FLW that both entities are separately assessing in the first half of 2023. Both these lists are **strictly confidential**, and all CHORIZO partners are reminded to **please not disseminate the lists outside of the CHORIZO project/partners.** While researching and identifying actions to assess for CHORIZO, partners are asked to please cross-reference with the 2023 ECFWF and JRC list, so as to not duplicate efforts.

APPENDIX 9.4 - Standardized Participant Information Sheet and Consent Form

Participant Information Sheet

Dear Participant,

This is an inquiry for participation in the research activities of the CHORIZO project. In this letter, you will receive information about the purpose of the project, the data collection and processing activity, what your participation will involve, and your rights.

It is important that you fully understand the purpose and details of this study before deciding whether or not to participate. Please read the following information carefully and ask any questions you may have. You are welcome to discuss this study with others, but the decision to participate is entirely up to you. If you choose to participate, you will be asked to sign a consent form.

Purpose of the project
The CHORIZO project, funded by the European Union (EU), aims to research and improve the understanding of how social norms influence behaviour related to Food Loss and Food Waste (FLW) generation. The in-depth interview you are being invited to participate in will help contribute to this research.

To significantly accelerate progress towards zero food waste, CHORIZO aims to use this knowledge to increase the effectiveness of decision-making and engagement of food chain actors, in changing social norms towards zero food waste.

To achieve its aim, the project will provide evidence on the role of existing social norms in actors' FLW behaviours through translating results from previous FLW actions into evidence and generate new evidence on social norms & FLW behaviours. Second, CHORIZO will embed these research results into innovation products that can foster change of FLW-related social norms. These products include more effective (sector-based) guidance, communication & science education packages and capacity building actions.

Who is responsible for the research project?
EVILVO – Flanders Research Institute for Agriculture, Fisheries and Food is the responsible for the overall project and is the project co-ordinator.

Purpose of the data collection activity?
Our purpose for the interview is to gain more detailed information and deeper insight into actions that have taken place to date to address FLW. Accordingly, we are interviewing actors who have been involved in implementing the action.

The following personal data will be collected: your name, title, organization, and gender.

Who is responsible for the data collection in this research activity?
[Partner's name, contact details (email, phone number), and institution] is the interviewer responsible for the data collection in this research activity.

Why are you being asked to participate?
Your participation is please being requested as a key actor involved in implementation of an action that is/has addressed FLW. Interviews are being conducted with a wide range of stakeholders across the EU member states - from the private and public sector, non-government organizations, civil society organizations, think-tanks, educational institutions, to national and international FLW-related platform members involved in actions addressing food loss and food waste.

What does participation involve for you?
If you chose to take part in the research activity, this will involve that you answer a series of predetermined questions in an interview by the interviewer. Your participation is expected to last approximately [TIME]. In case translation between different languages is needed, the interview may last a little longer. The interview includes questions about the specific action that is/has addressed FLW. If you permit, your answers will be recorded (via sound recording) and transcribed. If you are not comfortable with sound recording, detailed notes will be taken.

Potential Benefits, Risks or Discomforts for you
There are no direct benefits from your participation, and there are no foreseeable risks, disadvantages or discomforts in the participation.

Participation is voluntary
Participation in the project's research activities is completely voluntary, and you can refrain from answering individual questions if you wish. All information about you will be made anonymous. If you choose to participate, you can withdraw your consent at any time without having to give a reason. There will be no negative consequences for you if you choose not to participate or later decide to withdraw from the study. After withdrawal all your data will be deleted.

Your personal privacy – how we will store and use your personal data
We will use your personal data only for the purpose(s) specified in this information letter. We will process your personal data confidentially and in accordance with data protection legislation (the General Data Protection Regulation – GDPR). The interviewer will summarize the content of the interview and anonymize it at the latest by [DATE]. The full transcript and recording will not be kept after this date. The results of the interview will be anonymised before released to the rest of the project partners and entered onto secured folders on the CHORIZO Microsoft Teams drive. All CHORIZO consortium partners will have access to the anonymized data under the FAIR Principles[55] when needed to carry out the project and exploit the results. The results and analysis will only be communicated in anonymised form and be made available to the public via the website of CHORIZO, relevant publications, or other exploitation outcomes of the project. The anonymous data will thereafter be stored in a public repository for the use of other researchers in the interest of open science.

What will happen to your personal data at the end of the research project?
The project is scheduled to end 30th of October 2025. As stated previously, personal data will be anonymized. All project data will be stored only for the minimum period required to complete the project's research activities, which is 3 years, and according to the accounting rules that

[55] The FAIR Guiding Principles for scientific data management and stewardship | Scientific Data (nature.com)

apply under EU Horizon 2020, no longer than five years from the end of the project, when it will be deleted.

Your rights
So long as you can be identified in the collected data, you have the right to:

- access your personal data that is being processed (Art. 15 GDPR)
- request that your personal data is deleted ("right to be forgotten"; Art. 17 GDPR)
- request that incorrect personal data about you is corrected/rectified (Art. 16 GDPR)
- request for restriction of processing of your personal data (Art. 18 GDPR)
- receive a copy of your personal data (data portability) (Art. 20 GDPR),
- object to processing your personal data, on grounds relating to your particular situation (Art. 21 GDPR) and send a complaint to the Data Protection Officer (DPO) or National Data Protection Authority regarding the processing of your personal data.

What gives us the right to process your personal data?
We will process your personal data based only upon your consent.

Where can I find out more?
If you have questions or concerns about the project, or want to exercise your rights, contact our Data Protection Officer: [Name of the Chorizo Data Protection Officer at the partner's institution].

Yours sincerely,

[Signature]

[Partner's name responsible for conducting the interview / data collection]

Consent Form

Selecting "I Agree" below indicates that:

- You have received and read the information in the CHORIZO Participant Information Sheet;
- You understand the procedures described above and the expected duration of the storage of the data;
- You have been given the opportunity to ask questions;
- You voluntarily agree to participate, and you are free to withdraw at any time without giving a reason and without consequences;
- You understand that your personal information will be treated and handled in accordance with the provisions of the EU General Data Protection Regulation (Reg. 2016/679);
- You are at least 18 years of age.

o I Agree

If you consent to the use of your personal data for the processes outlined in this notice, under the CHORIZO project activities, please check accordingly.

I give my consent:

- o to participate in an interview;
- o for my personal data to be processed, as described in the information letter.

Name of participant (print):

……

Signature of participant:

……

Date:

……

APPENDIX 9.5 - Interview Protocol

Interview Protocol for CHORIZO Task 1.2
(Task 1.2: Multi-source Evidence Collection, Analysis, and Interpretation)

Location and Equipment:
If interviewing in-person, please ensure that the environment in which you are in is appropriate for an interview (quiet enough to have the conversation/discussion, opportunity to sit down, etc.) and that you have with you the necessary tools (i.e. audio recording device(s), computer, notepad, pens/pencils, etc.) If interviewing virtually, be sure that the necessary equipment is functioning (computer, audio, internet connection, etc.)

Introduction:
Before the interview commences, please provide a brief introduction of yourself, thank the participant for agreeing to do the interview, and allow them the opportunity to introduce themselves to you.

Overall objective of interview:
Please remind the participant about the overall objective of the interview: To obtain insight and a deeper understanding (via a series of questions) about the action (that they were involved in implementing) which addresses/addressed food loss and food waste.

Timeframe for interview:
Please let the participant know that the interview will take approximately 60 minutes.

Participant Information Sheet and Consent Form:
Please ask if the participant has received the Participant Information Sheet and the Consent Form, if there has been the opportunity to thoroughly review both, and if there are any remaining questions. If there are questions, please address them as best as possible. (Ideally, both the Participant Information Sheet and the Consent Form should have been sent to the participant at least a few days in advance of the interview, to allow time for review, questions, and signature.)

Signature/Consent Form:
Please ensure that the Consent Form has been signed and dated by the participant before commencing the interview. Please do not commence the interview without the signed Consent Form.

Recording:
If there are no questions, and the Consent Form has been signed, remind the participant that audio recording will commence. In cases of a virtual interview, if the participant does not want to be on video, please allow them the opportunity to turn off their camera. If they have not agreed to the audio recording, please do not record and be sure to take detailed notes.

Start the interview:
Proceed by stating and transcribing:
a) Who is conducting the interview: name, title, organization;
b) Who is being interviewed: Ask the participant's name, title, organization, gender (For "gender" please allow the options of: "man, "woman", "other" or "prefer not to say");

c) Date of interview;
d) Location of interview: location or virtual;
e) Expected duration of the interview: 60 minutes.

Closing the interview:
After the last question, please thank the participant for their time and insights, and ask them if there are any remaining questions or thoughts that they would like to share with you. Remind them of your contact information in case they would like/need to get in touch with you at any time in the future, and the CHORIZO website where they can follow the project's progress.

Extra Note:

- It is envisioned that the "General Information" questions have already been answered in large part during the desktop research portion of the task. However, if needed, please ask all the questions for which concrete information was not found during on-line research.

- Please remember to speak clearly, be an active listener throughout the process (i.e. be careful to not let your own assumptions get in the way of hearing the participant's perspective), and allow the participant time to fully answer a question (i.e. please do not interrupt or rush the participant).

APPENDIX 9.6 - Interview Questions

Interview Questions for CHORIZO Task 1.2
(Task 1.2: Multi-source Evidence Collection, Analysis, and Interpretation)

General Information:[56]

- Name of the action
  (Name of action, where it was found - i.e. indicate internet site, or if during literature review indicate article source, and date when it was found)

- Food chain stage
  (Primary production, transportation, processing and manufacturing (including valorisation), retail, redistribution, food services, households, whole supply chain, general awareness-raising)

- Country
  (Geographic coverage – international, national, regional, municipal)

- Action duration
  (Start date, end date, or on-going)

- Actors involved
  (Actors involved in implementing the action and the target audience)

- Goals / objectives
  (Brief description)

- Role of the action
  (Preventive or corrective in accordance to the food waste hierarchy)

- What was the need/incentive that triggered the action? Who took the initiative to start the action?

Food Loss/Waste:

- What was the amount and main composition of the food waste prevented, and over the course of what time-period?
  (Metric tons of fresh mass / Cereal-based products, fruits, vegetables, dairy, meat, eggs, fish, other / Time period)

- Generally (not in-depth), how was the amount of the food waste prevented calculated?

[56] It is envisioned that points under "general information" have been answered in large part during the desktop research portion of the task. But if there is missing information for any of these questions, partners are encouraged to please ask them during the interview.

Economic and Environmental Aspects:

- What was the total cost of the avoided food production?
  (Euros)

- Had food waste been generated, what would be the treatment process?
  (landfill, composting, incineration, anaerobic digestions, other, unknown)

- Have environmental indicators been included to assess the action? If yes, which indicators and if no, why not?

- What was the total cost of the action implementation and envisioned pay-back period?
  (Euros and time)

Sustainability

- Have measures (such as continued monitoring plans, additional funding and/or resources allocated, new infrastructure, etc.) been put in place to ensure the long-term sustainability of the action? If yes, what measure(s)? If no, why not?

Implementation

- What were the challenges in implementing the action, and how and by whom were they addressed?

Social Aspects:

- Have social indicators been included to assess the action? If yes, which indicators and if no, why not?

- Did the action lead to the creation of any additional jobs and/or skills? If yes, which skills and jobs?

- Was implementation of the action tailored to gender or other segments of society within the targeted audience? If yes, how?

- Were there impacts of the action that exacerbated or diminished gender inequities?

- In instances of food re-distribution, how many people were reached?
  (Number of people)

Social Norms / Behaviour:

- Did the action address relationships among different actors which leads to FLW? If yes, how?

- In what way has the action affected stakeholders' awareness and knowledge about FLW and its consequences?

- How has the action affected stakeholders' ability (via new skills - such as food planning, food storage, usage of technological tools/apps, etc.) to address FLW?

- Did the action address opportunities/constraints to address FLW (such as time and schedule constraints, insufficient access to necessary equipment such as bins, etc.)? If yes, please describe how the action promoted strategies to address opportunities/constraints.

- How has the action influenced stakeholders' attitude towards FLW?

- Did any behavioural change occur among actors? Did the participants change their expectations about their own or other's behaviour with respect to food waste?

FLW Datasets/Data Protocols:

- What FLW-related datasets were utilized by/are a result of the action?

If possible / there are no time constraints, please ask remaining questions:

- Besides addressing FLW, what were other positive impacts of this action?

- Were there any negative impacts of this action?

- Was the action transferred to another location/context? If yes, how? If no, why not?

- How was the assessment done to determine if the need was addressed – i.e. how was the success/failure of the action assessed?

APPENDIX 9.7 - Glossary for WP 1 and for Appendices 9.8 to 9.11

FOOD CHAIN STAGE:		SOURCE:
Primary Production: 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).
Processing and Manufacturing: 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.
Valorisation: 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).
Transportation: The transportation of food at any stage in the supply chain.		CHORIZO Project WP 1: Glossary of Key Terms
Retail: 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).
Redistribution: To redistribute surplus food fit for human consumption.		Caldeira, Carla, Valeria De Laurentiis, and Serenella Sala. (2019). *Joint Research Centre Technical Report: Assessment of food waste prevention actions.* Luxembourg: Publications Office of the European Union (page 12).
Food Services: 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).
Households: Consumption of food in the household or small residential facilities.		Ibid.

General Awareness-Raising: 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.
Whole Supply Chain: Address food loss and food waste along all stages of the supply chain.		CHORIZO Project WP 1: Glossary of Key Terms.

FOOD WASTE HIERARCHY:		**SOURCE:**
Prevention: 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).
Re-use (human consumption): Re-use surplus food for human consumption through redistribution networks and food banks while respecting safety and hygiene norms.		Ibid.
Re-use (animal feed): Feed use of certain food no longer intended for human consumption following EC guidelines.		Ibid.
Re-use (by-products) / Recycle (food waste): 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.
Recycle (nutrients recovery): Recovery of substances contained in FW for low added-value uses such as composting, digestate from anaerobic digestion.		Ibid.
Recovery (energy): Incineration of FW with energy recovery.		Ibid.

Disposal: Waste incinerated without energy recovery, waste sent to landfill, waste ingredient/product for sewage disposal.		Ibid.

MOA FRAMEWORK:		**SOURCE:**
Motivation: 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 group feels that a certain action is expected from them as a group member.		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." *Resources, Conservation and Recycling,* Volume 174, pp. 1 – 11. Vittuari, Matteo, Laura Garcia Herrero, Matteo Masotti, Elisa Iori, Carla Caldeira, Zhuang Qian, Hendrik Bruns, Erica van 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." *Sustainable Production and Consumption,* Volume 38, pp. 104 - 114. MOA Framework: Construct Definitions; internal document CHORIZO WP 3.
Ability: 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.		Ibid.
Opportunity: The availability and accessibility of materials and		Ibid.

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 suitable packs and portions (material resources).		

SOCIAL NORMS:		**SOURCE:**
Social norms: 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.		MOA Framework: Construct Definitions; internal document CHORIZO WP 3. Bicchieri, C. (2006). *The Grammar of Society: The Nature and Dynamics of Social Norms.* Cambridge and New York: Cambridge University Press. Weber, M., & Tribe, K. (2019). *Economy and Society: A New Translation*. Cambridge: Harvard University Press.
Descriptive social norm: 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.		MOA Framework: Construct Definitions; internal document CHORIZO WP 3. 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." *Advances in Experimental Social Psychology,* Volume 24, pp. 201–234.
Injunctive social norm: 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		MOA Framework: Construct Definitions; internal document CHORIZO WP 3. 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

seeing the members of the target group punished for non-compliance provide validation that the norm exists. Injunctive social norms indicate perceptions about normatively appropriate behaviour in a specific context (what kind of behaviour is approved or disapproved by the reference group).		Behaviour." *Advances in Experimental Social Psychology,* Volume 24, pp. 201–234.

OTHER:		**SOURCE:**
Food or Foodstuff: "Any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans."[57]		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).[58]
Waste: "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).[59]
Food Waste (FW): 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).
Food Waste (FW) Action: 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). *Joint Research Centre Technical Report: Assessment of food waste prevention actions.* Luxembourg:

[57] 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.

[58] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002R0178&from=EN

[59] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008L0098-20180705&from=EN

		Publications Office of the European Union (p. 9).[60]
Greenhouse Gas: A gas that contributes to the natural greenhouse effect – i.e. trapping heat within the atmosphere.[61]		Directive 2003/87/EC of the European Parliament and of the Council of 13 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).[62] https://www.eea.europa.eu/help/glossary/eea-glossary/greenhouse-gas (The European Environment Agency)

[60] https://publications.jrc.ec.europa.eu/repository/handle/JRC118276

[61] 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.

[62] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0087&from=EN

APPENDIX - 9.8 List of Actions Addressing Food Waste

- Please refer to attached excel document “CHORIZO D1.2 Total List of Actions”.

APPENDIX - 9.9 List of Actions - MOA Framework and Social Norms

- Please refer to attached excel document “CHORIZO D1.2 List of Actions MOA Social Norms”.

APPENDIX - 9.10 List of Actions - Technology & Innovation

- Please refer to attached excel document “CHORIZO D1.2 List of Actions Technology and Innovation”.

APPENDIX - 9.11 List of Actions - Baseline, Monitoring System, & Key Performance Indicators

- Please refer to attached excel document “CHORIZO D1.2 List of Actions Baseline, Monitoring and KPIs”.

APPENDIX 9.12 - List of Datasets

- Please refer to attached excel document “CHORIZO D1.2 List of Datasets”.

APPENDIX 9.13 - Interview Summaries

Explanatory Notes:

1. Objective of the interview summaries
The interview summaries are an overview, per interview conducted, of the following points in accordance with the Evidence Search Plan as outlined in appendix 9.1. The summaries include one additional topic: implementation challenges.

1. Name of the action
2. Food chain stage
3. Country
4. Action duration
5. Actors involved
6. Goals and objectives
7. Role of the action
8. Overall impacts of the action
9. Investment and pay-back period
10. Social norms and behavioural aspects impacted
11. Sustainability of the action
12. Available datasets
13. Identified R&I hotspots.
14. Concluding statement that includes assessment of the quality, validity and consistency of the evidence

2. Environmental, Nutritional, and Economic impacts
Two on-line calculators have been utilized to calculate the environmental impacts (GHGs, water use, land use, and eutrophication), nutritional impact, and cost-benefit analysis:
- European Commission (JRC) Food Waste Prevention Calculator (https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859)
- Food Loss + Waste Protocol – FLW Value Calculator (https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/)

The results of these calculations are provided in the interview summaries via the produced charts and graphs. All other written information in the summaries is based *solely* on data obtained at the time of / during the interviews conducted by CHORIZO project partners, including quantitative data such as the amount of food waste prevented. The quantitative figures may be subject to updates over time.

3. Amount of food waste prevented data
For some of the interviews there is no available data regarding the amount of food waste, and therefore it is not possible to use the calculators to determine environmental, nutritional, and economic impacts (including the cost-benefit analysis). The cost-benefit analysis was also dependent on obtaining the investment cost of the intervention.

4. Social Norms and Behavioural Aspects Impacted in the summaries (point number 10)
The Motivation, Opportunity, Ability, Injunctive Social Norm, Descriptive Social Norm portion refers to analysis of the action based on desktop research and interviews, and which portion (if any) of the MOA Framework and which social norm best applies to the intervention.

5. Concluding Statement in the summaries (point number 15)
Evidence quality, validity, and consistency refers to the below, in accordance with the Evidence Search Plan. In particular, the evidence validity utilizes the 4-level hierarchy outlined in Vizzoto et al. 2021.[63]

a) Evidence Quality

- Is the research question clearly stated?
- Are the goals, scope, context, and approach clear?
- Are impacts clear and justified?

b) Evidence Validity

Level I: Highest possible level. Studies that show causation using experimental (randomized controlled trials) or quasi-experimental designs and use food waste (or a proxy) as a dependent variable.
Level II: Studies to show a correlation using cross-sectional designs, using inferential statistics and feature food waste (or a proxy) as a dependent variable.
Level III: Includes large sample quantitative studies or mixed method studies that show neither causation nor correlation. They do not use inferential statistics and, consequently, do not have food waste (or a proxy) as a dependent variable.
Level IV: Small sample quantitative studies, conceptual and qualitative research that is essentially exploratory. The methods generally consist of interviews, focus groups, and secondary data extraction (from websites, company archives, etc.).

c) Evidence Consistency – comparing evidence:

- Where possible, compare evidence of the same action but in different geographical or implementation settings / contexts, and from industry practitioner vs. academic/research staff perspectives.

6. Datasets
All publicly available datasets in relation to the desktop research and interviews have been compiled into an excel document available in appendix 9.12.

[63] Please refer to the following article: Vizzoto, Felipe, Francesco Testa, and Fabio Iraldo. (2021). "Strategies to reduce food waste in the foodservices sector: A systematic review." *International Journal of Hospitality Management*, 95, (April): 1-10 (page 6).

Alnatura's Goal of 100% Redistribution

https://www.zugutfuerdietonne.de/fileadmin/zgfdt/sektorspezifische_Dialogforen/Gross-und_Einzelhandel/Dialogforum_Fallstudien-Sammlung.pdf

1. Name of the Action: Alnatura's Goal of 100% Redistribution

2. Food Chain Stage: Retail

3. Country: Germany (national)

4. Duration: 2015 – on-going

5. Actors Involved: The implementing actors are Alnatura, the redistribution sector (Tafel, Too Good to Go, and Scientific), and Thünen Institut. The target audience are consumers.

6. Description (including goals/objectives): Better collaboration with the redistribution sector, targeting 100% of its' stores. Expanding the cooperation of Alnatura stores with partner organisations (i.e., food bank) and food sharing initiatives.

7. Role (according to the Food Waste Hierarchy): Re-use (human consumption)

8. Overall Impacts:

- Brief Summary: By increasing the store's collaboration with redistribution organisations from 66% in 2014/15 to 100% in 2020/21, the average food waste per day per store was reduced by 48%, from 10.6kg to 5.5kg. Quantitatively, more people benefit from this food redistribution, as the activity now covers all store locations of this retailer.

- Food Waste Prevented: By increasing the store's collaboration with redistribution organisations from 66% in 2014/15 to 100% in 2020/21, the average food waste per day per store was reduced by 48%, from 10.6kg to 5.5kg. Usually most common type of food waste prevented is the ultra-fresh, fruit and vegetables, and bread.

- Environmental Impacts: Alnatura uses various factors to assess the impact of the food rescue measures – field reports on the status quo of the cooperation, the development of waste indicators on organic waste, and model projects and surveys in cooperation with the partner organisations Too Good To Go and the Thünen Institute (as part of the German Dialogue forum for retail and wholesale).

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Expect that more people have benefitted from the redistribution initiative, since it is now in operation at all Alnatura stores.

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: The company was able to successfully implement its target of collaborating with redistribution organisations in all its' store locations,

in accordance with a deeply rooted, internal business social norm of aligning with nature. This includes goals to systemically reduce food waste.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: A key challenge is that the redistribution depends on all the people involved in the process – consistency and reliability in terms of the amount collected is paramount.

12. Sustainability of the Action: The action is deeply rooted within the overall philosophy of the company, which constantly seeks to become more environmentally friendly. It is therefore likely that the action will be sustained until another project is developed.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: Quantification of economic and social impacts, as well as emission reductions; further quantification of the collected food after donation. So far pilots have been conducted in 4 stores with impressive results - worthwhile to at least repeat and there is potential also to cover more stores, however it is resource intensive.

15. Concluding Statement (including quality, validity, consistency): The activity's objective (to reach a 100% cooperation with redistributing organisations) was clearly stated and achieved. This increases the likelihood of food still being fit for human consumption to be used as such. Consequently, the retailer also successfully reduced its' food waste, and contributed to the overall scope of achieving a reduction in food waste of 50% by 2030. Fundamentally, the activity's success is based on the principles of environmentally friendly entrepreneurship. Methodologically, the results are very clear, even though there weren't any more complex environmental, economic, or social indicators calculated. The activity's lines-of-effort are replicable. In practice, retail is incentivised (either intrinsically by regulation or by voluntary agreements) to reach a 100% cooperation rate with social organisations. In Germany, due to the work of the Dialogue Forum on Retail and Wholesale, that collaboration among the biggest retailers was already at 80-90% in 2020. One hundred percent coverage is, however, more likely in urban contexts and if supported by the vision and mission of the company. The evidence validity is assessed to be at level III as results are based on Germany-wide quantitative analysis of all store locations, which provides a large amount of data.

App Sprecometro Wastemeter

https://www.sprecozero.it/scopri-lo-sprecometro/

1. Name of the Action: App Sprecometro Wastemeter

2. Food Chain Stage: Households

3. Country: Italy (national)

4. Duration: 2023-on-going

5. Actors Involved: The implementing actors are Waste Watcher International, Department of Agricultural and Food Sciences UNIBO, and Last Minute Market. The target audience is the consumer.

6. Description (including goals/objectives): An app that aims to generate awareness and knowledge useful for directing individual and collective choices toward reducing food waste, adopting healthy diets, and sustainable use of natural resources: soil, water, and energy.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The app was created to transform Waste Watcher International Observatory from representative samples to "the sample is you", then self-sampling by engaging people directly without having to go through surveys and market research companies. The activity resulted in 10,000 subscribers in a six-month period.
- Food Waste Prevented: No data is available as the app only went online in January 2023. Dataset is still too early to calculate the amount of food waste prevented.
- Environmental Impact: The app uses datasets to calculate the carbon and water footprint of individual products.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: Six temporary positions were created: three for the design and implementation and three for communication and dissemination.
- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: To be determined.

10. Social Norms and Behavioural Aspects Impacted: Putting consumers in groups within the app serves to convey the concept that food waste is fought as a group, not individually. Partners from the whole supply chain fund consumer research because by influencing the consumer you change the supply chain. Awareness throughout the supply chain is definitely increased.

- Motivation: Yes
- Opportunity: No
- Ability: Yes

- Injunctive Social Norm: No
- Descriptive Social Norm: Yes

11. Implementation Challenges: Mainly technical challenges regarding the app design and functions.

12. Sustainability of the Action: There was at the beginning a hype effect dictated by communication (press, television, radio) that made the number of registered users grow. There are partnerships with other public bodies, associations, research organizations that have their own network and sponsor the app. Partnerships with SmartFood (the centre on nutrition studies of the European Institute of Oncology) and with Slow Food - these partners create educational content and do communication in their own networks. The Sprecozero has become a tool of the Sprecozero in Comune project, which involves the Sprecozero Campaign with ANCI (National Association of Italian Municipalities). Groups have been activated in which municipalities participating in the project do waste assessment within municipalities. All these increased partnerships augment / bolster sustainability of the intervention.

13. Available Datasets: Dataset and data protocols are not public.

14. Identified Research and Innovation Hotspots: Not identified.

15. Concluding Statement (including quality, validity, consistency): The app could be a tool to propose messages related to social norms. The evidence validity is assessed to be at level IV.

Aprofita

https://consellalimentari.org/es/la-estrategia-agroalimentaria-valencia-2025
https://consellalimentari.org/es/aprofita-valencia/

1. Name of the Action: Aprofita

2. Food Chain Stage: Redistribution

3. Country: Spain (municipal-València)

4. Duration: 2020-on-going

5. Actors Involved: The implementing actors are members from the Conseil Alimentari de València, Ayuntamiento de Valencia, Cátedra Tierra Ciudadana (Universitat Politècnica de València), Universitat de València, Per L'Horta, Plataforma Sobirania Alimentària, Las Naves, Adicae, Food redistribution charities, Association of neighbors from Castellar Oliveral, Codinucova Association of Dietitians and Nutritionists from Comunidad de Valencia (Valencia Region), small agricultural producers, and Mercavalencia. The target audience are individuals/households experiencing food insecurity and the general public (for awareness raising).

6. Description (including goals/objectives): Aprofita València is one of the initiatives set up by the Food Council of the Municipality of Valencia. The activity brings together voluntary citizens to collect surplus food and deliver it to those in need.

7. Role (according to Food Waste Hierarchy): Re-use (human consumption)

8. Overall Impacts:

- Brief Summary: One of the initiatives set up by the Food Council of the Municipality of Valencia is Aprofita València. Voluntary citizens gather to collect surplus food and deliver it to those in need.

- Food Waste Prevented: There is no general data available currently about the amount of FLW prevented by the two main participating actors, Espigolada and Redona. Espigolada has data only for certain instances of gleaning. Redona has no data available. An app is being developed for release in the first half of 2023, that will give the two groups the capability to track the amount of recovered foodstuff directly from the wholesale market. The composition of FLW is mainly fresh vegetables and fruit. For Espigolada-Gleaning the savings has come from food rescued from the field, while for Redona it has come from wholesale markets.

- Environmental Impact: Not available.

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Not indicators per se, but have considered various variables: prioritizing socially and economically vulnerable families and neighbourhoods. All actions are carried out with the collaboration of another Working Group from the Conseil Alimentari de València: WG on The Right to Food. The plan is to professionalize the action and generate jobs. A part-time position was created to coordinate the action and

generate the guidelines during 2022. Also, via the action are able to engage various food chain actors at the same time. For example, producers and redistributors in the case of the gleaning actions. In that regard, producers have started to actively reach out to Aprofita Valencia in order to systematically redistribute their surplus when they produce more than what can be sold, thus establishing a link between production and consumption.

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Investment per year costs approximately EUR 22,000.

10. Social Norms and Behavioural Aspects Impacted: Awareness raising campaigns try to include small producers, retailing and distribution companies, and the general population. The wholesale market has become more aware of the environmental impact of their FLW, thus motivating them to become involved in an alliance geared towards climate resilience. One important component of the action is the training in matters related to FLW. That training is based on the needs that were identified when carrying out a diagnosis of the food system in València. Volunteers have been trained in these topics.

- Motivation: Yes
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The lack of resources (mostly human and staff resources) due to the highly voluntary-based nature of the activity.

12. Sustainability of the Action: The activity is still in its initial stages. However, it has become part of a Working Group within the Municipal Food Council. The large number of collaborating stakeholders could indicate a long-term interest.

13. Available Datasets: Not applicable.

14. Identified Research and Innovation Hotspots: Development of an app to systematically track FLW in markets.

15. Concluding Statement (including quality, validity, consistency): There is ambition and willingness to scale-up the activity to a strategy-level. Nonetheless, the operation is still in the process of establishing a systematized approach and unified indicators. The evidence validity is assessed to be at level IV.

Best of Waste

https://www.foodfromfood.eu/best-waste
https://wilderhof.be/

1. Name of the Action: Best of Waste

2. Food Chain Stage: Processing and Manufacturing

3. Country: Belgium (regional-Limburg province)

4. Duration: On-going

5. Actors Involved: The implementing actors are Wilderhof (via its Best of Waste project), ILVO, Innovatie Steunpunt, HAS Hogeschool, and Flanders' Food. The targeted audience are consumers.

6. Description (including goals/objectives): Process residual fruit into a healthy and long-lasting product in collaboration with the partners of Food from Food. One initiative done by the project is "Boost your life with BES't!" Five to ten tons of soft fruit from the Wilderhof company does not find its destination in the regular retail circuit because it is not of desired size, is damaged or deformed. Wilderhof has now found a destination for part of this "non-premium fruit'" - it is used to produce fresh juice.

7. Role (according to Food Waste Hierarchy): Recycle (Food Waste)

8. Overall Impacts:

- Brief Summary: The action has remained largely in the experimental phase. No upscaling to date. The berry juice is currently no longer being sold. The workload is high, with the marketing of the product being the main bottleneck. Nevertheless, the project resulted in different types of quality data: consumer information; marketing information; nutritional and technological knowledge (i.e., recipes for berry juices). Regarding quality control, schemes are in place, and they require extra workforce to ensure food safety.

- Food Waste Prevented: Soft fruits such as strawberries (six tonnes/per week), raspberries (two tonnes/per week), blackberries (two tonnes/per week). In total, 10 tonnes per week in a period of four months during the high season (June to September 2022).

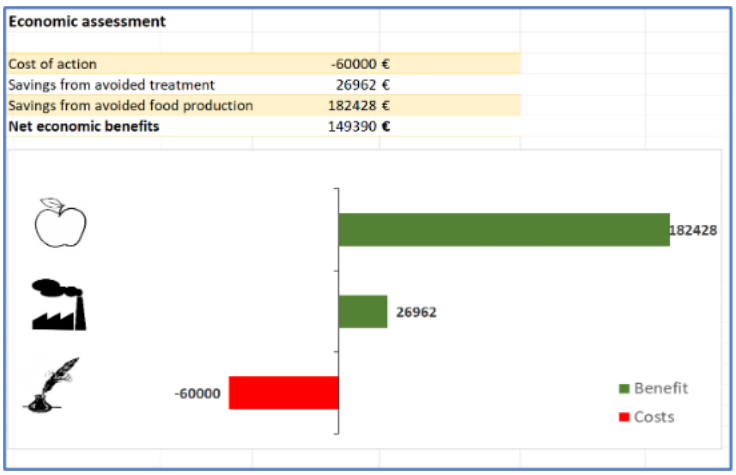
- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	3.24E+04	1.38E+05	**1.70E+05**
Ozone depletion	kg CFC-11 eq	0.00E+00	6.41E-04	1.56E+00	**1.56E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	1.26E-02	1.56E-02	**2.82E-02**
Human toxicity, cancer effects	CTUh	0.00E+00	2.00E-03	7.99E-04	**2.80E-03**
Particulate matter	Disease incidences	0.00E+00	1.32E-03	4.55E-03	**5.88E-03**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	3.88E+02	4.26E+03	**4.65E+03**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	7.24E+01	2.63E+02	**3.36E+02**
Acidification	mol H+ eq	0.00E+00	2.10E+02	8.87E+02	**1.10E+03**
Terrestrial eutrophication	mol N eq	0.00E+00	8.60E+02	3.14E+03	**4.00E+03**
Freshwater eutrophication	kg P eq	0.00E+00	1.69E+01	1.23E+01	**2.93E+01**
Marine eutrophication	kg N eq	0.00E+00	3.31E+01	3.80E+02	**4.13E+02**
Freshwater ecotoxicity	CTUe	0.00E+00	6.10E+05	1.35E+06	**1.96E+06**
Land use	Pt	0.00E+00	2.10E+05	6.57E+06	**6.78E+06**
Water use	m^3 world eq. deprived	0.00E+00	2.86E+03	1.00E+06	**1.00E+06**
Resource use, fossil	MJ	0.00E+00	-5.19E+04	1.04E+06	**9.84E+05**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-3.12E-03	2.57E-01	**2.54E-01**
Single Point	Pt	0.00E+00	6.64E-08	3.36E-07	**4.02E-07**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact:

Economic assessment	
Cost of action	-60000 €
Savings from avoided treatment	26962 €
Savings from avoided food production	182428 €
Net economic benefits	149390 €



Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Cost-Benefit analysis: 3.48

ACTION	TOTAL COST (EURO)	TOTAL BENEFITS (EURO) S = Savings from avoided treatment P = Savings from avoided food production	COST-BENEFIT RATIO[64]
Best of Waste	60,000	26,962 (S) + 182,428 (P) = 209,390	3.48

- Social Impact: Hired one new employee and an extra person who is responsible for transferring the fruit and for supervising (instructing) the people in the packing station. Additionally, to follow quality requirements, hired people to do the quality control on the field (in high season, up to 5 people part-time).

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. FRUIT & VEGETABLE			
			person/day - equivalents
Energy	##########	(kcal)	37,867
Protein	1,397,333	(g)	27,947
Carbohydrate	##########	(g)	63,191
Fiber	2,986,667	(g)	119,467
Calcium	##########	(mg)	26,667
Choline	##########	(mg)	23,224
Copper	97,333	(mg)	48,667
Food folate	##########	(mg)	64,667
Iron	578,667	(mg)	32,148
Magnesium	##########	(mg)	50,000
Manganese	235,467	(mg)	117,733
Niacin	772,267	(mg)	38,613
Panto acid	250,933	(mg)	25,093
Phosphorus	##########	(µg)	37,600
Potassium	##########	(mg)	107,200
Riboflavin	86,933	(mg)	51,137
Selenium	480,000	(mg)	6,857
Sodium	##########	(mg)	11,778
Thiamin	77,333	(µg)	51,556
Vit A	##########	(IU)	1,340,160
Vit B6	213,867	(mg)	106,933
Vit B12	-	(µg)	-
Vit C	##########	(mg)	201,333
Vit D	-	(µg)	-
Vit E	504,000	(mg)	18,667
Vit K	##########	(µg)	549,000
Zinc	226,667	(µg)	15,111

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

[64] Total Cost is based on data obtained from the interview, while the Total Benefits are based on calculations from the on-line European Commission food waste prevention calculator, to ultimately obtain the necessary numbers to achieve the cost-benefit ratio.
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

Horizon Europe

9. Investments and Pay-Back Period: EUR 60,000 with a pay-back period, on average, being one year. The cost for development is outweighed by the surplus price that can be asked for the fruit, yet sustainability / durability is not guaranteed.

10. Social Norms and Behavioural Aspects Impacted: Business to business (B2B): Non-premium fruits valorised, multiple benefits justify this "need" (e.g. economic, environmental, and corporate social responsibility).

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Some technological (e.g. juice composition, process that is safe from microbiological point of view) there have been bottlenecks, but they were overcome. A major bottleneck has been getting the product marketed. Scaling-up was not realised despite professional consultation. The high perishability of the product was also a challenge.

12. Sustainability of the Action: Keen to develop a way of working specifically focused on non-premium fruits and therefore constantly in the process of developing a tailored quality system to ensure longevity.

13. Available Datasets: Not publicly available.

14. Identified Research and Innovation Hotspots: "Perishability and food waste", "technology and food waste".

15. Concluding Statement (including quality, validity, consistency): Main component of the action is to valorise soft fruit into high-quality, nutritious juice for human consumption. Marketing it by emphasizing zero waste and nutritious uniqueness is a selling point. However, the share of consumers willing to pay for this niche product seems small. Difficult to sustain the initiative with marketing being the main bottleneck, combined with labour needs. Yet many points indicate that it could still work, partly because retailers would have a socio-economic benefit which is stated to be a strong driver. The action is strong on food quality and consistency (after experimenting with microbiological safeness). The evidence validity is assessed to be at level I.

Valorization of Biowaste for Biogas Production

https://www.vaxjo.se/sidor/bygga-och-bo/vatten-och-avlopp/slam-och-biogas/biogas-som-fordonsbransle.html

1. Name of the Action: Valorization of Biowaste for Biogas Production

2. Food Chain Stage: Processing and Manufacturing

3. Country: Sweden (municipal-Växjö)

4. Duration: 2012-on-going

5. Actors Involved: The implementing actors are the regional waste management company (SSAM) and the municipalities of Växjö, Lessebo and Tingsryd. The target audience are retail, distribution, food services, and households in Växjö, Lessebo, and Tingsryd.

6. Description (including goals/objectives): The Municipality of Växjö and SSAM transform food waste into biogas for city buses and passenger cars. There is a local gas station that lets people fill their cars with locally generated biogas.

7. Role (according to Food Waste Hierarchy): Recovery (Energy)

8. Overall Impacts:

- Brief Summary: The activity resulted in 70,230 tons of biowaste (from food loss and waste (FLW) prevention efforts) per year for biogas treatment in 2022. There is a 60% recovery rate, with a goal to eventually achieve a minimum rate of 70% per year.

- Food Waste Prevented (2022): There was 70,230 tonnes of biowaste delivered to the biogas treatment plant from the participating three municipalities. The bio-waste is weighed as soon as it arrives at the central facilities. The composition from households is a mixture of foodstuff. The composition from grocery stores is mostly vegetables, which are often in good condition and can still be consumed.

- Environmental Impact: Länstrafiken Kronoberg, a regional public transport company, uses biogas for its fleet of buses. Individuals can also fill their cars with locally produced biogas at a local petrol station.

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	1.42E+07	2.07E+08	**2.21E+08**
Ozone depletion	kg CFC-11 eq	0.00E+00	2.81E-01	7.58E+01	**7.60E+01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	5.54E+00	1.81E+02	**1.87E+02**
Human toxicity, cancer effects	CTUh	0.00E+00	8.78E-01	2.52E+00	**3.40E+00**
Particulate matter	Disease incidences	0.00E+00	5.80E-01	2.34E+01	**2.40E+01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.70E+05	3.55E+06	**3.72E+06**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	3.18E+04	3.27E+05	**3.58E+05**
Acidification	mol H+ eq	0.00E+00	9.22E+04	3.24E+06	**3.33E+06**
Terrestrial eutrophication	mol N eq	0.00E+00	3.78E+05	1.40E+07	**1.44E+07**
Freshwater eutrophication	kg P eq	0.00E+00	7.43E+03	4.12E+04	**4.86E+04**
Marine eutrophication	kg N eq	0.00E+00	1.45E+04	1.22E+06	**1.23E+06**
Freshwater ecotoxicity	CTUe	0.00E+00	2.68E+08	7.04E+08	**9.72E+08**
Land use	Pt	0.00E+00	9.24E+07	2.27E+10	**2.28E+10**
Water use	m^3 world eq. deprived	0.00E+00	1.26E+06	3.85E+08	**3.86E+08**
Resource use, fossil	MJ	0.00E+00	-2.28E+07	1.09E+09	**1.07E+09**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-1.37E+00	1.62E+02	**1.61E+02**
Single Point	Pt	0.00E+00	2.91E-05	5.02E-04	**5.31E-04**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Not available.
- Social Impact: The activity contributes to the generation of circular jobs.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	223,155,825
Protein	-	(g)	-
Carbohydrate	##########	(g)	117,026,590
Fiber	-	(g)	-
Calcium	##########	(mg)	351,150
Choline	##########	(mg)	191,536
Copper	2,458,050	(mg)	1,229,025
Food folate	-	(mg)	-
Iron	##########	(mg)	1,170,500
Magnesium	-	(mg)	-
Manganese	1,404,600	(mg)	702,300
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	##########	(mg)	200,657
Riboflavin	6,671,850	(mg)	3,924,618
Selenium	##########	(mg)	3,009,857
Sodium	##########	(mg)	146,313
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	207,308,556
Vit K	##########	(µg)	35,115,000
Zinc	3,511,500	(µg)	234,100

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: General awareness raising has been demonstrated by the increased rates of separate biowaste collection.

- Motivation: No
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Most challenges are related to behaviour change, e.g., people avoiding to some extent the use of dedicated biowaste bags due to their tendency to rupture.

12. Sustainability of the Action: The activity has been in operation for 11 years and has set ambitious goals. It is a strategic pillar of Växjö's environmental policy.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: “Biowaste to biofuel”, “circular jobs”, and “local impact”.

15. Concluding Statement (including quality, validity, consistency): The activity is very strong with systematized lines of efforts that are all incorporated into institutional structures (i.e., a municipal environmental initiative). The activity has consistent indicators due to solid monitoring plans. The evidence validity is assessed to be between levels II and III.

Budapest Bike Maffia

https://bikemaffia.com/projektek/etelmentes/

1. Name of the Action: Budapest Bike Maffia

2. Food Chain Stage: Redistribution

3. Country: Hungary (municipal-Budapest)

4. Duration: 2011-on-going

5. Actors Involved: The implementing actor is Budapest Bike Maffia, which identifies and coordinates with the participating charities receiving the food. The target audience are the food recipient charities.

6. Description (including goals/objectives): Ad hoc food rescue (minimum of 50 portions) with volunteers delivering the food to charities.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The activity carried out by Budapest Bike Mafia is a small start-up activity. It has positive environmental and economic results, as the delivery of surplus food to those in need clearly appears and can be detected. The social impact can also be seen, as it has a direct positive effect on those who are aided by donations; volume has the potential to grow.

- Food Waste Prevented: Budapest Bike Mafia saved approximately 20,000 portions (each portion weighting approximately 0.4kg, therefore a total of about 8,000kg) in 2022, consisting mainly of ready-made food and baked goods.

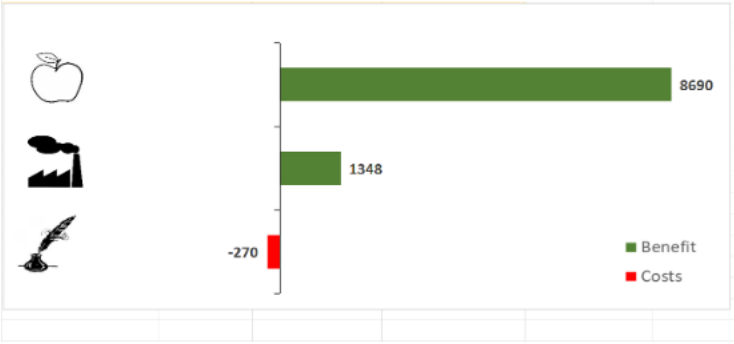
- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	2.93E+03	2.53E+04	**2.83E+04**
Ozone depletion	kg CFC-11 eq	0.00E+00	3.16E-05	3.84E-02	**3.84E-02**
Human toxicity, non-cancer effects	CTUh	0.00E+00	3.94E-03	2.08E-02	**2.48E-02**
Human toxicity, cancer effects	CTUh	0.00E+00	1.24E-04	2.97E-04	**4.21E-04**
Particulate matter	Disease incidences	0.00E+00	5.28E-05	2.75E-03	**2.80E-03**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.95E+01	4.62E+02	**4.81E+02**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	3.40E+00	4.32E+01	**4.66E+01**
Acidification	mol H+ eq	0.00E+00	8.00E+00	3.75E+02	**3.83E+02**
Terrestrial eutrophication	mol N eq	0.00E+00	3.20E+01	1.61E+03	**1.64E+03**
Freshwater eutrophication	kg P eq	0.00E+00	6.47E-01	4.73E+00	**5.37E+00**
Marine eutrophication	kg N eq	0.00E+00	5.37E+00	1.41E+02	**1.46E+02**
Freshwater ecotoxicity	CTUe	0.00E+00	2.82E+05	8.84E+04	**3.70E+05**
Land use	Pt	0.00E+00	9.85E+03	2.60E+06	**2.61E+06**
Water use	m^3 world eq. deprived	0.00E+00	1.29E+02	4.49E+04	**4.50E+04**
Resource use, fossil	MJ	0.00E+00	-9.95E+02	1.37E+05	**1.36E+05**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-6.59E-05	2.09E-02	**2.09E-02**
Single Point	Pt	0.00E+00	1.17E-08	6.00E-08	**7.17E-08**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact:

Economic assessment	
Cost of action	-270 €
Savings from avoided treatment	1348 €
Savings from avoided food production	8690 €
Net economic benefits	**9768 €**



Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Cost-Benefit Analysis: 37.1

ACTION	TOTAL COST (EURO)	TOTAL BENEFITS (EURO) S = Savings from avoided treatment P = Savings from avoided food production	COST-BENEFIT RATIO[65]
Budapest Bike Maffia	270	1,348 (S) + 8,690 (P) = 10,038	37.1

- Social Impact: Helping those in need. For example, in 2022, there were two hotels where refugees were accommodated, Canada and the Vita hotel - every day for six months Budapest Bike Maffia provided food.

[65] Total Cost is based on data obtained from the interview, while the Total Benefits are based on calculations from the on-line European Commission food waste prevention calculator, to ultimately obtain the necessary numbers to achieve the cost-benefit ratio.
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	25,420
Protein	-	(g)	-
Carbohydrate	3,999,200	(g)	13,331
Fiber	-	(g)	-
Calcium	40,000	(mg)	40
Choline	12,000	(mg)	22
Copper	280	(mg)	140
Food folate	-	(mg)	-
Iron	2,400	(mg)	133
Magnesium	-	(mg)	-
Manganese	160	(mg)	80
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	80,000	(mg)	23
Riboflavin	760	(mg)	447
Selenium	24,000	(mg)	343
Sodium	40,000	(mg)	17
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	637,600	(mg)	23,615
Vit K	320,000	(µg)	4,000
Zinc	400	(µg)	27

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The food saving activity of Budapest Bike Maffia is carried out with minimal investment and operating costs; it is mostly voluntary work. Not a large volume overall, but a highly efficient activity.

10. Social Norms and Behavioural Aspects Impacted: The activities of the Budapest Bike Maffia can make a significant contribution to the development and change of social standards related to donations in the sector, as well as to the development of attitudes in this regard - some of which are already noticeable.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The activity has a small budget, therefore the provision of resources in the event of a major increase could be a challenge. The current model is working well at the present scale / size, but increase in scale will require attention to specifics such as additional transport capacity necessary for the transportation of food.

12. Sustainability of the Action: The sustainability of the activity is likely to be well ensured with the current volume and size, but if there is a sizable increase, then improvements may be needed, which will require investments / financial resources necessary for growth.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: Budapest Bike Maffia is interesting from an innovation point of view because they began operating in a new sector and started to change social standards. It is interesting to consider how social standards in other countries or social standards in other sectors in Hungary can be transferred to the hospitality sector, as well as how changes in social standards can be influenced by communication so that changes take place more quickly.

15. Concluding Statement (including quality, validity, consistency): The activity carried out by Budapest Bike Maffia is a pioneering activity, and active in the catering sector where there is a significant surplus of food. The successful and effective development of the activity can bring immediate and significant results in reducing food waste with substantial social impact. The surplus from the catering sector tends to be high quality, high nutritional value, and high value food, which is particularly helpful to those who are in need. The evidence validity is assessed to be at level IV.

Campagna SprecoZero

https://www.sprecozero.it/

1. Name of the Action: Campagna SprecoZero

2. Food Chain Stage: General Awareness Raising

3. Country: Italy (national)

4. Duration: 2013-on-going

5. Actors Involved: The implementing actor is Waste Watcher International. The target audience is the general public.

6. Description (including goals/objectives): Campagna SprecoZero is Italy's only permanent food waste awareness campaign.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The Campaign was born as a spin-off of Last Minute Market. Part of the motivation comes from the drafting of the Bologna Charter on food waste and the creation of the Household Food Waste Prevention Day. From there commenced the awareness campaign that is currently the official campaign at the Italian national level, having obtained the sponsorship of ministries. The activity has raised public awareness and influenced public attitude towards reducing and preventing food waste.

- Food Waste Prevented: The activity showed a 13% reduction in food waste over the past three years (via self-reporting surveys).

- Environmental Impact: Not available.

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: The focus is on the role of the consumer, but there is also an upstream part where funders, active in other stages of the food supply chain also create communication content about FW. The Campaign not only increases awareness, but it also increases skills, because it provides information about how to reduce household waste via direct actions at home. The Campaign also produced and distributed an anti-waste kit for schools (educational and practical kits).

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: What is noticeable is that in general the focus on FW by the younger generation is amplified, because FW is an easy emotional issue to convey. Regarding behaviour there is more focus on the part of managing food in the home

(related to the skills that the Campaign conveys). The changes regarding the expectations people have about other people's behaviours are more visible than the expectations about themselves. There is much more attention on what others do, and the idea is that it is necessary for the other person to be more active towards reducing waste. Main reason why it is wrong to waste is the ethical aspect.

- Motivation: Yes
- Opportunity: No
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: Yes

11. Implementation Challenges: None.

12. Sustainability of the Action: The activity created more positive dialogue and relationships with companies to nudge the sponsor and provide useful returns.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: None identified.

15. Concluding Statement (including quality, validity, consistency): The activity was one of the first campaigns of its kind in Italy, which provides an example of a ground-breaking best-practice copied by many others. The evidence validity is assessed to be at level IV.

Valorisation of Chicory

(https://www.flandersfood.com/nl/artikel/2019/FoodfromFoodstories_witloof)

1. Name of the Action: Valorisation of Chicory

2. Food Chain Stage: Processing and Manufacturing

3. Country: Belgium

4. Duration: 2019-on-going

5. Actors Involved: The implementing actors are Food from Food project/Flanders Food, Chicory grower COOLS, and snack factory Gatronello. The target audience are consumers.

6. Description (including goals/objectives): Valorisation of chicory by-products from cultivation into a chicory croquette.

7. Role (according to Food Waste Hierarchy): Recycle (Food Waste).

8. Overall Impacts:

- Brief Summary: The activity utilises the outer chicory leaves, which have normally been discarded, to make them into croquettes to be sold at restaurants and thereby reducing food waste.
- Food Waste Prevented: Between November 2019 to May 2023, 8 tonnes of chicory leaves have been valorised into croquettes.
- Environmental Impact: No comprehensive calculation accounting for the environmental footprint (across production, distribution, and consumption) is available.

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	1.62E+03	2.38E+03	**4.00E+03**
Ozone depletion	kg CFC-11 eq	0.00E+00	3.21E-05	1.26E-02	**1.26E-02**
Human toxicity, non-cancer effects	CTUh	0.00E+00	6.31E-04	5.25E-03	**5.88E-03**
Human toxicity, cancer effects	CTUh	0.00E+00	1.00E-04	5.86E-05	**1.59E-04**
Particulate matter	Disease incidences	0.00E+00	6.61E-05	2.20E-04	**2.86E-04**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.94E+01	9.58E+01	**1.15E+02**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	3.62E+00	4.54E+00	**8.16E+00**
Acidification	mol H+ eq	0.00E+00	1.05E+01	3.26E+01	**4.31E+01**
Terrestrial eutrophication	mol N eq	0.00E+00	4.30E+01	1.27E+02	**1.70E+02**
Freshwater eutrophication	kg P eq	0.00E+00	8.47E-01	8.87E-01	**1.73E+00**
Marine eutrophication	kg N eq	0.00E+00	1.66E+00	1.37E+01	**1.54E+01**
Freshwater ecotoxicity	CTUe	0.00E+00	3.05E+04	1.36E+04	**4.41E+04**
Land use	Pt	0.00E+00	1.05E+04	1.99E+05	**2.10E+05**
Water use	m^3 world eq. deprived	0.00E+00	1.43E+02	2.38E+03	**2.52E+03**
Resource use, fossil	MJ	0.00E+00	-2.60E+03	2.58E+04	**2.32E+04**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-1.56E-04	1.97E-02	**1.96E-02**
Single Point	Pt	0.00E+00	3.32E-09	8.56E-09	**1.19E-08**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Value creation in the following fields: Research & Innovation was addressed (experimenting in lab for recipe creation), a company that distributes croquettes benefits from the new food product, and restaurant chefs diversify their menu. Cost-Benefit: Not available.

- Social Impact: Awareness raising about FLW creation and solution discussions amongst entrepreneurs, primary producers, food processors, distributors, and consumers. In the last few years, the motivation to reduce FLW is increasing, with many companies including sustainability in their company strategy. The project increases awareness, showcases the creativity and many complementary advantages of addressing food waste. Not only is food waste reduced, there is also the creation of new tastes / flavours, and health benefits.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. FRUIT & VEGETABLE			
			person/day - equivalents
Energy	3,786,667	(kcal)	1,893
Protein	69,867	(g)	1,397
Carbohydrate	947,867	(g)	3,160
Fiber	149,333	(g)	5,973
Calcium	1,333,333	(mg)	1,333
Choline	638,667	(mg)	1,161
Copper	4,867	(mg)	2,433
Food folate	1,293,333	(mg)	3,233
Iron	28,933	(mg)	1,607
Magnesium	1,000,000	(mg)	2,500
Manganese	11,773	(mg)	5,887
Niacin	38,613	(mg)	1,931
Panto acid	12,547	(mg)	1,255
Phosphorus	1,880,000	(µg)	1,880
Potassium	##########	(mg)	5,360
Riboflavin	4,347	(mg)	2,557
Selenium	24,000	(mg)	343
Sodium	1,413,333	(mg)	589
Thiamin	3,867	(µg)	2,578
Vit A	##########	(IU)	67,008
Vit B6	10,693	(mg)	5,347
Vit B12	-	(µg)	-
Vit C	604,000	(mg)	10,067
Vit D	-	(µg)	-
Vit E	25,200	(mg)	933
Vit K	2,196,000	(µg)	27,450
Zinc	11,333	(µg)	756

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Less than EUR 40,000 of investment thus far. Pay-back period is not available.

10. Social Norms and Behavioural Aspects Impacted: Behavioural aspects impacted included greater awareness about the FLW problem and creative solutions. For food-related social norms, sub-quality food (i.e., outer leaves of chicory) that can be valorised into a high-quality product.

- Motivation: Yes
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: This case study started with a farmer responding to the Food from Food project announcement for a product utilizing the outer leaves of his high-quality ground chicory. The initial challenge was to identify the right partner who could be interested in valorising the chicory while simultaneously finding other parties needed to achieve / implement the valorisation. Once the plan for valorisation was ready, the main challenge was technical (i.e. finding the right recipe), which required lab experiments in the ILVO food pilot.

12. Sustainability of the Action: The activity has been active for many years with the products being distributed and consumed in select restaurants, thereby demonstrating the project's durability.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: "Technology and food waste".

15. Concluding Statement (including quality, validity, consistency): The chicory croquette project is sustainable, and the product continues to be produced and consumed. The scope of food waste prevention is presently limited with the chicory leaves coming from one producer and the croquettes being consumed in a select number of restaurants. The production remains seasonal. The evidence validity is assessed to be at level II.

Consume food wisely!

https://borgenproject.org/countering-hunger-in-estonia/#:~:text=In%202016%2C%20the%20Estonian%20Food%20Bank%20and%20the,large%20stores%20and%20restaurants%20also%20supported%20the%20campaign

1. Name of the Action: Consume food wisely!

2. Food Chain Stage: General Awareness Raising

3. Country: Estonia (national)

4. Duration: 2016

5. Actors Involved: The implementing actors are the Estonian food bank, Stockholm Environment Institute Tallinn, and participating stores and restaurants. The target audience is the general public.

6. Description (including goals/objectives): The goal is to reduce food waste while also spreading awareness about the issue.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: Around 100 households, 20 different catering institutions, including schools and kindergartens, were involved in this campaign to raise awareness about food waste.
- Food Waste Prevented: Not available.
- Environmental Impact: The project has outreach with schools, giving online lectures about the environmental impacts of food waste.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: The project of Consume Food Wisely website is "alive" (up and running) and more information is regularly added to it / updated, aiming to increase the general public's awareness about food waste.
- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted:

- Motivation: Yes
- Opportunity: No
- Ability: No
- Injunctive Social Norm: No

- Descriptive Social Norm: No

11. Implementation Challenges: At the beginning, the activity had difficulty finding restaurants to participate in the endeavour. Eventually the activity found 11 restaurants and other institutions to participate in the program.

12. Sustainability of the Action: The Consume Food Wisely website is active and continues to be populated with useful information for participants and stakeholders. For instance, the participating schools now carry out activities during their "environment month" every year, looking in particular at the environmental benefits from decreasing food waste.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: "school and food waste", "catering institutions and food waste".

15. Concluding Statement (including quality, validity, consistency): The value of food wasted annually in Estonia is 166,000 tonnes of food waste, valued at EUR 165 million. For more granularity, every week an average large shop generates 1,400 kg of food while an average household generates 180kg of food waste per year. The project's objective was largely to raise awareness. The evidence validity is assessed to be at level IV due to the size of the project and exploratory nature.

Direct Food Surplus Redistribution

https://www.elelmiszerbank.hu/hu/tevekenysegunk/aruhazi_mentes.html

1. Name of the Action: Direct Food Surplus Redistribution

2. Food Chain Stage: Redistribution

3. Country: Hungary (national)

4. Duration: On-going

5. Actors Involved: The implementing actors are the Hungarian Foodbank Association, retailers, and charities. The target audience are the consumers.

6. Description (including goals/objectives): Direct food redistribution is a facilitated food donation process, managed by the Hungarian Food Bank Association, in cooperation with six retail chains and about 400 charities in the country.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The activity's goal is to result in a significant amount of food surpluses to be transmitted regularly. The related environmental, economic, and social impacts through the distribution of donated food are already significant.

- Food Waste Prevented: In 2022, roughly 8,000 tonnes of food were saved through direct delivery. The majority of this was in the form of baked goods, vegetables and fruit, durable food items, dairy products, meat products, and ready to eat meals.

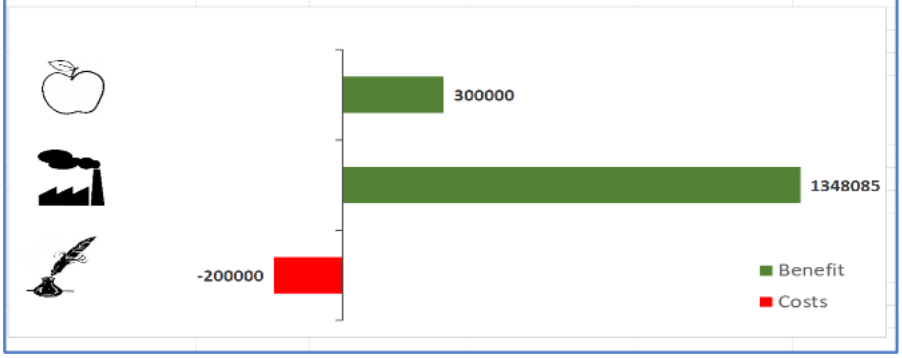
- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	2.93E+06	2.53E+07	**2.83E+07**
Ozone depletion	kg CFC-11 eq	0.00E+00	3.16E-02	3.84E+01	**3.84E+01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	3.94E+00	2.08E+01	**2.48E+01**
Human toxicity, cancer effects	CTUh	0.00E+00	1.24E-01	2.97E-01	**4.21E-01**
Particulate matter	Disease incidences	0.00E+00	5.28E-02	2.75E+00	**2.80E+00**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.95E+04	4.62E+05	**4.81E+05**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	3.40E+03	4.32E+04	**4.66E+04**
Acidification	mol H+ eq	0.00E+00	8.00E+03	3.75E+05	**3.83E+05**
Terrestrial eutrophication	mol N eq	0.00E+00	3.20E+04	1.61E+06	**1.64E+06**
Freshwater eutrophication	kg P eq	0.00E+00	6.47E+02	4.73E+03	**5.37E+03**
Marine eutrophication	kg N eq	0.00E+00	5.37E+03	1.41E+05	**1.46E+05**
Freshwater ecotoxicity	CTUe	0.00E+00	2.82E+08	8.84E+07	**3.70E+08**
Land use	Pt	0.00E+00	9.85E+06	2.60E+09	**2.61E+09**
Water use	m^3 world eq. deprived	0.00E+00	1.29E+05	4.49E+07	**4.50E+07**
Resource use, fossil	MJ	0.00E+00	-9.95E+05	1.37E+08	**1.36E+08**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-6.59E-02	2.09E+01	**2.09E+01**
Single Point	Pt	0.00E+00	1.17E-05	6.00E-05	**7.17E-05**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact:

Economic assessment	
Cost of action	-200000 €
Savings from avoided treatment	1348085 €
Savings from avoided food production	300000 €
Net economic benefits	**1448085 €**



Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Cost-Benefit Analysis: 8.2

ACTION	TOTAL COST (EURO)	TOTAL BENEFITS (EURO) S = Savings from avoided treatment P = Savings from avoided food production	COST-BENEFIT RATIO[66]
Direct Food Surplus	200,000	1,348,085 (S) + 300,000 (P) = 1,648,085	8.2

- Nutritional Impact:

B. What is the nutritional value of the FLW?

1. OTHER

			person/day - equivalents
Energy	##########	(kcal)	25,420,000
Protein	-	(g)	-
Carbohydrate	##########	(g)	13,330,667
Fiber	-	(g)	-
Calcium	##########	(mg)	40,000
Choline	##########	(mg)	21,818
Copper	280,000	(mg)	140,000
Food folate	-	(mg)	-
Iron	2,400,000	(mg)	133,333
Magnesium	-	(mg)	-
Manganese	160,000	(mg)	80,000
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	##########	(mg)	22,857
Riboflavin	760,000	(mg)	447,059
Selenium	##########	(mg)	342,857
Sodium	##########	(mg)	16,667
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	23,614,815
Vit K	##########	(µg)	4,000,000
Zinc	400,000	(µg)	26,667

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

[66] Total Cost is based on data obtained from the interview, while the Total Benefits are based on calculations from the on-line European Commission food waste prevention calculator, to ultimately obtain the necessary numbers to achieve the cost-benefit ratio.
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

9. Investments and Pay-Back Period: The activity's operation does not involve significant investments, as it is primarily a coordination activity. Consistent resources are needed for operation; increase has been in line with the size of the activity. Operating costs related to the activity are often reimbursed in terms of the quantity and value of the food received.

10. Social Norms and Behavioural Aspects Impacted: The introduction and continuous operation of direct delivery changed the social standards associated with the donation, especially in the food trading sector. It can now be stated that compared to the beginning of the activity, food donation is now a general norm for most companies active in the sector.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The most important challenges were to develop the right processes for coordination, vis-à-vis the donor and recipients, and to identify the receiving organisations with the capacity to carry out continuous activities related to direct delivery.

12. Sustainability of the Action: Sustainability of direct delivery seems to be ensured in the long term. Although the activity alone does not generate revenue, the costs necessary for carrying out the activity is provided through donations and / or other sources.

13. Available Datasets: Data related to direct delivery are held by the food banks; these data can be evaluated and analysed if requested.

14. Identified Research and Innovation Hotspots: Direct delivery as a logistics model is an excellent example of how a new and innovative process can be implemented in a more efficient way to mitigate food waste, and increase donated food to needy recipients between the incumbent actors.

15. Concluding Statement (including quality, validity, consistency): Direct delivery describes an operating model that has been able to produce high growth results for the Hungarian Food Bank Association. This model is already used in several other countries and in several food banks. There is still room for further extension and direct delivery will increase the volume of food donation significantly. The evidence validity is assessed to be at level IV.

Etelmento

https://www.etelmento.com/

1. Name of the Action: Ételmentő

2. Food Chain Stage: Processing and manufacturing

3. Country: Hungary (national)

4. Duration: 2021-on-going

5. Actors Involved: The implementing actor is TransFoodMission Ltd and the target audience is the consumer.

6. Description (including goals/objectives): Ételmentő utilizes a beer by-product to produce granolas and create food products that are made exclusively from raw materials either considered 'waste' for aesthetic reasons or because the raw material is only partially necessary for the product made by the given food industry company.

7. Role (according to Food Waste Hierarchy): Re-use (By-products)

8. Overall Impacts:

- Brief Summary: The most significant impact has been the reassessment of the food waste hierarchy, (aka the 'pyramid'). For instance, food waste by-products were often limited to biogas / biofuel production or animal feed. The activity expanded the scope of the "pyramid" for food by-products for other industry categories, including those with higher value-chain food sector properties.

- Food Waste Prevented: The activity has achieved 2 tonnes of usage of by-product thus far in 2023. The activity is expected to reach 3.5-4.0 tonnes of by-product.

- Environmental Impact: Do not have a system or capacity yet to monitor environmental indicators. Open and interested in working with a partner which already uses such measurements or tools.

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	1.47E+03	1.18E+04	**1.32E+04**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.58E-05	4.32E-03	**4.33E-03**
Human toxicity, non-cancer effects	CTUh	0.00E+00	1.97E-03	1.03E-02	**1.23E-02**
Human toxicity, cancer effects	CTUh	0.00E+00	6.20E-05	1.44E-04	**2.06E-04**
Particulate matter	Disease incidences	0.00E+00	2.64E-05	1.33E-03	**1.36E-03**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	9.77E+00	2.02E+02	**2.12E+02**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	1.70E+00	1.86E+01	**2.03E+01**
Acidification	mol H+ eq	0.00E+00	4.00E+00	1.84E+02	**1.88E+02**
Terrestrial eutrophication	mol N eq	0.00E+00	1.60E+01	7.96E+02	**8.12E+02**
Freshwater eutrophication	kg P eq	0.00E+00	3.24E-01	2.34E+00	**2.67E+00**
Marine eutrophication	kg N eq	0.00E+00	2.69E+00	6.93E+01	**7.20E+01**
Freshwater ecotoxicity	CTUe	0.00E+00	1.41E+05	4.01E+04	**1.81E+05**
Land use	Pt	0.00E+00	4.92E+03	1.29E+06	**1.30E+06**
Water use	m^3 world eq. deprived	0.00E+00	6.45E+01	2.19E+04	**2.20E+04**
Resource use, fossil	MJ	0.00E+00	-4.97E+02	6.23E+04	**6.18E+04**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-3.29E-05	9.23E-03	**9.20E-03**
Single Point	Pt	0.00E+00	5.87E-09	2.86E-08	**3.45E-08**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Started to sow the seed with partners on how to think about human resources, who has special needs, and has been excluded. This Margin Life's Community, such as those who are trying to reintegrate from a rehabilitation centre to society, is how provide an opt-out training for such people at partner companies and then a long-term job opportunity.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	11,121
Protein	-	(g)	-
Carbohydrate	1,749,650	(g)	5,832
Fiber	-	(g)	-
Calcium	17,500	(mg)	18
Choline	5,250	(mg)	10
Copper	123	(mg)	61
Food folate	-	(mg)	-
Iron	1,050	(mg)	58
Magnesium	-	(mg)	-
Manganese	70	(mg)	35
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	35,000	(mg)	10
Riboflavin	333	(mg)	196
Selenium	10,500	(mg)	150
Sodium	17,500	(mg)	7
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	278,950	(mg)	10,331
Vit K	140,000	(µg)	1,750
Zinc	175	(µg)	12

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The project continues to operate at modest resource levels. Therefore, in the short term, the return can be more easily realised in the new advisory model. In the case of more substantial investment, it is possible that it will not apply to the project but rather approach project partners.

10. Social Norms and Behavioural Aspects Impacted: The project deals with changing social norms on two fronts. On the one hand, it seeks to change the management of food processing companies so that they consider by-products not just as waste but as a potentially valuable food product. On the other hand, also looks towards customers / consumers to provide information about preference for which products.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenge is to find by-products from which can produce a product to be sold competitively in retail trade, while also being cost-effective.

12. Sustainability of the Action: The activity's sustainability has changed significantly by switching from a product-producing position to an advisory position, thereby reducing investment needs while allowing the project to carry out similar activities in several industries simultaneously.

13. Available Datasets: The activity has not yet developed a systematic database which would be extremely useful if it contained the different routes of by-product valorisation internationally. There are plans to create such a database.

14. Identified Research and Innovation Hotspots: The activity is interesting for its innovative valorisation of food by-products and the development of new recipes.

15. Concluding Statement (including quality, validity, consistency): The project is currently considered to be at the start-up phase. However, the area in which it operates has a number of options to allow it to potentially grow. The activity has significant potential for future growth. The evidence validity is assessed at level IV.

Élelmiszer Érték Fórum (Food Value Forum)

(https://www.azelelmiszerertek.hu/)

1. Name of the Action: Élelmiszer Érték Fórum (Food Value Forum)

2. Food Chain Stage: General Awareness Raising

3. Country: Hungary (national)

4. Duration: 2014-on-going

5. Actors Involved: The implementing actors are the Ministry of Agriculture and the Food Bank Association. The target audience are the subscribing institutions, food sector companies and their associations and NGOs. The full list is available at https://www.azelelmiszerertek.hu/csatlakozok.

6. Description (including goals/objectives): Stakeholder forum on food waste established by the Ministry of Agriculture and the Food Bank Association. The Food Value Forum is a national platform with the primary objective being to dialogue, exchange information and knowledge.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The environmental, economic, and social impact of the Food Value Forum is essentially an indirect effect. Rather than being involved in the implementation of a specific project, it focuses on coordination to facilitate cooperation between different participants and projects about knowledge and information exchange.

- Food Waste Prevented: The Food Value Forum is a national platform. It does not have specific objectives, but primarily aims to increase knowledge and exchange information. Thus, no precise measurement is available and there is no information on exactly what quantity and composition of food waste has been prevented by the forum's work.

- Environmental Impact: Not applicable.

- Economic Impact and Cost-Benefit: Not applicable.

- Social Impact: No data available.

- Nutritional Impact: Not applicable.

9. Investments and Pay-Back Period: The operation of the Forum does not require significant investments, as it is a coordinating forum. The operating cost is low (EUR 2,700 per year), and although its return cannot be accurately measured, it is primarily focused on ensuring that key actors and projects work together, and thus very likely that a return will be achieved on a continual basis.

10. Social Norms and Behavioural Aspects Impacted: The functioning of the Forum has no direct impact on social standards and behaviour linked to food waste, but it can have a positive impact on participants' development through cooperation in related projects. For example, an increasing number of companies in the food trading segment are actively involved in food waste reduction actions, which primarily involves the donation of surplus food and participation in consumer awareness-forming activities related to food waste.

- Motivation: Yes
- Opportunity: No
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: During the implementation of the Food Value Forum, the first step was to create a forum where there were difficulties in involving relevant partners, but the cooperation between the Agricultural Ministry and the Food Bank Association was a good partnership, and this could serve as a good example when creating similar forums.

12. Sustainability of the Action: Since the Forum does not require significant funding or infrastructure conditions, long-term sustainability does not depend on the creation of these necessary resources. The Hungarian Food Bank Association can provide the necessary resources for the secretariat's tasks from its own budget in the long term.

13. Available Datasets: The Forum has not used and created data and data protocols on its own, but the project, called No Leftovers, under the auspices of the Forum, carried out a survey on retail food waste in Hungary, and this survey contains specific data on household food waste as well. National Food Chain Safety Office (2021) Research Summary of Household Food Waste Survey: https://portal.nebih.gov.hu/documents/10182/21442/Kutatasi+osszefoglalo_Haztartasi+elelmiszerhulladak+felmeres+2021.pdf/.

14. Identified Research and Innovation Hotspots: The Food Value Forum work is primarily innovation in terms of knowledge management and by examining the most useful and effective means of information flow between actors in the same field.

15. Concluding Statement (including quality, validity, consistency): The Food Value Forum has established a platform in Hungary to enable all the institutions and organisations working on the subject to obtain information and cooperation at the same table, which will help them not to operate competitive or independent initiatives in the country, but rather achieve cooperation, work on joint projects, and coordinate as much as possible, so that the fight against food waste can be more cohesive and effective. The overall scope, context and approach of the forum is clear. Similar national food waste platforms are already operating successfully in several other European countries. The evidence validity is assessed to be at level IV.

Food Waste Fighters

https://www.airfield.ie/food-waste-fighters/

1. Name of the Action: Food Waste Fighters (FWF)

2. Food Chain Stage: Households

3. Country: Ireland (national)

4. Duration: 7-29 August 2021

5. Actors Involved: The implementing actor is the Airfield Estate. The target audience are households.

6. Description (including goals/objectives): The main objective: It is a food waste project that aims to help consumers, and in particular households, to reduce their food waste by half by 2030. Included a total of 125 people from August 7-29, 2021. Aims to help communities eat more sustainably and reduce the environmental challenge of food waste by raising awareness and teaching simple solutions. The main pieces of the program included a food waste app (No Waste) and keeping a diary to raise consciousness about how food was being handled in the home. With the app, could scan the bar code and it would provide estimated dates for the food in terms of being safe / good to use. Other component of the app: shopping list feature. This helped to manage food in the home. The food diary was done with a small sample - i.e. a few families. It involved kitchen scales and a record sheet, with participants asked to take note of their daily waste weight as well as the composition.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity originally targeted lower-income and food insecure households and individuals. The main impact was raising awareness about food waste. The idea being not only to address food waste, but thereby to also help these families save some money.

- Food Waste Prevented: There was a 27.75% reduction in food waste due to using the inventory app (No Waste) in the program (August 7-29, 2021). The biggest room for improvement needed: to reduce waste of fruit, vegetables and bread. The average daily food waste per participant decreased from 813.37g to 587.68g = 225.69g for the project period (August 7-29, 2021) (post focus group results).

- Environmental Impact: No data available because total amount of food waste prevented is below 1 kilogram. The implementer, Airfield, definitely takes into consideration the environmental aspects in their holistic approach to food. Separate to the Food Waste Fighters is the soil exhibition for example. But with the FWF program also had videos highlighting the greenhouse gas emissions component of food waste.

- Economic Impact and Cost-Benefit: No data available because of the minimum 1 kilogram of food waste prevented needed for the calculator.

- Social Impact: The intervention targeted a particular economic demographic - i.e. those struggling more economically. The idea being not only to address food waste, but thereby also help these families save some money. No additional skills per se were acquired, with the exception that participants did learn how to use the app.

- Nutritional Impact: No data available because of the minimum 1 kilogram of food waste prevented needed for the calculator.

9. Investments and Pay-Back Period: Safe Food Ireland provided EUR 1,500 to finance the project. As it is a pilot project, no pay-back is expected economically.

10. Social Norms and Behavioural Aspects Impacted: Participants were more receptive to acknowledge food waste as a serious issue that needs to be addressed and which can also work to their economic advantage. The activity raised awareness. Participants noted behaviour changes: buying less food to prevent waste, re-organizing the fridge to have a better overview of what is in it, and cooking smaller portions. Of 125 participants surveyed, 89% indicated they experienced more awareness of household food waste while 12% reported a reduction in brown bin weight.

11. Implementation Challenges: The key challenge was Covid, in that participants and stakeholders missed the person-to-person contact to allow more of an impact. The activity had to primarily rely on videos and on-line interaction. In terms of the app itself, the time required to enter the data and know how to do this was a challenge for some of the participants initially.

12. Sustainability of the Action: As a pilot program, Airfield does not envision to continue the activity for the time-being. In-person interaction with participants was low - Covid proved to be a challenge.

- Motivation: Yes
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

13. Available Datasets: As part of the FWF program, Airfield did a survey in December 2020 of 850 people to explore attitudes and habits around food and food waste.
https://qrcgcustomers.s3-eu-west-1.amazonaws.com/account13805329/21989937_1.pdf?0.7370489296368845

14. Identified Research and Innovation Hotspots: “households and food waste” and “app and food waste”.

15. Concluding Statement (including quality, validity, consistency): The activity is an innovative and valuable project, which was very successful in terms of raising awareness and lowering food waste in the community households. It provides solid information about perceptions relating to food. Strong on quality and consistency. It was though a relatively small sample size (i.e., 125 people), and relied mainly on self-reporting of individuals in terms of FW levels. The evidence validity is assessed to be at level IV.

Food Waste Mitigation Strategy

1. Name of the Action: Food Waste Mitigation Strategy

2. Food Chain Stage: Food Services

3. Country: Denmark (municipal-Copenhagen)

4. Duration: 2021-on-going

5. Actors Involved: The implementing actor is the municipality of the city of Copenhagen. The target audience is the food services sector.

6. Description (including goals/objectives): This food waste mitigation intervention runs in the City of Copenhagen and started in 2021. It is part of the municipality's ambition to cut food waste on the public plate and is part of the city's urban food strategy. It is targeted at the municipal food service and is an active intervention where the intervention components are food waste mitigation counselling, awareness raising and training for kitchen staff. It is targeted at all institutional food service units in the city.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity aims to cut in half food waste in 746 units (day care, institutions, schools, residential institutions, nursing homes and commercial kitchens) by 2030.

- Food Waste Prevented: The activity achieved 3,173 tonnes of food waste prevented in 2021; on track to achieving the 2030 goal.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	2.62E+05	1.30E+07	**1.32E+07**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.07E-02	1.80E+01	**1.80E+01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	4.72E-01	1.01E+01	**1.06E+01**
Human toxicity, cancer effects	CTUh	0.00E+00	3.21E-02	1.55E-01	**1.87E-01**
Particulate matter	Disease incidences	0.00E+00	1.04E-02	1.32E+00	**1.33E+00**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	4.53E+03	2.65E+05	**2.70E+05**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	9.08E+02	2.23E+04	**2.32E+04**
Acidification	mol H+ eq	0.00E+00	1.12E+03	1.80E+05	**1.81E+05**
Terrestrial eutrophication	mol N eq	0.00E+00	4.56E+03	7.64E+05	**7.69E+05**
Freshwater eutrophication	kg P eq	0.00E+00	1.28E+02	3.42E+03	**3.55E+03**
Marine eutrophication	kg N eq	0.00E+00	6.83E+02	8.47E+04	**8.54E+04**
Freshwater ecotoxicity	CTUe	0.00E+00	2.32E+07	6.49E+07	**8.81E+07**
Land use	Pt	0.00E+00	1.15E+06	1.24E+09	**1.24E+09**
Water use	m^3 world eq. deprived	0.00E+00	1.41E+05	2.64E+07	**2.65E+07**
Resource use, fossil	MJ	0.00E+00	6.81E+05	7.61E+07	**7.67E+07**
Resource use, minerals and metals	kg Sb eq	0.00E+00	1.25E-01	1.26E+01	**1.28E+01**
Single Point	Pt	0.00E+00	1.34E-06	3.14E-05	**3.28E-05**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Economic savings from food waste reduction are realised by each participating school. Cost-Benefit analysis: Not available.

- Social Impact: Not available.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	10,082,208
Protein	-	(g)	-
Carbohydrate:	##########	(g)	5,287,276
Fiber	-	(g)	-
Calcium	##########	(mg)	15,865
Choline	4,759,500	(mg)	8,654
Copper	111,055	(mg)	55,528
Food folate	-	(mg)	-
Iron	951,900	(mg)	52,883
Magnesium	-	(mg)	-
Manganese	63,460	(mg)	31,730
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	##########	(mg)	9,066
Riboflavin	301,435	(mg)	177,315
Selenium	9,519,000	(mg)	135,986
Sodium	##########	(mg)	6,610
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	9,366,226
Vit K	##########	(µg)	1,586,500
Zinc	158,650	(µg)	10,577

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: There is no specific line-item or separate budget for this activity. The activity's costs are funded from the city's general budget as part of its wider food and meal strategy. As a result, it has not been possible to obtain specific costs related to this activity.

10. Social Norms and Behavioural Aspects Impacted: The social norms and behaviours impacted are those between the members of the participating kitchen staff, who are required to work collaboratively with colleagues in a new way to achieve the activity's food waste prevention goals. For instance, when planning meals, the staff collaborate to ensure that lessons learned from previous menus are taken into account to best minimize food waste as part of one of the considerations when menu planning (e.g. origin of food / organic and quality of food).

- Motivation: Yes
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Tackling food waste is another priority that has been added to the list for the kitchen staff and school administrations. It has been a challenge to have the topic

prioritised. The 2030 goal has been a really effective tool in keeping attention on the issue as an action-forcing deadline.

12. Sustainability of the Action: The activity is planned as part of a four-year cycle, with funding guaranteed for this duration. However, the 2030 target should assure continued funding past the four years of guaranteed funding, as long as it remains a political priority for the city.

13. Available Datasets: Not currently available.

14. Identified Research and Innovation Hotspots: “Food waste and urban kitchens”, “technology and food waste prevention”.

15. Concluding Statement (including quality, validity, consistency): The activity has an ambitious and specific goal, decreasing food waste in school kitchens and canteens in Copenhagen by 50% by 2030. This action combines awareness raising with technology to support kitchen staff in achieving the target. The evidence validity is assessed to be between levels II and III.

Madværkstedet Madspild (Food Waste Workshop) & Madspilskolen (Food Waste School)

https://arlafonden.dk/madspild-paa-skoleskemaet
https://www.toender.dk/din-kommune/nyheder-og-presse/nyheder-og-pressemeddelelser/madspild-pa-skoleskemaet-13668877/
https://arlafonden.dk/madspildsskolen/

1. Name of the Actions: Madværkstedet Madspild (Food Waste Workshop) & Madspilskolen (Food Waste School)

2. Food Chain Stage: General Awareness Raising (both actions)

3. Country: Denmark (municipal – Silkeborg – Food Waste Workshop) (Copenhagen, Aarhus, Odense, Alborg, Korsor – Food Waste School)

4. Duration: On-going (both actions)

5. Actors Involved: For the Workshop, the implementing actors are the Arla-foundation and Arla. The target audience is the municipality of Silkeborg and participating school pupils (grades six, seven, and eight). For the Food Waste School, the implementing actors are also Arla-foundation and Arla, as well as students.

6. Description (including goals/objectives): Workshop: A cooking-related teaching course to provide insight into the understanding of and experience with how food waste can be reduced through teaching courses to school pupils. School: A camp-type food activity / class during school holidays to learn about food, food waste and its impact.

7. Role (according to Food Waste Hierarchy): Prevention (both actions)

8. Overall Impacts:

- Brief Summary: Both activities focus on increased food waste prevention knowledge and skills. The knowledge varies from environmental impact of wasting food, the monetary loss from food waste, and various practical tips to tackle food waste.
- Food Waste Prevented: Not available.
- Environmental Impact: Not available.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: Impact on children in terms of raising awareness about food waste and its consequences, and to provide them with some skills regarding how best can address it.
- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Data not available.

10. Social Norms and Behavioural Aspects Impacted:

- Motivation: No
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Two specific challenges were noted in relation to funding. First, the need for better communication and collaboration between the schools and municipality. Second, the municipality funds 80% of the program, but the schools are responsible for the remaining 20% which is difficult for them.

12. Sustainability of the Action: No data available.

13. Available Datasets: There is a dataset with a list of all the workshop participants, schools visited, and the number of visits. However, this data is not public due to GDPR concerns.

14. Identified Research and Innovation Hotspots: To design better education and pedagogy concepts to facilitate food literacy training. To design educational tools that stimulate the students' interest to work with food.

15. Concluding Statement (including quality, validity, consistency): Both actions seem to have clear concepts and execution plans. However, the concept continually needs to be executed by someone with experience running workshops or visiting schools for a three-hour course. As both actions are more skills-oriented program, follow up and continuity of the skills is important. As both actions are completely focused on education and learning for young people, fun types of activities seem to have a good impact. The evidence validity is assessed at level IV for both actions.

Food Winners Brugge

https://bruggesmaakt.brugge.be/foodwinners_handleiding_a5_web_eng

1. Name of the Action: Food Winners Brugge (part of the Bruggesmaakt Framework)

2. Food Chain Stage: Households

3. Country: Belgium (municipal-Brugge/Bruges)

4. Duration: 2020-2022

5. Actors Involved: The implementing actors are the municipality of Bruges (through the Bruggesmaakt strategy and the Food Lab) and FoodWIN. The target audience are households.

6. Description (including goals/objectives): Participating households (5,000) to weigh their food waste for seven days in a row for both solid waste and liquid waste (soup, water, coffee, etc.) and to obtain a 30% reduction in food loss and waste.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity resulted in a reduction of 44,400kg of FLW from almost 5000 participating households (a 55% year-on-year reduction in FLW).

- Food Waste Prevented: Participants kept track of their food waste by weighing their waste each day over a seven-day period, and then reported the numbers to the municipality. In its first year, the activity had 50 participating households and resulted in a 65% reduction in FLW. For the second year, the activity had 512 participating households and resulted in a 76% reduction, totalling 19,626kg of prevented FLW. In its third year (2022), 4,809 households participated with a 55% reduction, for a total of 44,400 kg of FLW prevented. Bread appears to be a significant composition of the food waste.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	3.25E+03	1.81E+05	**1.84E+05**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.50E-04	2.51E-01	**2.51E-01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	5.02E-03	1.42E-01	**1.47E-01**
Human toxicity, cancer effects	CTUh	0.00E+00	4.42E-04	2.17E-03	**2.62E-03**
Particulate matter	Disease incidences	0.00E+00	1.59E-04	1.85E-02	**1.86E-02**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	6.47E+01	3.71E+03	**3.78E+03**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	1.30E+01	3.12E+02	**3.25E+02**
Acidification	mol H+ eq	0.00E+00	1.82E+01	2.52E+03	**2.54E+03**
Terrestrial eutrophication	mol N eq	0.00E+00	7.42E+01	1.07E+04	**1.08E+04**
Freshwater eutrophication	kg P eq	0.00E+00	1.97E+00	4.79E+01	**4.99E+01**
Marine eutrophication	kg N eq	0.00E+00	7.87E+00	1.19E+03	**1.19E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	2.07E+05	9.08E+05	**1.12E+06**
Land use	Pt	0.00E+00	1.77E+04	1.74E+07	**1.74E+07**
Water use	m^3 world eq. deprived	0.00E+00	1.94E+03	3.69E+05	**3.71E+05**
Resource use, fossil	MJ	0.00E+00	8.06E+03	1.06E+06	**1.07E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	1.63E-03	1.77E-01	**1.78E-01**
Single Point	Pt	0.00E+00	1.50E-08	4.40E-07	**4.55E-07**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Ambassadors were representative of the various inhabitants of the city: students, families, elderly people, people from various neighbourhoods, social groups etc. Ambassadors developed skills regarding how to engage people in the fight against food waste. Food planning skills were acquired by participating households.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	141,081
Protein	-	(g)	-
Carbohydrate	##########	(g)	73,985
Fiber	-	(g)	-
Calcium	222,000	(mg)	222
Choline	66,600	(mg)	121
Copper	1,554	(mg)	777
Food folate	-	(mg)	-
Iron	13,320	(mg)	740
Magnesium	-	(mg)	-
Manganese	888	(mg)	444
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	444,000	(mg)	127
Riboflavin	4,218	(mg)	2,481
Selenium	133,200	(mg)	1,903
Sodium	222,000	(mg)	93
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	3,538,680	(mg)	131,062
Vit K	1,776,000	(µg)	22,200
Zinc	2,220	(µg)	148

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The investment cost has totalled EUR 180,911. Pay-back period is not available.

10. Social Norms and Behavioural Aspects Impacted: The activity created a committed network of participants that are taking active measures at home.

- Motivation: Yes
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: Yes
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenge of the action has been dealing with the large number of engaged households.

12. Sustainability of the Action: The activity was carried out over three separate periods. It was not originally conceived and/or designed to be sustained over the long-time, but to promote behavioural change in the short to mid-term through collaboration.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: “Households and food waste”, “tracking food waste”.

15. Concluding Statement (including quality, validity, consistency): The activity has achieved significant results, in particular the mobilisation of over 5,000 participating households (a significant achievement for a city population of 120,000). The achieved reduction in FLW demonstrates the behavioural change of its participants. The evidence reality is assessed to be between levels II and III.

Foodello

https://www.foodello.be/page/34/how-it-works

1. Name of the Action: Foodello

2. Food Chain Stage: Retail

3. Country: Belgium (regional-Flanders) and Finland (initially)

4. Duration: 2016

5. Actors Involved: The implementing actor is Foodello, which is part of Fiksu Ruoka, a Finnish company. The target audience are the consumers.

6. Description (including goals/objectives): The activity saves products that do not end up in the supermarket because the best-before date is approaching, a product has disappeared from the range, or because there is a printing error on the packaging, etc., and offers them to the consumer at a discounted price.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption).

8. Overall Impacts:

- Brief Summary: Foodello conducts awareness raising campaigns in order to change public perception about "best before" date markings for increased consumption to reduce unnecessary food waste. Foodello also buy products from wholesalers and then transports these products to retailers located in the Netherlands who resell them at a lower price (approximately 40% reduction).

- Food Waste Prevented: Counting food saved in the Netherlands and Belgium, recorded 1 million kilos (1,000 tonnes) of food per year (mostly pasta, meat rice, sweets, snacks).

- Environmental Impact: FOODELLO calculates its' carbon dioxide (CO2) footprint for the entire operation. At the end of the year they compensate the CO2 emissions they have generated with their operation; buy "forest rights" for a specific forest in Finland, so that it is allowed to grow. Thereby encourage biomass growth and offset their CO2 emissions.

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	2.02E+05	3.17E+06	**3.37E+06**
Ozone depletion	kg CFC-11 eq	0.00E+00	4.01E-03	4.80E+00	**4.80E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	7.88E-02	2.60E+00	**2.68E+00**
Human toxicity, cancer effects	CTUh	0.00E+00	1.25E-02	3.72E-02	**4.97E-02**
Particulate matter	Disease incidences	0.00E+00	8.26E-03	3.43E-01	**3.51E-01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	2.43E+03	5.77E+04	**6.02E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	4.53E+02	5.39E+03	**5.85E+03**
Acidification	mol H+ eq	0.00E+00	1.31E+03	4.68E+04	**4.82E+04**
Terrestrial eutrophication	mol N eq	0.00E+00	5.38E+03	2.02E+05	**2.07E+05**
Freshwater eutrophication	kg P eq	0.00E+00	1.06E+02	5.91E+02	**6.97E+02**
Marine eutrophication	kg N eq	0.00E+00	2.07E+02	1.76E+04	**1.78E+04**
Freshwater ecotoxicity	CTUe	0.00E+00	3.81E+06	1.11E+07	**1.49E+07**
Land use	Pt	0.00E+00	1.32E+06	3.25E+08	**3.27E+08**
Water use	m^3 world eq. deprived	0.00E+00	1.79E+04	5.61E+06	**5.63E+06**
Resource use, fossil	MJ	0.00E+00	-3.25E+05	1.72E+07	**1.68E+07**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-1.95E-02	2.61E+00	**2.60E+00**
Single Point	Pt	0.00E+00	4.15E-07	7.50E-06	**7.91E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Foodello targets its efforts to change consumer behaviour via socio-economic incentives for cheaper products, which is not only more sustainable but also economically relevant due to the increased cost-of-living. Cost-Benefit: Not available.

- Social Impact: Foodello targets social sustainability by developing socio-economic skills in marketing, order selection and packaging in the framework of Foodello's operations.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	3,177,500
Protein	-	(g)	-
Carbohydrate	##########	(g)	1,666,333
Fiber	-	(g)	-
Calcium	5,000,000	(mg)	5,000
Choline	1,500,000	(mg)	2,727
Copper	35,000	(mg)	17,500
Food folate	-	(mg)	-
Iron	300,000	(mg)	16,667
Magnesium	-	(mg)	-
Manganese	20,000	(mg)	10,000
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	##########	(mg)	2,857
Riboflavin	95,000	(mg)	55,882
Selenium	3,000,000	(mg)	42,857
Sodium	5,000,000	(mg)	2,083
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	2,951,852
Vit K	##########	(µg)	500,000
Zinc	50,000	(µg)	3,333

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The action had an investment plan to roll out EUR 20 million throughout Europe, particularly focusing on Belgium and the Netherlands, with the aim to recover investment costs over the course of two years.

10. Social Norms and Behavioural Aspects Impacted: There is an increasing amount of media attention on the action and on food loss and waste in general. Awareness has been raised for stakeholders through the media (e.g. radio, TV, and social media). Due to the media attention and on-going discussions, a change in consumption behaviour is expected, particularly in the retailer sector. Consumers are motivated to buy at reduced price without sacrificing quality. The environmental benefit is an additional inducement for many customers.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenge encountered has been socially inclined. Most customers are unsure what the date markings mean and are further confused by the lack of an industry-wide standard behind this labelling. As a result, most consumers confuse “best before” dates for “expiration” dates, and mistakenly believe perfectly safe and tasty food / drink products are unsafe or spoiled based on this labelling. Equally, retailers are motivated to throw out these items due to consumer aversion. A great deal of sensitization is still needed in this regard to educate consumers. Some producers fear image damage as they think their products / brand will be advertised and sold at reduced prices.

12. Sustainability of the Action: The action appears to be sustainable as Foodello currently operates in Belgium and the Netherlands and plans to extend to other European countries. By now Foodello has become very accurate in its predictions about what and how much food they can manage to get marketed according to their business model. The result is the creation of very little food waste.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: **“**Supply chain efficiency and FLW”, “marketing and FLW”, “redistribution and FLW”, “corporate social responsibility and FLW”, and “FLW solutions versus brand image”.

15. Concluding Statement (including quality, validity, consistency): Foodello is making good progress in reducing and preventing food waste at the retail stage of production caused by product date markings. The delivery logistics is outsourced to a subcontractor who delivers the products via “order-picking” to clients, who are mostly consumers who buy the products via the Foodello website, and therefore, able to follow up in real time how many of the products are sold. Being able to save an approximate one million kg of food products of all categories amounting to about EUR 4 million per year is worth commending and a completely sustainable project. The evidence validity is assessed to be between level III and IV.

Foodsavers Antwerp

https://www.antwerpen.be/product/doneer-voedseloverschotten

1. Name of the Action: Foodsavers Antwerp

2. Food Chain Stage: Redistribution

3. Country: Belgium (municipal-Antwerp)

4. Duration: 2020-on-going

5. Actors Involved: The implementing actor is the municipality of Antwerp. The target audience are food redistribution / social enterprises.

6. Description (including goals/objectives): Foodsavers is an initiative of the city of Antwerp that collects food surpluses free of charge and redistributes them to aid organizations that are committed to food distribution.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: Food savers Antwerp's activity focuses on the collection of surplus food from auctions, foodbanks, supermarkets, and Fédération Européenne des Activités du Déchet / European Waste Management (FEAD) for redistribution to targeted beneficiaries through different frontline charities and social centres. The goal is to provide support to frontline charities who are in daily direct contact with and trusted by the beneficiaries.

- Food Waste Prevented: The main food waste composition: meat, dairy, dry food stuff, fruits and vegetables. The source of procured food items in 2021 includes: vegetable auctions (133,385kg), supermarkets (229,884kg), foodbanks (135,495kg), and the Fund for European Aid to the Most Deprived (612,895kg).

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	2.02E+02	3.17E+03	**3.37E+03**
Ozone depletion	kg CFC-11 eq	0.00E+00	4.01E-06	4.80E-03	**4.80E-03**
Human toxicity, non-cancer effects	CTUh	0.00E+00	7.88E-05	2.60E-03	**2.68E-03**
Human toxicity, cancer effects	CTUh	0.00E+00	1.25E-05	3.72E-05	**4.97E-05**
Particulate matter	Disease incidences	0.00E+00	8.26E-06	3.43E-04	**3.51E-04**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	2.43E+00	5.77E+01	**6.02E+01**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	4.53E-01	5.39E+00	**5.85E+00**
Acidification	mol H+ eq	0.00E+00	1.31E+00	4.68E+01	**4.82E+01**
Terrestrial eutrophication	mol N eq	0.00E+00	5.38E+00	2.02E+02	**2.07E+02**
Freshwater eutrophication	kg P eq	0.00E+00	1.06E-01	5.91E-01	**6.97E-01**
Marine eutrophication	kg N eq	0.00E+00	2.07E-01	1.76E+01	**1.78E+01**
Freshwater ecotoxicity	CTUe	0.00E+00	3.81E+03	1.11E+04	**1.49E+04**
Land use	Pt	0.00E+00	1.32E+03	3.25E+05	**3.27E+05**
Water use	m^3 world eq. deprived	0.00E+00	1.79E+01	5.61E+03	**5.63E+03**
Resource use, fossil	MJ	0.00E+00	-3.25E+02	1.72E+04	**1.68E+04**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-1.95E-05	2.61E-03	**2.60E-03**
Single Point	Pt	0.00E+00	4.15E-10	7.50E-09	**7.91E-09**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Foodsavers supports its' staff via a training program for new skills and support for those (re)entering the job market. Cost-Benefit analyis: Not available.

- Social Impact: Impact outcomes have included the reduction of food poverty, the fostering of occupational integration and collaboration, and the prevention of food waste.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	6,990,500	(kcal)	3,495
Protein	-	(g)	-
Carbohydrate:	549,890	(g)	1,833
Fiber	-	(g)	-
Calcium	5,500	(mg)	6
Choline	1,650	(mg)	3
Copper	39	(mg)	19
Food folate	-	(mg)	-
Iron	330	(mg)	18
Magnesium	-	(mg)	-
Manganese	22	(mg)	11
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	11,000	(mg)	3
Riboflavin	105	(mg)	61
Selenium	3,300	(mg)	47
Sodium	5,500	(mg)	2
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	87,670	(mg)	3,247
Vit K	44,000	(µg)	550
Zinc	55	(µg)	4

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Not applicable.

10. Social Norms and Behavioural Aspects Impacted: Foodsavers focuses on educating people. For instance, food donated to NGOs has traditionally suffered from a high degree of seasonality, especially for fruits or vegetables. NGOs routinely request more variety throughout the year, something beyond Foodsavers' ability. Instead, Foodsavers provided training (i.e. recipes for seasonal products and ingredients) so that these NGOs can address this challenge. Foodsavers actions demonstrated noticeable success, as participating NGOs passed this information to households which raised their ability to address this persistent challenge.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: With roughly 21 staff members, one challenge continues to be capacity and staffing resources. Foodsavers employees are trained and coached with the overarching aim that they find traditional jobs in the wider economy (i.e. occupational integration). Foodsavers' success means that the organisation has fewer trained staff, thus resulting in a high turnover rate. Another challenge is related to infrastructure and equipment

(e.g. trucks and storage space, including fridges). As in food redistribution, the input is quite unpredictable, collection means and storage spaces can get saturated, therefore limiting the amount of waste that is effectively redistributed. An additional challenge is related to food providers (i.e., supermarkets). Some have full-time workers supporting food redistribution, but not all food providers do, so it is case-by-case dependent on how the store is organised. Finally, most NGOs depend on volunteers and therefore may experience difficulties in finding trained volunteers, which may impact redistribution efficiency.

12. Sustainability of the Action: The organisation is growing, and this success has been recognised by the municipality.

13. Available Datasets: Not applicable.

14. Identified Research and Innovation Hotspots: There is a need for a standardised reporting system of FLW.

15. Concluding Statement (including quality, validity, consistency): The activity combines social and environmental goals and has demonstrated strong quality and consistency in its outcomes. The evidence validity is assessed to be at level III.

Foodsharing Tartu

https://www.foodsharing.ee/eng.html

1. Name of the Action: Foodsharing Tartu

2. Food Chain Stage: Redistribution

3. Country: Estonia (municipal-Tartu)

4. Duration: 2019-on-going

5. Actors Involved: The implementing actors are Foodsharing Tartu volunteers, and participating retailers, companies, and producers. The target audience are consumers.

6. Description (including goals/objectives): Foodsharing Tartu is a movement that saves and distributes leftover food in Tartu, cooperating with individuals, retailers, companies, and food producers.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The activity resulted in five food sharing points, ten partners, 30 volunteers, and an estimated 9,000kg of food redistributed to date this year (2023).

- Food Waste Prevented: The activity resulted in food waste prevention in the amount of 46,883kg in 2022, 26,600kg in 2023. All types of food, groceries from five large grocery stores.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	1.79E+04	1.49E+05	**1.67E+05**
Ozone depletion	kg CFC-11 eq	0.00E+00	2.00E-04	2.25E-01	**2.26E-01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	1.68E-02	1.22E-01	**1.39E-01**
Human toxicity, cancer effects	CTUh	0.00E+00	7.44E-04	1.75E-03	**2.49E-03**
Particulate matter	Disease incidences	0.00E+00	4.36E-04	1.61E-02	**1.66E-02**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.36E+02	2.71E+03	**2.85E+03**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	2.39E+01	2.54E+02	**2.77E+02**
Acidification	mol H+ eq	0.00E+00	7.11E+01	2.20E+03	**2.27E+03**
Terrestrial eutrophication	mol N eq	0.00E+00	2.89E+02	9.47E+03	**9.76E+03**
Freshwater eutrophication	kg P eq	0.00E+00	5.49E+00	2.78E+01	**3.33E+01**
Marine eutrophication	kg N eq	0.00E+00	2.59E+01	8.26E+02	**8.52E+02**
Freshwater ecotoxicity	CTUe	0.00E+00	1.21E+06	5.20E+05	**1.73E+06**
Land use	Pt	0.00E+00	7.92E+04	1.53E+07	**1.54E+07**
Water use	m^3 world eq. deprived	0.00E+00	2.14E+02	2.64E+05	**2.64E+05**
Resource use, fossil	MJ	0.00E+00	-1.97E+04	8.07E+05	**7.87E+05**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-1.78E-03	1.23E-01	**1.21E-01**
Single Point	Pt	0.00E+00	5.65E-08	3.52E-07	**4.09E-07**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Not available.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	148,707
Protein	-	(g)	-
Carbohydrate:	##########	(g)	77,984
Fiber	-	(g)	-
Calcium	234,000	(mg)	234
Choline	70,200	(mg)	128
Copper	1,638	(mg)	819
Food folate	-	(mg)	-
Iron	14,040	(mg)	780
Magnesium	-	(mg)	-
Manganese	936	(mg)	468
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	468,000	(mg)	134
Riboflavin	4,446	(mg)	2,615
Selenium	140,400	(mg)	2,006
Sodium	234,000	(mg)	98
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	3,729,960	(mg)	138,147
Vit K	1,872,000	(µg)	23,400
Zinc	2,340	(µg)	156

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: People are more aware of their behaviour and are changing to reduce food waste.

- Motivation: Yes
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Ensuring volunteers with the necessary skill-set.

12. Sustainability of the Action: Expected to continue and be sustainable.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: "Gender disparities (i.e. more men receiving food donations)" and "food bank savings".

15. Concluding Statement (including quality, validity, consistency): The activity has contributed positively to the redistribution of food while reducing a large amount of food waste. Food sharing gives non-wasted food a chance to address the food insecure and reduce the amount of solid waste in trash / dump facilities. Social norms are also influenced so that more people are motivated to reduce food waste. The project programme can be transferred to other countries. The evidence validity is assessed to be at level IV.

For Resten App

https://taenk.dk/forbrugerliv/mad-og-indkoeb/app-undgaa-madspild-med-resten-appen

1. Name of the Action: For Resten App

2. Food Chain Stage: Households

3. Country: Denmark (national)

4. Duration: 2016 - on-going

5. Actors Involved: The implementing actors are the Consumer Council (Forbrugerrådet Tænk), Agriculture & Food Ministry (Landbrug & Fødevarer), and Stop Food Waste (Stop Spild Af Mad). The target audience is households.

6. Description (including goals/objectives): The thought process behind the app is "empty the fridge". The app offers good ideas and inspiration for how to make the best possible use of surplus food in the fridge and freezer.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity's overall impact is two-fold: (i) focus on creating and raising awareness and (ii) providing knowledge and skills about food ingredients (e.g. how to cook and store different food ingredients).
- Food Waste Prevented: There are roughly 7,000 - 8,000 active monthly users. However, there is no data available on the amount of food waste prevented.
- Environmental Impact: Not available.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: There are several thousands of active monthly users, but social impacts have not been systematically measured.
- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: Usage of the app raises awareness about food waste. This "self-selection" of users means that those who use the app are already motivated to learn and tackle food waste.

- Motivation: No
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No

- Descriptive Social Norm: No

11. Implementation Challenges: The main challenges are technical in updating and making the app as consumer-friendly as possible; striving to find the balance about what to recommend to people, (for example a plant-based diet and / or meat alternative diet).

12. Sustainability of the Action: The activity needs significant technical upgrades for the app and its' content. The app should be more digital with a data-based recommendation system however, the challenges is resources.

13. Available Datasets: The organization has data solely on how many times the app is downloaded.

14. Identified Research and Innovation Hotspots: Development of targeted content, such as new national dietary guidelines based on a data-based recommendation system.

15. Concluding Statement (including quality, validity, consistency): The activity has a good and clear concept. It is not focused on a specific target group. There are limited resources. The evidence validity is assessed at level IV.

Project: Hrana ni odpadek

https://www.bf.uni-lj.si/sl/raziskave/raziskovalni-projekti/2021030217220822/hrana-ni-odpadek:-preprecevanje,-zmanjsevanje-in-uporaba-odpadne-hrane

1. Name of the Action: Project: Hrana ni odpadek

2. Food Chain Stage: Whole Supply Chain

3. Country: Slovenia (national)

4. Duration: 2020-2022

5. Actors Involved: The implementing actor is the Slovenian Research Agency (ARRS). The target audience are stakeholders throughout the whole supply chain.

6. Description (including goals/objectives): The activity provides an analysis of the situation and the causes of food waste in Slovenia. The activity highlights preventing food surpluses through redistribution, valorisation, education, awareness raising, digital tools, prizes, and competitions, technological innovations for food and non-food uses, training, sales innovations, improved public procurement, certification, legislation, grants, and incentives.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity provides an analysis of the situation and the causes of food waste in Slovenia.
- Food Waste Prevented: The activity did not prevent food waste. The activity rather examined the situation, including the causes of food waste in general. The activity did not calculate the amount of prevented food waste.
- Environmental Impact: The analysis highlights composting and the separate collection of food waste in each food supply chain.
- Economic Impact and Cost-Benefit: One form of action introduced in the food and HoReCa sector was the creation of additional jobs where employees managed the waste generated by the company. Employees with environmental training and competencies were responsible for training and waste management. Employees were trained on the causes and consequences of food waste, the importance of monitoring and measuring food waste in all links of the food chain, the culture of food safety, etc. Cost-Benefit analysis: Not available.
- Social Impact: The activity aimed to establish examples of good practices to redirect surplus food to the most vulnerable groups. Semi-structured interviews were conducted with stakeholders involved in food waste activities. The activity facilitated the creation of additional jobs, and people have received additional training in proper food waste management. The participants were also educated on food safety assurance, causes and consequences of food waste, etc.

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: The activity's initial funding was EUR 80,000.

10. Social Norms and Behavioural Aspects Impacted: The activity highlighted and raised awareness on the intrinsic and societal benefits of reducing food waste among all stakeholders in the food chain.

- Motivation: Yes
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The activity analysed the situation, in particular the causes of food waste among the different actors across the food chain. The challenge the activity faced was that this study was limited only to those stakeholders who are already interested in this topic of food waste and willing to participate in the questionnaire.

12. Sustainability of the Action: Drivers and causes of food waste was analysed. After the study was completed, the project was closed. The study is helpful for all actors in the food chain as well as for all individuals.

13. Available Datasets: The activity provided results based on an overview of the situation in Slovenia and on existing activities and good practices aimed at designing measures to prevent food surpluses and reuse, and interviews with actors in the supply chain. The study is available at https://wwwbf.uni-lj.si/mma/CRP_V4_2011_R1_1_Preliminarna_analiza_vzrokov_-dopolnjena_verzija_28.10.2021.pdf/2022031407264698/?m=1647239206.

14. Identified Research and Innovation Hotspots: "Food waste and households", "food waste and HoReCa", "valorisation", "technology and innovation".

15. Concluding Statement (including quality, validity, consistency): The consistency of the analysis cannot be determined as it was not carried out in different geographical areas or implementation settings as the activity was exploratory and qualitative. The study involved semi-structured interviews with stakeholders involved in food waste activities. The evidence validity is assessed to be at level IV.

IKEA Germany / United Against Food Waste

https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-Less-is-more-Food-waste.pdf

1. Name of the Action: IKEA Germany / United Against Food Waste (UAW)

2. Food Chain Stage: Food Services

3. Country: Germany (national)

4. Duration: 2018-on-going

5. Actors Involved: Implementing actors are IKEA Germany and NGO UAW. The target audience is IKEA Germany.

6. Description (including goals/objectives): Reducing food waste in its food stores together with UAW through a strategic selection of measures after installing a food waste management system.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: While the activity did not reveal insight into the data of the individual cases, it clearly presented a correlation between food waste reduction and economic and ecological benefits.

- Food Waste Prevented: The activity prevented 374,000 kg of food waste between April – December 2021. Therefore, 935,000 meals were saved from disposal.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	6.67E+04	1.18E+06	**1.25E+06**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.46E-03	1.79E+00	**1.79E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	2.74E-02	9.74E-01	**1.00E+00**
Human toxicity, cancer effects	CTUh	0.00E+00	4.50E-03	1.39E-02	**1.84E-02**
Particulate matter	Disease incidences	0.00E+00	2.84E-03	1.28E-01	**1.31E-01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	8.51E+02	2.16E+04	**2.24E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	1.60E+02	2.02E+03	**2.18E+03**
Acidification	mol H+ eq	0.00E+00	4.42E+02	1.75E+04	**1.80E+04**
Terrestrial eutrophication	mol N eq	0.00E+00	1.81E+03	7.54E+04	**7.72E+04**
Freshwater eutrophication	kg P eq	0.00E+00	3.63E+01	2.21E+02	**2.57E+02**
Marine eutrophication	kg N eq	0.00E+00	7.12E+01	6.57E+03	**6.65E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	1.17E+06	4.13E+06	**5.31E+06**
Land use	Pt	0.00E+00	4.40E+05	1.22E+08	**1.22E+08**
Water use	m^3 world eq. deprived	0.00E+00	8.19E+03	2.10E+06	**2.11E+06**
Resource use, fossil	MJ	0.00E+00	-9.42E+04	6.42E+06	**6.33E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-4.17E-03	9.78E-01	**9.74E-01**
Single Point	Pt	0.00E+00	1.41E-07	2.80E-06	**2.95E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: For the staff, the UAW approach usually results in learning and new routines.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	1,188,385
Protein	-	(g)	-
Carbohydrate	##########	(g)	623,209
Fiber	-	(g)	-
Calcium	1,870,000	(mg)	1,870
Choline	561,000	(mg)	1,020
Copper	13,090	(mg)	6,545
Food folate	-	(mg)	-
Iron	112,200	(mg)	6,233
Magnesium	-	(mg)	-
Manganese	7,480	(mg)	3,740
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	3,740,000	(mg)	1,069
Riboflavin	35,530	(mg)	20,900
Selenium	1,122,000	(mg)	16,029
Sodium	1,870,000	(mg)	779
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	1,103,993
Vit K	##########	(µg)	187,000
Zinc	18,700	(µg)	1,247

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: It is estimated that 4 euro per kg of food waste was saved. Further details were not available.

10. Social Norms and Behavioural Aspects Impacted: Social norms are affected on multiple levels. For the staff, the UAW approach usually results in learning and new routines, which also result in a combined effort to fulfil the shared goal of reducing team waste. In this case, a new norm is "installed" in the company. This however only works properly when there is transparency involving the staff throughout all steps of the program. Additionally, once the norm has successfully been "installed" the restaurant can act as a multiplier of the norm when it informs customers of this new activity and therefore inspires and engages customers to follow suit at home. Finally, there is a greater, societal norm shift towards reducing food waste, which has created an entire market for food waste solutions.

- Motivation: No
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Involving the staff via regular collaboration throughout the process. Consistent monitoring is also necessary to sustain the actions and adapt them to constantly changing kitchen processes.

12. Sustainability of the Action: The actions are sustained if an annual two-step monitoring is applied. This is necessary, as the kitchen processes constantly evolves and therefore, food waste prevention actions need adjustment accordingly.

13. Available Datasets: None currently available.

14. Identified Research and Innovation Hotspots: **"**Food waste and retailers", "food waste and commercial kitchens".

15. Concluding Statement (including quality, validity, consistency): The process applied by UAW appears *prima facie* to be successful. UAW is based on a clear business model. However, UAW also emphasises the need for social norms to go along with operations. The kitchen staff are required to be involved in finding solutions, since they are in the best position to identify food waste reduction opportunities for new norms. The evidence validity is assessed to be at level II and III depending on the company.

Invendus pas Perdus

https://www.1030.be/fr/invendus-pas-perdus#:~:text=Un%20projet%20solidaire&text=La%20commune%20vient%20aussi%20aider,les%20Schaerbeekois%20les%20plus%20fragilis%C3%A9s

1. Name of the Action: Invendus pas Perdus

2. Food Chain Stage: Redistribution

3. Country: Belgium (municipal-Schaerbeek)

4. Duration: 2017-on-going

5. Actors Involved: The implementing actors are the city of Schaerbeek (Service eco-conseil within the Sustainable Development department), partner supermarkets (about 5), associations, which are the ones that get the redistributed food (about 16). The target audience are the people experiencing food insecurity.

6. Description (including goals/objectives): Since December 2017, a municipal employee collected unsold products from several partner supermarkets and brought them to associations such as the Red Cross, the Episol social grocery store. Schaerbeek is the first municipality to have set up a large-scale circuit, recently passing a milestone of 100 tonnes of redistributed food.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The recovery of 80 tons of unsold food per year and its redistribution to roughly 2,500 beneficiaries.

- Food Waste Prevented: The amount of recovered unsold food items has totalled 308 tonnes to date (the project starting at 2018 till the present – April 2023). The composition is 98% fresh food, including 45% vegetables, 30% fruit, 15% dairy, and with the rest composed of bread and charcuterie items. Partner supermarkets are required daily to list the mass and the economic value of the surplus food for every donation.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	6.24E+04	9.75E+05	**1.04E+06**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.23E-03	1.48E+00	**1.48E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	2.43E-02	8.02E-01	**8.26E-01**
Human toxicity, cancer effects	CTUh	0.00E+00	3.85E-03	1.14E-02	**1.53E-02**
Particulate matter	Disease incidences	0.00E+00	2.54E-03	1.06E-01	**1.08E-01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	7.47E+02	1.78E+04	**1.85E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	1.39E+02	1.66E+03	**1.80E+03**
Acidification	mol H+ eq	0.00E+00	4.04E+02	1.44E+04	**1.48E+04**
Terrestrial eutrophication	mol N eq	0.00E+00	1.66E+03	6.21E+04	**6.37E+04**
Freshwater eutrophication	kg P eq	0.00E+00	3.26E+01	1.82E+02	**2.15E+02**
Marine eutrophication	kg N eq	0.00E+00	6.38E+01	5.41E+03	**5.48E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	1.17E+06	3.40E+06	**4.58E+06**
Land use	Pt	0.00E+00	4.05E+05	1.00E+08	**1.01E+08**
Water use	m^3 world eq. deprived	0.00E+00	5.51E+03	1.73E+06	**1.73E+06**
Resource use, fossil	MJ	0.00E+00	-1.00E+05	5.29E+06	**5.19E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-6.00E-03	8.05E-01	**7.99E-01**
Single Point	Pt	0.00E+00	1.28E-07	2.31E-06	**2.44E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: For 1 EUR that goes into the activity, EUR 5 worth of food are redistributed. Since the start of the activity, Invendus pas Perdus has redistributed EUR 1.61 million worth of foodstuff. Cost-Benefit: Not available.

- Social Impact: Not available.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	978,670
Protein	-	(g)	-
Carbohydrate	##########	(g)	513,231
Fiber	-	(g)	-
Calcium	1,540,000	(mg)	1,540
Choline	462,000	(mg)	840
Copper	10,780	(mg)	5,390
Food folate	-	(mg)	-
Iron	92,400	(mg)	5,133
Magnesium	-	(mg)	-
Manganese	6,160	(mg)	3,080
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	3,080,000	(mg)	880
Riboflavin	29,260	(mg)	17,212
Selenium	924,000	(mg)	13,200
Sodium	1,540,000	(mg)	642
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	909,170
Vit K	##########	(µg)	154,000
Zinc	15,400	(µg)	1,027

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Investment subsidies have totalled approximately EUR 547,000. The pay-back ratio is five to one.

10. Social Norms and Behavioural Aspects Impacted: Collaborating workers from the retail sector have shown increasing awareness on the topic and importance of food loss and waste, hence leading to changed behaviour.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Competing with private initiatives that collect unsold foodstuff with a profit-making goal with consideration to benefit nutritionally vulnerable individuals and households.

12. Sustainability of the Action: The activity has qualified for funding till 2026 (minimum). The activity's monitoring framework is very mature, and the action is highly systematized and integrated into city-level food policy.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: Food redistribution and retail sector.

15. Concluding Statement (including quality, validity, consistency): The activity has a very strong monitoring framework that incorporates indicators to track the economic impact of the program. The activity is highly professionalized with dedicated employees, with the whole operation systematically integrated into city-wide and level public policy. The evidence validity is assessed to be between levels II and III.

JótéKonyha

https://www.elelmiszerbank.hu/hu/projektjeink/jotekonyha.html

1. Name of the Action: JótéKonyha

2. Food Chain Stage: Food Services

3. Country: Hungary (national)

4. Duration: On-going

5. Actors Involved: The implementing actors are the Hungarian Foodbank, JótéKonyha team, (occasionally) client employees, and participating charities. The target audience are the customers and clients.

6. Description (including goals/objectives): JótéKonyha is a social enterprise of the Hungarian Foodbank, offering food waste-free catering services. Surplus (if any) and food from charity cooking events gets (re)distributed to charities.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The environmental impact is primarily related to the environmental impact of saved foods. The economic impact, through the use of the profits generated by JóteKonyha via the social enterprise. The social impact is the direct effect of food donations, and also the attitude-forming changes affecting customers.

- Food Waste Prevented: It is estimated that about 1 tonne of food could be saved in 1 year, including the preparation, service, consumption of the food, and the related surpluses. The amount of food saved and distributed to those in need during catering activities was a total of about 2000 meals last year (2022). Regarding the number of meals, it is a significant achievement, considering that there is a high rate of food waste in catering of about 30-40 %, especially in event catering, but in JoteKonyha's case it was less than 10%.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	6.60E+02	4.08E+03	**4.74E+03**
Ozone depletion	kg CFC-11 eq	0.00E+00	3.73E-06	5.66E-03	**5.66E-03**
Human toxicity, non-cancer effects	CTUh	0.00E+00	1.30E-03	3.19E-03	**4.49E-03**
Human toxicity, cancer effects	CTUh	0.00E+00	2.09E-05	4.90E-05	**6.98E-05**
Particulate matter	Disease incidences	0.00E+00	2.49E-06	4.16E-04	**4.18E-04**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	2.29E+00	8.36E+01	**8.59E+01**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	3.42E-01	7.04E+00	**7.38E+00**
Acidification	mol H+ eq	0.00E+00	2.20E-01	5.68E+01	**5.70E+01**
Terrestrial eutrophication	mol N eq	0.00E+00	6.39E-01	2.41E+02	**2.42E+02**
Freshwater eutrophication	kg P eq	0.00E+00	2.09E-02	1.08E+00	**1.10E+00**
Marine eutrophication	kg N eq	0.00E+00	1.57E+00	2.67E+01	**2.83E+01**
Freshwater ecotoxicity	CTUe	0.00E+00	9.64E+04	2.05E+04	**1.17E+05**
Land use	Pt	0.00E+00	8.92E+02	3.91E+05	**3.92E+05**
Water use	m^3 world eq. deprived	0.00E+00	1.76E+01	8.31E+03	**8.33E+03**
Resource use, fossil	MJ	0.00E+00	3.61E+02	2.40E+04	**2.43E+04**
Resource use, minerals and metals	kg Sb eq	0.00E+00	2.43E-05	3.98E-03	**4.00E-03**
Single Point	Pt	0.00E+00	3.50E-09	9.91E-09	**1.34E-08**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: JoteKonyha operates as an economically and sustainable business and is able to finance its' activities continuously with resources available for continuous development. Cost-Benefit analysis: Not available.

- Social Impact: The social impact can be measured from the direct effect of food donations, increasing number of catering customers and a positive change in the attitudes of those customers.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	6,355,000	(kcal)	3,178
Protein	-	(g)	-
Carbohydrate	499,900	(g)	1,666
Fiber	-	(g)	-
Calcium	5,000	(mg)	5
Choline	1,500	(mg)	3
Copper	35	(mg)	18
Food folate	-	(mg)	-
Iron	300	(mg)	17
Magnesium	-	(mg)	-
Manganese	20	(mg)	10
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	10,000	(mg)	3
Riboflavin	95	(mg)	56
Selenium	3,000	(mg)	43
Sodium	5,000	(mg)	2
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	79,700	(mg)	2,952
Vit K	40,000	(µg)	500
Zinc	50	(µg)	3

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: So far, about HUF 30-40 million (EUR 100,000) has been invested in the charity as a social enterprise. The return on investment is calculated in the long term. According to our assessment, JoteKonyha is constantly producing the investment that we have put into it, and one third of the profits are constantly being turned back into development, so that the activity can grow year after year.

10. Social Norms and Behavioural Aspects Impacted: JótéKonyha has an impact on hospitality and the spread of a more sustainable and conscious approach in the catering sector – particularly the attitude of the customers. Guests of events are very open to the food saving and donating attitude, and the result is that the plate residue is minimal, in many cases there is near to zero. There seems to be an increasing openness to food saving. Other companies in this sector and catering service providers have now started to strive to meet these needs and customer needs by acting in a similar way.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenge is to create a business activity within the activities of a non-profit organisation in a segment where normally for-profit enterprises operate. A particular challenge was the Covid period.

12. Sustainability of the Action: The sustainability of JótéKonyha seems to be ensured in the long term, and it also has potential for growth.

13. Available Datasets: None currently available.

14. Identified Research and Innovation Hotspots: The most important innovation result is how to achieve sustainability goals, reduce food waste in the form of an economically sustainable social enterprise, while also shaping an approach, in a sustainable, long-term manner.

15. Concluding Statement (including quality, validity, consistency): As a social enterprise, JoteKonyha can serve as a best practice for other organizations carrying out similar activities. Creating such a social enterprise not only helps achieve key goals, but also a number of secondary benefits come with it for the organization's operation, such as raising awareness and expanding food waste mitigation networks to further strengthen social inclusion. The evidence validity is assessed to be at level IV.

Krut

https://krut.cc/pages/uber-uns

1. Name of the Action: Krut (processing over-produced and imperfect vegetables)

2. Food Chain Stage: Processing and Manufacturing

3. Country: Austria (national)

4. Duration: On-going

5. Actors Involved: The implementing actor is Krut, which buys overproduced and imperfect vegetables from conventional and organic producers. The target audience are the consumers.

6. Description (including goals/objectives): Reducing food waste by processing vegetables into Kimchi and Kombucha. Over-produced vegetables and fruits are the main ingredients of all the products.

7. Role (according to the Food Waste Hierarchy): Recycle (Food Waste)

8. Overall Impacts:

- Brief Summary: Krut, a private company, processes over-produced or imperfect vegetables into Kimchi and Kombucha.

- Food Waste Prevented: Only vegetables; usually between 500 kg to 1 tonne per production unit. Each batch is referred to as production unit. Consequently, roughly 12 batches produced per year totals 6,000 kg-12 tonnes.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	8.89E+02	1.79E+03	**2.67E+03**
Ozone depletion	kg CFC-11 eq	0.00E+00	2.26E-05	9.46E-03	**9.48E-03**
Human toxicity, non-cancer effects	CTUh	0.00E+00	5.09E-04	3.94E-03	**4.45E-03**
Human toxicity, cancer effects	CTUh	0.00E+00	6.86E-05	4.39E-05	**1.13E-04**
Particulate matter	Disease incidences	0.00E+00	3.86E-05	1.65E-04	**2.04E-04**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.23E+01	7.18E+01	**8.41E+01**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	2.34E+00	3.40E+00	**5.74E+00**
Acidification	mol H+ eq	0.00E+00	5.76E+00	2.45E+01	**3.02E+01**
Terrestrial eutrophication	mol N eq	0.00E+00	2.36E+01	9.49E+01	**1.18E+02**
Freshwater eutrophication	kg P eq	0.00E+00	4.92E-01	6.66E-01	**1.16E+00**
Marine eutrophication	kg N eq	0.00E+00	1.12E+00	1.03E+01	**1.14E+01**
Freshwater ecotoxicity	CTUe	0.00E+00	2.15E+04	1.02E+04	**3.17E+04**
Land use	Pt	0.00E+00	5.72E+03	1.50E+05	**1.55E+05**
Water use	m^3 world eq. deprived	0.00E+00	1.69E+02	1.78E+03	**1.95E+03**
Resource use, fossil	MJ	0.00E+00	-7.66E+02	1.93E+04	**1.85E+04**
Resource use, minerals and metals	kg Sb eq	0.00E+00	1.54E-05	1.48E-02	**1.48E-02**
Single Point	Pt	0.00E+00	2.19E-09	6.42E-09	**8.61E-09**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Farmers have new opportunities to sell suboptimal food and they became more open towards Krut. Retailers have a new opportunity to place more sustainable products in their stores. Cost-Benefit analysis: Not available.

- Social Impact: The barrier to talk about over-production or food waste in farms has declined as consumers are presented with new opportunities in grocery stores. Krut workshops also help to raise awareness with the wider public about the benefits of fermentation and how to accomplish it.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. FRUIT & VEGETABLE			
			person/day - equivalents
Energy	2,840,000	(kcal)	1,420
Protein	52,400	(g)	1,048
Carbohydrate	710,900	(g)	2,370
Fiber	112,000	(g)	4,480
Calcium	1,000,000	(mg)	1,000
Choline	479,000	(mg)	871
Copper	3,650	(mg)	1,825
Food folate	970,000	(mg)	2,425
Iron	21,700	(mg)	1,206
Magnesium	750,000	(mg)	1,875
Manganese	8,830	(mg)	4,415
Niacin	28,960	(mg)	1,448
Panto acid	9,410	(mg)	941
Phosphorus	1,410,000	(µg)	1,410
Potassium	##########	(mg)	4,020
Riboflavin	3,260	(mg)	1,918
Selenium	18,000	(mg)	257
Sodium	1,060,000	(mg)	442
Thiamin	2,900	(µg)	1,933
Vit A	##########	(IU)	50,256
Vit B6	8,020	(mg)	4,010
Vit B12	-	(µg)	-
Vit C	453,000	(mg)	7,550
Vit D	-	(µg)	-
Vit E	18,900	(mg)	700
Vit K	1,647,000	(µg)	20,588
Zinc	8,500	(µg)	567

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Not yet profitable; but the goal is to reach profitability by end of 2023. No external funding / venture capitalists.

10. Social Norms and Behavioural Aspects Impacted: Farmers have new opportunities to sell suboptimal food and they became more open towards Krut regarding informing them about over-production. The barrier to talk about over-production or food waste in farms was reduced. Meanwhile, consumers are presented with new opportunities in grocery stores. Krut workshops also help consumers become more aware about the benefits of fermentation and how to accomplish it. Retailers have a new opportunity to place more sustainable products in their stores.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: A key challenge has been overcoming the reluctance of producers to talk about their surplus. Procurement of products is also time consuming.

12. Sustainability of the Action: Once the business reaches profitability by the end of the year, the action can be sustained and expanded through usual business operation.

13. Available Datasets: Not yet available.

14. Identified Research and Innovation Hotspots: Research into how to address surpluses in the market, as well as the norms placed on high product standards (optical standards for vegetables and fruits) making food-saving procurement difficult; investigating how much of this is due to regulation and how much is simply due to norms that go beyond regulations.

15. Concluding Statement (including quality, validity, consistency): The overall goals are clear: to save suboptimal food (from regional producers) through fermentation. The data provided is almost exclusively qualitative, as the case study is small and it is a new business. Complete sustainability and impact assessments are not yet available. The business model is consistent with other re-processing businesses. The challenges that Krut faces are mostly expensive procurement, because of societal norms which pressure producers to communicate less openly about the challenges faced regarding over-produced food. Evidence validity assessed at level IV.

LaRiSo

https://site.unibo.it/laboratorio-ristorazione-sostenibile/it

1. Name of the Action: LaRiSo

2. Food Chain Stage: Food Services

3. Country: Italy (regional-Eimlia-Romagna)

4. Duration: 2022-2023

5. Actors Involved: The implementing actor is the University of Bologna. The target audience are schools, local health units, etc.

6. Description (including goals/objectives): The activity facilitates a living-lab, a participatory working table with the goal to improve integrated sustainability in food service industry and school food services.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: Improving the overall sustainability of school canteen services in Emilia Romagna region.
- Food Waste Prevented: Not available.
- Environmental Impact: Not available.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: Not available.
- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted:

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Bringing together different stakeholders with different issues / concerns / priorities.

12. Sustainability of the Action: Via public funding.

13. Available Datasets: Dataset and data protocols are not public.

14. Identified Research and Innovation Hotspots: The co-creation of the activity could provide creative and tailored solutions to improve awareness and abilities in school environments. Moreover, the evaluation design for the implementation of the intervention can provide quality data of food waste produced at school level.

15. Concluding Statement (including quality, validity, consistency): The activity has great potential to put together all relevant stakeholders who are involved in the management of Italian school canteens and the implementation design could offer high quality data for impact evaluation. The evidence validity is assessed to be at level IV.

Leaf No Waste

https://horticultureconnected.ie/news/leaf-no-waste/

1. Name of the Action: Leaf No Waste

2. Food Chain Stage: Primary Production

3. Country: Ireland (national)

4. Duration: 2022-on-going

5. Actors Involved: The implementing actors are Leaf No Wate (project) and the Technological University Dublin. The target audience are primary producers, retailers, and consumers.

6. Description (including goals/objectives): Address food waste by combining plant fortification with sustainable compostable packaging, to have the commodity stay naturally fresh for as long as possible (compared to the existing system).

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity impacted how to reduce food waste through information sharing and collaboration with stakeholders to improve packaging and transportation for more sustainable food waste prevention.

- Food Waste Prevented: The main composition of the food waste being addressed are vegetable leaves (e.g., salad, spinach, kale, mustard leaves, etc.). There is no data on levels of food waste prevented as the activity is still in its trial phase.

- Environmental Impact: Environmental impacts are still to be determined for the same reason as the economic impacts (i.e. still in trial phase). However, project partners are talking about plastic versus compostable packaging for fresh produce to reduce food waste and mitigate greenhouse gas emissions for an end-product that is sustainable for all stakeholders across the supply chain. This demonstrates a change in their own perceptions.

- Economic Impact and Cost-Benefit: No data available as the activity is still in its trial phase. Cost-benefit: Not available.

- Social Impact: The Leaf No Waste's community outreach has been effective. For example, in early June 2023 held the "Revealing Grangegorman 2023" event, open to community and the surrounding area to come and learn about food waste, plastic, alternative packaging, and sustainability in produce from Leaf No Waste researchers (presentation and discussion). On its' social media accounts there are tips and videos to address food waste, making stakeholders (in particular consumers) more aware of and capable to address food waste.

- Nutritional Impact: No data available as the activity is still in its trial phase.

9. Investments and Pay-Back Period: The prize was for EUR 2 million over an approximate three-and-a-half-year period (January 2021 - September 2024). It is too early to assess what the pay-back will be, as that is contingent upon the success of the trial phase and how best to maximize the packaging innovations.

10. Social Norms and Behavioural Aspects Impacted: Due to the activity, the participants and stakeholders involved are much more receptive to listening about different options and possibilities to address packaging and food waste. They have moved from "why should I do this?" to "how can I improve what I am doing and better address sustainability?"

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: No specific challenges other than the initial funding to start such a detailed project, which was obtained via the SFI prize (Science Foundation Ireland).

12. Sustainability of the Action: There is a systematic and clear approach in place. Papers are to be published and information shared throughout the process, so that the work can continue to be built upon. Funding is in place and key to doing the trials. It is a project that can be replicated and done in other contexts.

13. Available Datasets: A consumer perception survey is due to come out in the coming months, but it will not be publicly available as the data needs analysis. Data of the trials will come out and be published on Open Access. A paper was presented at a conference in June.

14. Identified Research and Innovation Hotspots: 'silicic acid and plant fortification', 'plant production', and 'compostable packaging'.

15. Concluding Statement (including quality, validity, consistency): The project ranks high on quality, validity, and consistency. It is well-funded and because of its scientific nature should be able to be replicated in other contexts. The evidence validity is assessed to be at level I.

Less Food Waste – More Ecology and Climate Friendly Food

https://skolenivirkeligheden.dk/ballerup/forloeb/baeredygtighed-klima-co2-reduktion/mindre-madspild-mere-okologi-og-klimavenlig-mad

1. Name of the Action: Less Food Waste – More Economy and Climate Friendly Food

2. Food Chain Stage: General Awareness Raising

3. Country: Denmark (municipal-Ballerup)

4. Duration: On-going

5. Actors Involved: The implementing actor is the municipality of Ballerup. The target audience are participating school students.

6. Description (including goals/objectives): Via entertaining presentations, students are prepared for a sustainable future in the kitchen. The activity also focuses on the role food waste plays globally and locally; the nature of ecology; how to choose climate-friendly food and its connection to less food waste and the UN's 17 global goals for sustainability; what the most sustainable balance is for our food; and how to save water and electricity when cooking.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity's overall impact focused on raising food waste awareness, knowledge and skills with school kids and canteens employees. For school children the focus was on the environmental impact while for canteen employees it covered environmental, social, and economic impacts.
- Food Waste Prevented: The students donated whatever their parents provided from the home refrigerator: carrots, some chicken wings, some pasta, some rice, some boiled rice, boiled pasta, old onions, and other daily food items.
- Environmental Impact: Not available.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: Behaviour impacts were focused on school children and canteen staff, but the community households were also affected positively.
- Nutritional Impact: Not available

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: It is about changing behaviour, such as when grocery shopping and cooking.

- Motivation: Yes

- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenge with school children was their resistance to learn about food waste prevention, especially since the activity's time frame was limited due to the school schedule and term.

12. Sustainability of the Action: The action has been running since many years due to political commitments, reflecting a top-down approach.

13. Available Datasets: No datasets available.

14. Identified Research and Innovation Hotspots: To design better education and learning concepts to facilitate food literacy training.

15. Concluding Statement (including quality, validity, consistency): The action is mix of three different concepts: organic ingredients, reducing food waste, and more climate friendly meals. The concept is perfect and can involve multiple stakeholders, while there is room for more implementation.

Let's Save Food

https://www.viernulvier.gent/nl/pQxENsK/let-s-save-food#:~:text=In%20de%20Sint%2DPietersnieuwsstraat%2C%20net,automaat%20gered%20van%20de%20afvalberg, https://letssavefood.be/

1. Name of the Action: Let's Save Food

2. Food Chain Stage: Redistribution

3. Country: Belgium (regional-Flanders, municipal-Ghent, Brugge/Bruges)

4. Duration: On-going

5. Actors Involved: The implementing actor is Let's Save Food. The targeting audience are the consumers.

6. Description (including goals/objectives): Let's Save Food vending machines sell products that otherwise would be wasted. Non-profit organization volunteers refill the vending machine several times a day with bread, biscuits, freeze-dried-fruit, or other snacks. In this way, everything in the machine is saved from going to waste. Preventing food loss in a consistently sustainable way, by collecting and distributing local food surpluses. In addition, Let's Save Food is out to fight against climate change and enhance social connections within the community.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption).

8. Overall Impacts:

- Brief Summary: Each week, approximately 1,000 individuals collect food items for their families at distribution centres via an initiative that provides surplus food items which would otherwise have been thrown away.

- Food Waste Prevented: Four to five tonnes of food per week on average. The first redistribution was in March 2018 (an average full calendar year therefore entails approximately 192-240 tonnes of food waste prevented). The composition is mostly bread and bread products (i.e., coffee cakes), couscous, cut vegetables, cooked vegetables, meat, desserts, and packaged vegetables.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	3.89E+04	6.08E+05	**6.47E+05**
Ozone depletion	kg CFC-11 eq	0.00E+00	7.69E-04	9.21E-01	**9.21E-01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	1.51E-02	5.00E-01	**5.15E-01**
Human toxicity, cancer effects	CTUh	0.00E+00	2.40E-03	7.14E-03	**9.54E-03**
Particulate matter	Disease incidences	0.00E+00	1.59E-03	6.59E-02	**6.75E-02**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	4.66E+02	1.11E+04	**1.16E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	8.69E+01	1.04E+03	**1.12E+03**
Acidification	mol H+ eq	0.00E+00	2.52E+02	8.99E+03	**9.24E+03**
Terrestrial eutrophication	mol N eq	0.00E+00	1.03E+03	3.87E+04	**3.97E+04**
Freshwater eutrophication	kg P eq	0.00E+00	2.03E+01	1.13E+02	**1.34E+02**
Marine eutrophication	kg N eq	0.00E+00	3.98E+01	3.37E+03	**3.41E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	7.32E+05	2.12E+06	**2.85E+06**
Land use	Pt	0.00E+00	2.53E+05	6.24E+07	**6.27E+07**
Water use	m^3 world eq. deprived	0.00E+00	3.43E+03	1.08E+06	**1.08E+06**
Resource use, fossil	MJ	0.00E+00	-6.23E+04	3.30E+06	**3.23E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-3.74E-03	5.02E-01	**4.98E-01**
Single Point	Pt	0.00E+00	7.97E-08	1.44E-06	**1.52E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: The total food savings to the participants is roughly EUR 2.9 million per year. Cost-Benefit analysis: Not available.

- Social Impact: The project's goal is for most of the participating individuals benefiting from the activity to gradually decrease their purchases from traditional retailers, with the long-term aim to incentivise manufacturers to produce less.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	610,080
Protein	-	(g)	-
Carbohydrate:	##########	(g)	319,936
Fiber	-	(g)	-
Calcium	960,000	(mg)	960
Choline	288,000	(mg)	524
Copper	6,720	(mg)	3,360
Food folate	-	(mg)	-
Iron	57,600	(mg)	3,200
Magnesium	-	(mg)	-
Manganese	3,840	(mg)	1,920
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	1,920,000	(mg)	549
Riboflavin	18,240	(mg)	10,729
Selenium	576,000	(mg)	8,229
Sodium	960,000	(mg)	400
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	566,756
Vit K	7,680,000	(µg)	96,000
Zinc	9,600	(µg)	640

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The activities are done mainly by volunteers with costs covered by the local municipality. The approximate total savings from food waste prevention production since the start of the initiative (March 2018) is more than EUR 14.5 million.

10. Social Norms and Behavioural Aspects Impacted: Customers and volunteers working for Let's Save Food have become more aware of the negative aspects of FW and are trying to reduce it. Although the attitude towards FW is changing, due to large amounts of food surplus in the food bank, many people collect more food than they would need. It is not known if this food is wasted or shared with others.

- Motivation: Yes
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Maintaining food safety from the collection to distribution of food items was the biggest challenge. Let's Save Food addressed this by bringing onboard experienced staff. Another challenge was to understand the approach regarding if food can still be distributed. The organisation uses common sense and experience to determine if a product should still be distributed close to or beyond its "best use" date.

12. Sustainability of the Action: The sustainability of the action is dependent on the financing from the local municipality. Let's Save Food staff are primarily volunteers who are allowed to take food home. The organisation does not have any alternative funding resource.

13. Available Datasets: Not available, more oriented on practical work (receiving and distributing food). This can be due to being mostly volunteer-based initiatives and a lack of possibilities to share their work with the public. Some data can be found on https://letssavefood.be/.

14. Identified Research and Innovation Hotspots: Food waste and supply chain efficiency and management.

15. Concluding Statement (including quality, validity, consistency): Let's Save Food has a significant social impact on the families using their services. They also have an economic impact as large amounts of food are saved from being wasted, saving the means used to produce the food. The organisation claims that their action can decrease the demand for products in supermarkets and decrease production as people who collect the food will not buy these products from traditional retailers. Although the group can probably point to anecdotal evidence, a hard metric and link are difficult to investigate as cohesive data is not yet available. The initiative appears to be sustainable as they have been in operation for five years and there is overall satisfaction with their work both from the municipality and participants. The action is strong on food quality and consistency. The evidence validity is assessed to be at level IV.

LIFE IP CARE4CLIMATE

https://www.care4climate.si/sl/o-projektu/podrocja-aktivnosti-projekta/odpadna-hrana

1. Name of the Action: LIFE IP CARE4CLIMATE

2. Food Chain Stage: Households

3. Country: Slovenia (national)

4. Duration: 2019-on-going

5. Actors Involved: The implementing actors are the Ministry of Environment, Ministry of Climate and Energy, and 15 partners from the public, non-governmental and private sectors. The target audience are households.

6. Description (including goals/objectives): An on-line diary application was set up for households to record data on food waste.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The study aimed to obtain data on the generation and management of food waste in households and to test the feasibility of the chosen method of keeping a kitchen diary. For this purpose, a web-based application was set up through which households reported data on the amount of food waste they measured (weighed) on seven consecutive days during two periods (autumn-winter 2021 and spring-summer 2022). The Ministry of the Environment and Spatial Planning has set up a survey to build on household food waste generation and management data. The households included in the survey were categorized according to place of residence, statistical region, type of settlement, type of building, and status of household members (employed, retired, students, minors, etc.). Environmental and economic impacts have not been included and addressed in the analysis.

- Food Waste Prevented: The composition of food waste in households measured in autumn-winter 2021 was 45.2% vegetables, 26.8% fruit; 4.5% bread and bakery products; 4.5% meat and meat products; 3.2% milk and dairy products; 3.2% beverages, fats, sweeteners, soups, pasta, rice, cereals; 5.2% condiments and sauces; and 3.5% other food groups. The composition of food waste measured in the spring-summer period 2022 was 44.5% vegetables; 20.9% fruit; 7.2% bread and bakery products; 5% meat and meat products; 3.2% milk and dairy products; 2.8% beverages, fats, sweeteners, soups, pasta, rice, cereals; and 2.8% other food groups.

- Environmental Impact: Not available.

- Economic Impact and Cost-Benefit: Not available.

- Social Impacts: By utilizing the on-line diary, awareness about amount and composition of food waste increased within households.

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: The total project's funding was EUR 27.3 million over a 6-year period, therefore approximately EUR 4.5 million per year. This activity is part of a larger project.

10. Social Norms and Behavioural Aspects Impacted: In the survey, 52 households (out of a total 83 households) identified that they had not carried out certain actions during the kitchen diary in the past but planned to do so after their participation in the survey was complete. The activities most frequently identified by the households surveyed were buying food in bulk, using leftovers to prepare a new meal, and being careful about the quantity of food.

11. Implementation Challenges: The autumn-winter survey did not consider the seasonal impact on food waste generation (in summer months, when more fresh fruit and vegetables are available, the quantity of food waste is higher). In the LIFE IP CARE4CLIMATE project the ILO repeated the survey from April to June 2022 to address this issue. The second survey provided improved and more extensive data set for calculating different indicators and monitoring the impact of the different factors on food waste generation. Households measured and reported food waste volumes (self-marking), making it more difficult to assess the accuracy and reliability of the data obtained. When they completed questionnaires, some households had not entered their data correctly per the given instructions.

12. Sustainability of the Action: Not applicable. The activity's aim was to collect information about food waste in the households. No follow-up measures, additional funding, and infrastructure have been put in place.

- Motivation: Yes
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: Yes

13. Available Datasets: The analysis presents the data results by using the household food waste diary method. Datasets are available at https://www.care4climate.si/sl/o-projektu/podrocja-aktivnosti-projekta/odpadna-hrana.

14. Identified Research and Innovation Hotspots: The survey aimed to obtain data on the generation and management of food waste in households to test the feasibility of the chosen kitchen diary method. A web-based application was set up via which households entered data on the amount of food waste.

15. Concluding Statement (including quality, validity, consistency): The study is quantitative, covering a large sample of households: 52 households (out of a total of 83 households) were interviewed and included in the survey. The food waste generated in the study was calculated based on the results obtained from the interviews. The consistency of the analysis cannot be determined as it was not carried out in different geographical areas or implementation settings. The evidence validity is assessed to be at level II.

LIPOR (Dose Certa, Terra a Terra, Horta a Porta)

https://www.lipor.pt/pt/sensibilizar/100-desperdicio/desperdicio-alimentar/
https://www.lipor.pt/fotos/gca/normativo_dose_certa_mod_843_01_15827533663245c68f2d51.pdf

1. Name of the Action: LIPOR (Dose Certa Terra a Terra, Horta a Porta)

2. Food Chain Stage: Food Services (Dose Certa), General Awareness-Raising (Terra a Terra, Horta a Porta)

3. Country: Portugal (municipal-Porto) (Dose Certa, Terra a Terrra, Horta a Porta)

4. Duration: On-going (Dose Certa, Terra a Terrra, Horta a Porta)

5. Actors Involved: The implementing actors are LIPOR, Associação Portuguesa de Nutrição, and regional municipalities. The target audience are restaurants and the food services sector.

6. Description (including goals/objectives): Dose Certa is a program aimed at restaurants and canteens. Businesses that adhere to this initiative commit to implement active measures to tackle FLW.
Terra a Terra: Composting bins are distributed to households and communities to produce compost out of bio-waste. Support is provided for producing compost.
Horta a Porta: Organic gardening, allotments are allocated to residents for growing organic vegetables. Compost is produced locally with gardeners valorising their own bio-waste.
LIPOR promotes several initiatives to address food waste at the household and food services levels: from vegetable gardens, composting, guides, and initiatives for restaurants and canteens.

7. Role (according to Food Waste Hierarchy): Prevention (Dose Certa), Recycle (nutrients recovery - Terra a Terra and Horta a Porta).

8. Overall Impacts:

- Brief Summary: Altogether the LIPOR activities appear to have greatly reduced food waste in the Porto metropolitan area. LIPOR has also contributed to raising awareness on the topic of FLW and sustainable food. They have also contributed to reduce GHG emissions.

- Food Waste Prevented: The consolidated data for LIPOR (in tonnes):
  2019: 12,338
  2020: 13,719
  2021: 12,879
  2022: 15,177
  2023 (to date): 2,159.47
  (Data is available at: https://portal.lipor.pt/pls/apex/f?p=2020:1:0 https://portal.lipor.pt/pls/apex/f?p=2020:2:0.)

- Environmental Impact (based on consolidated data of FW data):

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	8.56E+06	6.19E+07	**7.05E+07**
Ozone depletion	kg CFC-11 eq	0.00E+00	5.72E-02	8.59E+01	**8.59E+01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	1.61E+01	4.84E+01	**6.45E+01**
Human toxicity, cancer effects	CTUh	0.00E+00	2.90E-01	7.43E-01	**1.03E+00**
Particulate matter	Disease incidences	0.00E+00	5.32E-02	6.31E+00	**6.36E+00**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	3.48E+04	1.27E+06	**1.30E+06**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	5.46E+03	1.07E+05	**1.12E+05**
Acidification	mol H+ eq	0.00E+00	6.26E+03	8.62E+05	**8.68E+05**
Terrestrial eutrophication	mol N eq	0.00E+00	2.25E+04	3.66E+06	**3.68E+06**
Freshwater eutrophication	kg P eq	0.00E+00	5.48E+02	1.64E+04	**1.69E+04**
Marine eutrophication	kg N eq	0.00E+00	1.96E+04	4.05E+05	**4.25E+05**
Freshwater ecotoxicity	CTUe	0.00E+00	1.18E+09	3.10E+08	**1.49E+09**
Land use	Pt	0.00E+00	1.44E+07	5.94E+09	**5.95E+09**
Water use	m^3 world eq. deprived	0.00E+00	2.80E+05	1.26E+08	**1.26E+08**
Resource use, fossil	MJ	0.00E+00	3.62E+06	3.64E+08	**3.67E+08**
Resource use, minerals and metals	kg Sb eq	0.00E+00	2.61E-01	6.04E+01	**6.07E+01**
Single Point	Pt	0.00E+00	4.37E-05	1.50E-04	**1.94E-04**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Not available.

- Nutritional Impact (based on consolidated data of FW data):

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	48,224,918
Protein	-	(g)	-
Carbohydrate	##########	(g)	25,289,941
Fiber	-	(g)	-
Calcium	##########	(mg)	75,885
Choline	##########	(mg)	41,392
Copper	531,195	(mg)	265,598
Food folate	-	(mg)	-
Iron	4,553,100	(mg)	252,950
Magnesium	-	(mg)	-
Manganese	303,540	(mg)	151,770
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	##########	(mg)	43,363
Riboflavin	1,441,815	(mg)	848,126
Selenium	##########	(mg)	650,443
Sodium	##########	(mg)	31,619
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	44,800,256
Vit K	##########	(µg)	7,588,500
Zinc	758,850	(µg)	50,590

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: For consumers, the activity has contributed to raising awareness on the topic of FLW prevention and, more largely, on sustainable food practices. For food services, Dose Certa has raised awareness by contributing to the dissemination of knowledge and new skills towards reducing food waste in the food services sector.

- Motivation: Yes
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: Yes
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenges were resource constraints, particularly in staff and funding.

12. Sustainability of the Action: The strategic pillar of LIPOR will certainly be continued, but it depends to some extent on European funding.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: Home and community composting and vegetable gardening – to the extent providing composting schemes contributes to raising awareness and educating beneficiaries on food waste prevention.

15. Concluding Statement (including quality, validity, consistency): Consistent set of actions (i.e. 1. Horta a Porta, 2. Terra a terra, 3. Dose Certa) carried out by LIPOR, the waste management authority of the Greater Porto Area. Each action targets different actors, step of the value chain, or situation where waste is generated, effectively contributing to prevent food waste. Data is collected at organisation level and presents a high degree of validity and consistency. The evidence of validity is assessed to be at level III.

Hub di Quartiere contro lo Spreco Alimentare (Local Food Hubs)

https://foodpolicymilano.org/hub-quartiere-spreco-alimentare/

1. Name of the Action: Hub di Quartiere contro lo Spreco Alimentare (Local Food Hubs)

2. Food Chain Stage: Redistribution

3. Country: Italy (municipal-Milan)

4. Duration: 2018/2019-on-going

5. Actors Involved: The implementing actors are Municipality of Milan, Politecnico Milano, Assolombarda, QUBI, Banco Alimentare, and collaborating companies. The target audience are the individuals / households who are experiencing food insecurity.

6. Description (including goals/objectives): Since 2015, the activity has operated Local Food Waste Hubs to recover food surpluses from local supermarkets and canteens and redistribute it to people in need through local neighbourhood networks. The Municipality allocated city-owned buildings for stocking and redistribution of recovered food and implemented a tax reduction measure that rewards businesses that donate food with a 20% reduction on the waste tax.

7. Role (according to Food Waste Hierarchy): Re-use (human consumption)

8. Overall Impacts:

- Brief Summary: The current hubs divert a significant amount of food waste away from anaerobic digestion (AD) and towards people experiencing or vulnerable to food insecurity.

- Food Waste Prevented: A monitoring framework was established in the activity's inception phase. Supermarkets estimate what is donated, the hubs weigh what they receive. A University was included in the project and supported the activity's data collection, which can be found on the city of Milan's website listed above.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	7.94E+04	9.40E+05	**1.02E+06**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.28E-03	1.42E+00	**1.43E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	1.87E-02	7.73E-01	**7.92E-01**
Human toxicity, cancer effects	CTUh	0.00E+00	4.09E-03	1.10E-02	**1.51E-02**
Particulate matter	Disease incidences	0.00E+00	3.14E-03	1.02E-01	**1.05E-01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	8.64E+02	1.71E+04	**1.80E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	1.58E+02	1.60E+03	**1.76E+03**
Acidification	mol H+ eq	0.00E+00	5.23E+02	1.39E+04	**1.44E+04**
Terrestrial eutrophication	mol N eq	0.00E+00	2.14E+03	5.98E+04	**6.20E+04**
Freshwater eutrophication	kg P eq	0.00E+00	4.05E+01	1.76E+02	**2.16E+02**
Marine eutrophication	kg N eq	0.00E+00	6.63E+01	5.22E+03	**5.29E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	1.03E+06	3.28E+06	**4.32E+06**
Land use	Pt	0.00E+00	5.26E+05	9.66E+07	**9.71E+07**
Water use	m^3 world eq. deprived	0.00E+00	1.50E+03	1.67E+06	**1.67E+06**
Resource use, fossil	MJ	0.00E+00	-1.71E+05	5.10E+06	**4.93E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-1.41E-02	7.77E-01	**7.62E-01**
Single Point	Pt	0.00E+00	1.36E-07	2.23E-06	**2.36E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit analysis: Not available.

- Social Impact: The social impact has been the redistribution of 260,000 meals (valued at EUR 450,000) each year to individuals and households experiencing food insecurity.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	943,718
Protein	-	(g)	-
Carbohydrate:	##########	(g)	494,901
Fiber	-	(g)	-
Calcium	1,485,000	(mg)	1,485
Choline	445,500	(mg)	810
Copper	10,395	(mg)	5,198
Food folate	-	(mg)	-
Iron	89,100	(mg)	4,950
Magnesium	-	(mg)	-
Manganese	5,940	(mg)	2,970
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	2,970,000	(mg)	849
Riboflavin	28,215	(mg)	16,597
Selenium	891,000	(mg)	12,729
Sodium	1,485,000	(mg)	619
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	876,700
Vit K	##########	(µg)	148,500
Zinc	14,850	(µg)	990

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The city has not needed to invest its own money into the activity, for instance leveraging buildings it already owns as hub sites. The costs linked to staff and premises are otherwise covered by NGO and private sector actors (e.g. foundations and banks).

10. Social Norms and Behavioural Aspects Impacted: In addition to addressing the waste of food by supermarkets (which have taken their own measures to reduce food waste since being part of this initiative) the hubs also act as a place where people can learn about date marking and what constitutes a healthy diet.

- Motivation: Yes
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The right physical location has been the biggest challenge and is a reason why there is not yet full coverage in Milan. Funding and sponsors are not currently a problem, which is likely helped by the activity's high profile due to having won the Earthshot Prize.

12. Sustainability of the Action: The activity takes many different approaches to ensure its sustainability. The city has found that the large number of stakeholders involved is a substantial benefit, ensuring continued activity even when one participant is not active. Additionally, at the start of each hub, all partners sign a four-year minimum commitment.

13. Available Datasets: The only available public data is available on the city's website: https://foodpolicymilano.org/wp-content/uploads/2023/05/Policy-Brief_Hub-di-Quartiere_maggio-2023.pdf

14. Identified Research and Innovation Hotspots: Municipal food redistribution.

15. Concluding Statement (including quality, validity, consistency): The activity represents a pioneering and innovative approach to food redistribution at a local and city-wide level. This activity successfully leverages philanthropic funding to address food waste in the city while also tackling the social issue of food insecurity. The activity's quality has consistently remained high as it addresses the reuse and reduction elements of the food waste hierarchy. There are no other organisations and / or programs operating similar or comparative schemes on the same scale. The evidence validity is assessed to be between levels II and III.

Plan Alimentation Durable 2016-2021

https://api-site.paris.fr/images/76336, https://cdn.paris.fr/paris/2022/12/26/plan-alimentation-durable-2022-2027-version-finale-19-decembre-2022-light-plus3-QgJx.pdf, https://a06-v7.apps.paris.fr/a06/jsp/site/plugins/odjcp/DoDownload.jsp?id_entite=56427&id_type_entite=6
https://cdn.paris.fr/paris/2019/07/24/ab3a6b9a1cefcdecff008741cffcebb6.pdf

1. Name of the Action: Plan Alimentation Durable 2016-2021

2. Food Chain Stage: Whole Supply Chain

3. Country: France (municipal-Paris)

4. Duration: 2015-2020 / 2022-on-going

5. Actors Involved: The implementing actors are the Paris City Council (coordinating entity), 17 Caisses des écoles, Centre d'Action Sociale de la ville de Paris, Direction de la Famille et de la Petite Enfance, Association d'action sociale en faveur des personnels de la Ville de Paris, and Direction des Solidarités (DSOL) de la Ville de Paris. The target audience are school children, early childhood care children, the elderly, people experiencing food insecurity, City Council staff, and child welfare establishment attendants.

6. Description (including goals/objectives): Reducing food waste through public procurement of sustainable food and shorter supply chains. The plan goes beyond food waste, it is an integral food policy plan. However, challenge four of the plan specifically focuses on food loss and food waste.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity aims to improve the functioning of canteens and the procurement of food to be more sustainable by decreasing the amount of generated food waste.
- Food Waste Prevented: No consolidated data. The activity adopts a systemic approach that aims to reduce all types of waste, including non-food items like packaging and plastics. The current surveys were based on menus offered in canteens.
- Environmental Impact: Not available.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: Increased awareness of all participating actors about food waste.
- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: The activity has increased awareness of all participating actors and stakeholders in its FLW lines-of-effort and has therefore perhaps contributed to positively shape and alter behaviour at different levels.

- Motivation: Yes
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenges were related to governance due to insufficient coordination mechanisms and monitoring, as well as a lack of standardised reporting.

12. Sustainability of the Action: The activity's principal aim and focus are the improved and increased sustainability of the management of canteens.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: **"**food waste and canteens", "schools and food waste", "redistribution of food and poverty".

15. Concluding Statement (including quality, validity, consistency): The activity has an ambitious plan that appears to be well-implemented. However, there is limited data on results and impacts. The evidence validity is assessed to be at level III.

Plan-eet App

https://vlaco.be/thuiskringlopen/voedselverlies-beperken/plan-eet

1. Name of the Action: Plan-eet App

2. Food Chain Stage: Households

3. Country: Belgium (regional-Flanders)

4. Duration: On-going

5. Actors Involved: The implementing actor is VLACO with the target audience being Flemish households.

6. Description (including goals/objectives): An app geared towards becoming better cognizant of how much food is wasted in Flemish households (measuring food waste) and to provide tips and tricks to help deal with food as consciously as possible (e.g., techniques to store food optimally, recipes to process leftovers, and tips to buy only what you need in the store).

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: An app geared towards becoming better cognizant of how much food is wasted in Flemish households (measuring FW), and to provide tips and tricks to help deal with food as consciously as possible. Examples include techniques to store food optimally, recipes to process leftovers and even tips to buy only what you need in the store. Around 1,700 users of the app at the time of the interview (2023).

- Food Waste Prevented: It is difficult to estimate because only 1% of the registered users weigh their wasted food. The weight is also seen as a general food waste and not divided into different categories. Till now, app users have mostly consulted the many types of info and tips that they obtain from the app on how to avoid / diminish FLW in their household. Over the next few years, the ambition is to get the app users motivated to weigh their FLW. In autumn of 2023, planning to launch a campaign to trigger the app users to weigh their FW. This was the original goal of the app, to have a baseline measurement and a measurement after they have been using the app for a while, for specific segments of consumers.

- Environmental Impact: GHG emissions related to the amount of wasted food and category: carton (21-58kg CO_2 per month), bronze (4-16 kg CO_2 per month), silver (1-4kg CO_2 per month), gold (<1kg CO_2 per month). It is a very general indicator, based on averages (across food categories).

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Looking into possibly giving a workshop for people who are digitally illiterate to help them use the app. There are also about 50 instructors in Flanders willing to give workshops on biological circulation, composting, etc. Some of these instructors

specialize in household FW. The instructors will give in different municipalities workshops related to "budget cooking", "cooking with food leftovers".

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: The cost to build the app was EUR 40,000.

10. Social Norms and Behavioural Aspects Impacted: Not yet measured. The app aims to motivate users to diminish FLW generation at the household level. The app also provides skills and abilities to concretely support households on how they can prevent FLW (i.e. via leftover recipes).

- Motivation: Yes
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Motivating people to continue using the app and to weigh and report food waste in the app. More specifically, the challenge is to motivate people to do the weighing all year round, because you need to take into account seasonal differences. There were also some technical bugs in the app that have not yet been able to be solved. It implies that some users do not see some info pop-ups. The app providers do not know which users get to see which information, making it difficult to evaluate the impacts of the app.

12. Sustainability of the Action: At least until 2025 (as it is part of Smart Life project). Afterwards, the interviewed organisation is motivated to maintain it, however, uncertainty about budget does not make this a certainty.

13. Available Datasets: Fusions report and VITO report.

14. Identified Research and Innovation Hotspots: Measure food waste generation by letting people weigh it themselves at household level.

15. Concluding Statement (including quality, validity, consistency): The app is a very good tool to reach consumers and improve knowledge and skills about food waste at household level. There may be many types / subgroups of people who are not using the app for various reasons (e.g. digital illiteracy, time constraints, etc.). This is a bias in the users' population and hence affects the way in which it can create impact. It is possible to provide targeted functionalities / content to app users, however, this would require more financial support. The evidence validity is assessed to be at level IV.

Program Ekošola Project: 'Hrana ni za tjavendan'

https://ekosola.si/hrana-ni-za-tjavendan/

1. Name of the Action: Program Ekošola Project: 'Hrana ni za tjavendan'

2. Food Chain Stage: Food Services

3. Country: Slovenia (national)

4. Duration: 2018-on-going

5. Actors Involved: The implementing actors are Association Doves, FEE Slovenia, and Program EKOŠOLA (Program Eco school). The target audience are participating school children and households.

6. Description (including goals/objectives): By recording food leftovers in a diary, the activity aimed to learn which food is most often wasted, how much is left, where it goes, and why children waste it.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity included measurement of the amount of food thrown away from the trays in the pupil's meals, including generated content (i.e., recipes, and tips) to reduce food waste.

- Food Waste: The activity measured that on an average day a total of 1,277 meals are distributed to pupils, with 2.6kg of fruit, 6kg of bread, and the remaining leftovers totalling 41.1 kg of food waste (for a total of 49.7kg per meal).

- Environmental Impact: The activity included proper composting and separate collection of waste in a bio-waste container.

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: There were education sessions in kindergartens and schools which encouraged children, pupils, students, staff, and parents to consider food waste's social, environmental, and economic problems and negative impact.

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: The project was co-financed by Lidl Slovenia, but exact figures were not available at the time of the interview.

10. Social Norms and Behavioural Aspects Impacted: Participants became more skilled in reducing and preventing food waste at home and at school. They learned how to store food products properly, how to reuse unused food, how to recycle and dispose of food scraps

properly (composting and separate disposal in a bio-waste bin). Overall, there was an increased awareness of responsible food handling.

- Motivation: Yes
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: Yes

11. Implementation Challenges: The main challenges in carrying out the measurements was the correct entering, recording, and measuring food waste in the diary.

12. Sustainability of the Action: A few pilot institutions were selected, which have drawn up concrete action plans for the current school year. They want to continue the activity (following specific guidelines) in the future, to measure more precisely the amount of food wasted, and to monitor long-term practical actions.

13. Available Datasets: The activity resulted in the identification and measurement of food waste in the schools, identification of the causes of food waste, and the implementation of campaigns to reduce food waste. One of the lines-of-effort included was to measure the amount of food thrown away from the trays in the student dormitory. They measured the fruit and bread discarded at snack and lunch times. Datasets are available at the following link: https://ekosola.si/wp-content/uploads/2019/11/Dodatek-dnevniku-zavr%C5%BEene-hrane.pdf.

14. Identified Research and Innovation Hotspots: The activity aimed to reduce and prevent food waste at home and school, encourage the practical use of new food, and raise awareness about responsible food management.

15. Concluding Statement (including quality, validity, consistency): The activity was quantitative, involving a sample of children in schools and kindergartens. The consistency of the analysis cannot be determined as it was not carried out in different geographical areas or implementation settings. The evidence of validity is assessed to be at level III.

SmartMat Hbg

https://helsingborg.se/forskola-och-utbildning/helsingborgs-stads-skolor/skolmat/smartmat-hbg/

1. Name of the Action: SmartMat Hbg

2. Food Chain Stage: Food Services

3. Country: Sweden (municipal-Helsingborg)

4. Duration: 2017-2020

5. Actors Involved: The implementing actors are the municipality of Helsinborg and Måltidsservice (meal services of schools). The target audience are participating school children and canteen staff.

6. Description (including goals/objectives): Local initiative which aimed to halve food waste and increase the proportion of climate-smart food in 40 municipal schools. Various methods and mechanisms have been used, involving different stakeholders in schools.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: Each school measures food from the kitchen, food put out but not eaten, and food wasted on the plate. These three are weighed and the data is input into a municipality website. Counter-intuitively, the more popular canteen food items have greater food waste as students take more than they can finish eating.

- Food Waste Prevented: The activity has resulted in food waste reduction from 75g per meal to 38g per meal from 2018 to 2020 - i.e. total reduction of 37 grams per meal.

- Environmental Impact: Not available.

- Economic Impact and Cost-Benefit: Not available.

- Social Impacts: The action increased awareness individually for chefs and students, and in the process addressed how their interactions with food contribute to FLW. Part of the awareness raising saw students in the kitchens with chefs to gain a greater understanding and awareness. It has been seen that where there is a closer relationship between student and chef there is greater awareness and engagement from the students. Additionally, children with parents who subsequently talk about food waste at home were found to care more about FW than children whose parents did not talk about it.

- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Costs are not able to be attributed to implementation costs. Only an estimate of savings between 1-2 million Swedish Krona.

10. Social Norms and Behavioural Aspects Impacted: This activity has targeted the social norms and behaviours in a school cafeteria setting, including the food preparers as well as school staff and students. For long-term impact, the activity aims to positively change children's eating behaviour vis-à-vis food waste awareness.

- Motivation: No
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Accustomize kitchen staff to provide weights and measures.

12. Sustainability of the Action: The activity took place over 2 years and its' success resulted in its' continuation indefinitely. It has been shown that continually engaging with kitchen staff is necessary to continue to ensure success.

13. Available Datasets: There are no publicly available data sets, although the city has access to real time data as provided by the school meal services.

14. Identified Research and Innovation Hotspots: Food waste and school canteens.

15. Concluding Statement (including quality, validity, consistency): This activity demonstrates that awareness raising and providing knowledge and education to all parties in a school (canteen staff, cooks, students, and faculty) can significantly reduce and sustain lower food waste levels. The quality and validity of the action are good. The evidence validity is assessed to be between levels II and III.

Sustainable Acquisition of Foodstuff (school canteens)

https://www.umea.se/download/18.19a41f3a17567e789ef21d4/1604918341527/10.%20Eco-innovation%20and%20sustainable%20employment.pdf

1. Name of the Action: Sustainable Acquisition of Foodstuff (school canteens)

2. Food Chain Stage: Food Services

3. Country: Sweden (municipal-Umeå)

4. Duration: 2017-on-going

5. Actors Involved: The implementing actors are the municipality of Umeå and school canteen personnel (who are public sector employees of the municipality). The target audience are the participating school children from age 1 to 19 (representing about 80% of total audience), teachers and other personnel from schools (about 20%).

6. Description (including goals/objectives): Green public procurement criteria for acquisition of foodstuff, including menu planning.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: The activity aims to reduce food waste generated in school canteens, up to a maximum of 20g of food waste per served meal (in 2022, the average was 15g). The activity has a marginal cost as the work is done by existing food planners and canteen staff.

- Food Waste Prevented: Counter-intuitively, food loss and waste (FLW) is greater with the most popular food items. School children serve themselves in the canteens and often take more of the popular items than they are able to finish, thus producing more FLW compared to the less popular food items. Carbohydrates represent a sizeable portion of FLW (e.g., potatoes and rice). Proteins also make up a large proportion of FLW. In 2022, there was 47,697kg of plate waste (i.e. served items not eaten), 5,950kg of cooking waste (i.e. food stuffs discarded during preparation) and 42,197kg in serving waste (i.e. items not served to students). This amounted to a total of 15g of waste per served meal. All data is publicly available at: https://opendata.umea.se/pages/maltidsservicestatistik/.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	7.14E+03	3.92E+05	**3.99E+05**
Ozone depletion	kg CFC-11 eq	0.00E+00	3.29E-04	5.43E-01	**5.44E-01**
Human toxicity, non-cancer effects	CTUh	0.00E+00	8.76E-03	3.06E-01	**3.15E-01**
Human toxicity, cancer effects	CTUh	0.00E+00	9.59E-04	4.70E-03	**5.66E-03**
Particulate matter	Disease incidences	0.00E+00	3.83E-04	3.99E-02	**4.03E-02**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.46E+02	8.02E+03	**8.17E+03**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	2.94E+01	6.75E+02	**7.05E+02**
Acidification	mol H+ eq	0.00E+00	4.68E+01	5.45E+03	**5.50E+03**
Terrestrial eutrophication	mol N eq	0.00E+00	1.91E+02	2.31E+04	**2.33E+04**
Freshwater eutrophication	kg P eq	0.00E+00	4.79E+00	1.04E+02	**1.08E+02**
Marine eutrophication	kg N eq	0.00E+00	1.51E+01	2.56E+03	**2.58E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	3.01E+05	1.96E+06	**2.26E+06**
Land use	Pt	0.00E+00	4.48E+04	3.76E+07	**3.76E+07**
Water use	m^3 world eq. deprived	0.00E+00	4.02E+03	7.98E+05	**8.02E+05**
Resource use, fossil	MJ	0.00E+00	1.31E+04	2.30E+06	**2.31E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	3.09E-03	3.82E-01	**3.85E-01**
Single Point	Pt	0.00E+00	2.82E-08	9.51E-07	**9.80E-07**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: Not available.

- Social Impact: Not available.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	304,532
Protein	-	(g)	-
Carbohydrate	##########	(g)	159,701
Fiber	-	(g)	-
Calcium	479,200	(mg)	479
Choline	143,760	(mg)	261
Copper	3,354	(mg)	1,677
Food folate	-	(mg)	-
Iron	28,752	(mg)	1,597
Magnesium	-	(mg)	-
Manganese	1,917	(mg)	958
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	958,400	(mg)	274
Riboflavin	9,105	(mg)	5,356
Selenium	287,520	(mg)	4,107
Sodium	479,200	(mg)	200
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	7,638,448	(mg)	282,905
Vit K	3,833,600	(µg)	47,920
Zinc	4,792	(µg)	319

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The investment was negligible. Payback period is not applicable.

10. Social Norms and Behavioural Aspects Impacted: Workers, having their awareness raised on FLW and have been instructed how to measure FLW. Food planners and canteen staff were educated on the unnecessary costs associated with FLW. It is unclear if students' awareness and behaviour have changed.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The biggest challenge has been raising awareness in a way that integrates all stakeholders involved in the operation of school kitchens and canteens.

12. Sustainability of the Action: The activity is sustainable in the long term. Operations are embedded within the municipal climate and environment strategy. Moreover, the activity is done within clear monitoring frameworks under an open-data philosophy.

13. Available Datasets: All data about the action is publicly available at: https://opendata.umea.se/pages/maltidsservicestatistik/

14. Identified Research and Innovation Hotspots: Development of an integrated monitoring framework of FLW per meal that reports in a open-data fashion.

15. Concluding Statement (including quality, validity, consistency): The activity is very strong in terms of monitoring frameworks. Moreover, it has institutional support as it is one of the pillars of the municipal climate / environment policy. As the activity is embedded into the day-to-day activities of existing flood planners and canteen staff; the work cannot be analysed in isolation from the overall canteen operations. Therefore, it is difficult to estimate the activity's cost. The evidence validity is assessed to be at level II.

Voedselhub Mechelen

https://www.mechelen.be/voedselhub

1. Name of the Action: Voedselhub Mechelen

2. Food Chain Stage: Redistribution

3. Country: Belgium (municipal-Mechelen)

4. Duration: On-going

5. Actors Involved: Implementing actors are the municipal government of Mechelen (city), Buurwinkel La Luna, and Foodsavers. The Target audience are the consumers in Mechelen.

6. Description (including goals/objectives): The Food Hub Together with Ecoso created the first food hub in Mechelen. Through FoodSavers, safe food surpluses were collected from supermarkets for local traders, who distributed the food to anti-poverty organizations and schools in Mechelen.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The activity had clear impacts across many categories. The number of households reached increased at an average rate of nine families per week. This growth helps boost food availability for low-income families and/or unemployed members.

- Food Waste Prevented: Eight to nine tonnes of food collected per week (approximately 8,000-9,000 kg) presently (after three years). Initially, it was same quantity per month (that is three years ago when the action started). Operations are yet to be at full capacity due to numerous daily factors, hence a lot of food is still being thrown away. Short shelf-life products are mostly saved. Fresh foods mostly fruits and vegetables (67%) from auctions. From the supermarkets, everything else especially products close to expiration such as dairy, meat, fish, and prepared meals. A future goal is to redistribute highly processed foods such as chips and cookies.

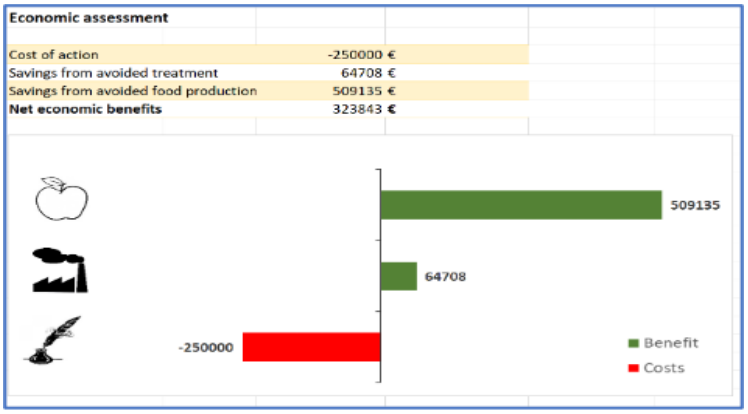
- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	7.78E+04	1.22E+06	**1.29E+06**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.54E-03	1.84E+00	**1.84E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	3.03E-02	1.00E+00	**1.03E+00**
Human toxicity, cancer effects	CTUh	0.00E+00	4.80E-03	1.43E-02	**1.91E-02**
Particulate matter	Disease incidences	0.00E+00	3.17E-03	1.32E-01	**1.35E-01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	9.32E+02	2.22E+04	**2.31E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	1.74E+02	2.07E+03	**2.25E+03**
Acidification	mol H+ eq	0.00E+00	5.04E+02	1.80E+04	**1.85E+04**
Terrestrial eutrophication	mol N eq	0.00E+00	2.06E+03	7.74E+04	**7.94E+04**
Freshwater eutrophication	kg P eq	0.00E+00	4.06E+01	2.27E+02	**2.68E+02**
Marine eutrophication	kg N eq	0.00E+00	7.95E+01	6.75E+03	**6.83E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	1.46E+06	4.25E+06	**5.71E+06**
Land use	Pt	0.00E+00	5.05E+05	1.25E+08	**1.25E+08**
Water use	m^3 world eq. deprived	0.00E+00	6.87E+03	2.16E+06	**2.16E+06**
Resource use, fossil	MJ	0.00E+00	-1.25E+05	6.59E+06	**6.47E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-7.48E-03	1.00E+00	**9.97E-01**
Single Point	Pt	0.00E+00	1.59E-07	2.88E-06	**3.04E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impacts: The economic impact has come from other families whose members are employed by this action (15 people are working full time for the action), which also serves as a sustainable income source for their households. In addition, infrastructural development has occurred such as cold storage warehouses and refrigerated trucks for the transportation and distribution of surplus fresh foods. This has led to the improvement of technical skills for the management of these storage facilities.

Economic assessment	
Cost of action	-250000 €
Savings from avoided treatment	64708 €
Savings from avoided food production	509135 €
Net economic benefits	323843 €



Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Cost-Benefit Analysis: 2.29

ACTION	TOTAL COST (EURO)	TOTAL BENEFITS (EURO) S = Savings from avoided treatment P = Savings from avoided food production	COST-BENEFIT RATIO[67]
Voedselhub Mechelen	250,000	64,708 (S) + 509,135 (P) = 573,843	2.29

- Social Impact: The existence of a "social grocery store" also further improves social cohesion within the community. Other stakeholders have realised the wholistic benefits (social, economic, and environmental) and sustainability aspects of re-integrating surplus food into community and not just throwing food away (and adding to the unsustainable rate of solid waste disposal in landfills).

[67] Total Cost is based on data obtained from the interview, while the Total Benefits are based on calculations from the on-line European Commission food waste prevention calculator, to ultimately obtain the necessary numbers to achieve the cost-benefit ratio.
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	1,220,160
Protein	-	(g)	-
Carbohydrate	##########	(g)	639,872
Fiber	-	(g)	-
Calcium	1,920,000	(mg)	1,920
Choline	576,000	(mg)	1,047
Copper	13,440	(mg)	6,720
Food folate	-	(mg)	-
Iron	115,200	(mg)	6,400
Magnesium	-	(mg)	-
Manganese	7,680	(mg)	3,840
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	3,840,000	(mg)	1,097
Riboflavin	36,480	(mg)	21,459
Selenium	1,152,000	(mg)	16,457
Sodium	1,920,000	(mg)	800
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	1,133,511
Vit K	##########	(µg)	192,000
Zinc	19,200	(µg)	1,280

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The government at the municipal level or the city took care of the cost (both fixed and variable cost etc), amounting to about EUR 250,000 per year. Some funds and subsidies came through partnership with or involvement in other European projects.

10. Social Norms and Behavioural Aspects Impacted: Most evident behaviour impacted (according to the interviewee) was the increased willingness to cooperate and donate surplus food products by both big and small retailers for redistribution.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Challenges in implementing the action were in the aspects of logistics and operational cost which were overcome or borne by the city and additional funds from European projects and other organisations.

12. Sustainability of the Action: The activity, which is executed by the government at the municipality as a major source of funds, with additional funds coming in from partnering with other European projects, gives the initiative a buffer for sustainability as the topic of food waste is very high in the political agenda of the government at the municipality level and European level.

13. Available Datasets: None currently available.

14. Identified Research and Innovation Hotspots: **"**Technology and food waste", "apps and food waste", "transformation and food waste", "ad hoc processing and food waste", and "storage and food waste".

15. Concluding Statement (including quality, validity, consistency): Foodsavers Mechelen has made good progress in fighting food waste as well as providing socio-economic benefits. With government and partner funding, the activity appears to be a sustainable initiative. Cohesive data is not yet available, but it would be interesting to see what the official stats are after the first full year of operation post-Covid. The action is strong on quality and consistency. The evidence validity is assessed to be at level III.

Vollcorner 'Marketing von Suboptimal Food in Öko-handel'

https://www.zugutfuerdietonne.de/fileadmin/zgfdt/sektorspezifische_Dialogforen/Gross-und_Einzelhandel/Dialogforum_Fallstudien-Sammlung.pdf

1. Name of the Action: VollCorner "Marketing von Suboptimal Food im Öko-Handel"

2. Food Chain Stage: Retail

3. Country: Germany (national)

4. Duration: 2021 (Q1)

5. Actors Involved: The implementing actors are VollCorner, Universität Kassel/Witzenhausen, and farmers. The target audience are consumers.

6. Description (including goals/objectives): Scientific test on optically imperfect carrots (e.g. selling carrots with optical imperfections, measuring how unusual the carrots can look until they are not purchased anymore) on the effect of different communication strategies and price reductions.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: Approximately 600 kg of suboptimal carrots were sold within a 12-week period. No environmental, economic, or social indicators were used to assess the impact. However, changed motivation by retailer and consumer and changed opportunity for producers and consumers clearly related results from this action.

- Food Waste Prevented: Within the timeframe (Q1 2021 – 12 weeks) 600 kg of suboptimal carrots were sold. However, it is unclear whether these sub-optimal products would have ended as food waste otherwise, and possible inaccuracies in measurement due to unprepared scales may have skewed the sales data.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	1.07E+02	2.58E+02	**3.65E+02**
Ozone depletion	kg CFC-11 eq	0.00E+00	2.35E-06	1.28E-03	**1.28E-03**
Human toxicity, non-cancer effects	CTUh	0.00E+00	4.40E-05	4.23E-04	**4.67E-04**
Human toxicity, cancer effects	CTUh	0.00E+00	7.22E-06	5.49E-06	**1.27E-05**
Particulate matter	Disease incidences	0.00E+00	4.55E-06	2.23E-05	**2.69E-05**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.37E+00	1.10E+01	**1.24E+01**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	2.57E-01	7.38E-01	**9.95E-01**
Acidification	mol H+ eq	0.00E+00	7.09E-01	2.85E+00	**3.56E+00**
Terrestrial eutrophication	mol N eq	0.00E+00	2.91E+00	1.11E+01	**1.40E+01**
Freshwater eutrophication	kg P eq	0.00E+00	5.82E-02	7.16E-02	**1.30E-01**
Marine eutrophication	kg N eq	0.00E+00	1.14E-01	1.18E+00	**1.30E+00**
Freshwater ecotoxicity	CTUe	0.00E+00	1.88E+03	2.35E+03	**4.23E+03**
Land use	Pt	0.00E+00	7.06E+02	1.62E+04	**1.69E+04**
Water use	m^{-1} world eq. deprived	0.00E+00	1.31E+01	1.97E+02	**2.10E+02**
Resource use, fossil	MJ	0.00E+00	-1.51E+02	2.75E+03	**2.60E+03**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-6.68E-06	1.61E-03	**1.61E-03**
Single Point	Pt	0.00E+00	2.25E-10	8.10E-10	**1.04E-09**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impacts and Cost-Benefits analysis: Not available.

- Social Impact: Not available.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. carrot			
			person/day - equivalents
Energy	246,000	(kcal)	123
Protein	5,580	(g)	112
Carbohydrate	57,480	(g)	192
Fiber	16,800	(g)	672
Calcium	198,000	(mg)	198
Choline	52,800	(mg)	96
Copper	270	(mg)	135
Food folate	114,000	(mg)	285
Iron	1,800	(mg)	100
Magnesium	72,000	(mg)	180
Manganese	858	(mg)	429
Niacin	5,898	(mg)	295
Panto acid	1,638	(mg)	164
Phosphorus	210,000	(µg)	210
Potassium	1,920,000	(mg)	549
Riboflavin	348	(mg)	205
Selenium	600	(mg)	9
Sodium	414,000	(mg)	173
Thiamin	396	(µg)	264
Vit A	##########	(IU)	20,047
Vit B6	828	(mg)	414
Vit B12	-	(µg)	-
Vit C	35,400	(mg)	590
Vit D	-	(µg)	-
Vit E	3,960	(mg)	147
Vit K	79,200	(µg)	990
Zinc	1,440	(µg)	96

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: No assessment. However, retailers have introduced new product lines as a result. Profitability of the action can be assumed as the motivating factor.

10. Social Norms and Behavioural Aspects Impacted:
Opportunity and motivation have been successfully impacted. First, choice editing (introducing suboptimal food into store) has given customers a new opportunity. Second, producers have a new opportunity to market food that otherwise would not make it to market without additional processing.

- Motivation: No
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Regular site visits and interviews were conducted less frequently due to Covid. Procurement and identification of visually distinct suboptimal products remains difficult. Logistics of supplying such products for a continued and necessary longer

amount of time was difficult. Dependency on many separate actors throughout the entire supply chain was a consistent challenge. For many actors suboptimal food was a completely new activity. There were also technological problems in terms of the scales having to be prepared differently to distinguish between traditional and sub-optimal carrots. There was invariably data loss from malfunctioning of scales and / or human errors at the point of sales. This additional work for a similar but separate product required increased communication to address these challenges.

12. Sustainability of the Action: Retailer introduced an own suboptimal product line as a follow-up.

13. Available Datasets: None currently available.

14. Identified Research and Innovation Hotspots: Influence of gender for emotional and informative communication material on suboptimal foods.

15. Concluding Statement (including quality, validity, consistency): The activity is well designed and tackles a valid topic in a consistent manner. The sales tests in the organic retail show that products with minor visual defects (even without a price reduction) continue to be very well received by the customers (compared to sub-optimal apples which were less well received without a price reduction). In the case of clear visual defects that give customers the impression of a damaged or inferior carrot, the product was unsaleable despite a price reduction. Both tested emotional and informative communication strategies were able to slightly increase the sales of suboptimal products. These insights are valuable to inspire further action in the field. The evidence of validity is assessed to be at level IV.

Waste Watch

https://be.sodexo.com/nl/media/world-environment-day-2021.html

1. Name of the Action: Waste Watch / Sodexo

2. Food Chain Stage: Food Services

3. Country: Belgium (regional-Flanders / municipal-Brussels)

4. Duration: 2019-2022

5. Actors Involved: The implementing actor is Sodexo in collaboration with digital start-up Leanpath. The target audience are food services in various sectors.

6. Description (including goals/objectives): An innovative digital solution by Sodexo. Decreased food waste by 50% in its restaurants by 2022. The program covered 180 industrial kitchens from different sectors: from a hospital, school, residential care centre, army base, and various companies to its own headquarters in Ixelles.

7. Role (according to Food Waste Hierarchy): Prevention.

8. Overall Impacts:

- Brief Summary: Almost one third of all food produced is wasted in-country. This is an average of 345 kg per person per year in Belgium. This is an enormous challenge due to the size of the CO2 impact from FW. Two main categories are considered: pre-consumer (all food loss and waste that does not reach the consumer) and post-consumer (all food waste that comes from consumers' plates). SODEXO's focus is on the pre-consumer stage to extract maximum impact.

- Food Waste Prevented: The most wasted food categories in industrial kitchens are soups (because they are more dependent on the weather), followed by vegetables, with meat being lowest. Over-production is generally the main cause of waste.

- Environmental Impacts: The action aims to reduce carbon footprint produced from food waste by 50% by 2025 in Belgium.

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	2.57E+04	1.44E+06	**1.46E+06**
Ozone depletion	kg CFC-11 eq	0.00E+00	1.19E-03	1.99E+00	**1.99E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	3.98E-02	1.12E+00	**1.16E+00**
Human toxicity, cancer effects	CTUh	0.00E+00	3.50E-03	1.72E-02	**2.07E-02**
Particulate matter	Disease incidences	0.00E+00	1.26E-03	1.46E-01	**1.48E-01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	5.13E+02	2.94E+04	**2.99E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	1.03E+02	2.48E+03	**2.58E+03**
Acidification	mol H+ eq	0.00E+00	1.44E+02	2.00E+04	**2.01E+04**
Terrestrial eutrophication	mol N eq	0.00E+00	5.88E+02	8.48E+04	**8.54E+04**
Freshwater eutrophication	kg P eq	0.00E+00	1.56E+01	3.80E+02	**3.95E+02**
Marine eutrophication	kg N eq	0.00E+00	6.24E+01	9.40E+03	**9.46E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	1.64E+06	7.20E+06	**8.84E+06**
Land use	Pt	0.00E+00	1.40E+05	1.38E+08	**1.38E+08**
Water use	m^3 world eq. deprived	0.00E+00	1.54E+04	2.93E+06	**2.94E+06**
Resource use, fossil	MJ	0.00E+00	6.39E+04	8.44E+06	**8.50E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	1.29E-02	1.40E+00	**1.41E+00**
Single Point	Pt	0.00E+00	1.19E-07	3.49E-06	**3.61E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: The industrial kitchens get to save money and reduce operation cost by reducing food waste. Cost-Benefit analysis: Not available.

- Social Impact: Not available.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	1,118,480
Protein	-	(g)	-
Carbohydrate:	##########	(g)	586,549
Fiber	-	(g)	-
Calcium	1,760,000	(mg)	1,760
Choline	528,000	(mg)	960
Copper	12,320	(mg)	6,160
Food folate	-	(mg)	-
Iron	105,600	(mg)	5,867
Magnesium	-	(mg)	-
Manganese	7,040	(mg)	3,520
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	3,520,000	(mg)	1,006
Riboflavin	33,440	(mg)	19,671
Selenium	1,056,000	(mg)	15,086
Sodium	1,760,000	(mg)	733
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	1,039,052
Vit K	##########	(µg)	176,000
Zinc	17,600	(µg)	1,173

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted: The behaviour of most staff in industrial kitchens have been altered for the better vis-à-vis food waste. SODEXO's approach is to monitor and reduce food waste by installing "trackers". These trackers measure food waste so the staff can monitor how much is wasted. Participating kitchens have all expressed surprise at the greater than expected amounts of food waste. This has made them more aware and changed operational procedures to mitigate food waste. While the reaction to this is subjective (e.g. dependent on personalities that varies by individual) the program has clearly impacted positively the practice of industrial kitchens and their behaviour towards food waste.

- Motivation: No
- Opportunity: Yes
- Ability: Yes
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Changing the mindset of kitchen owners and companies the group works with to reduce food waste – making it a clear priority. Secondly, the COVID-19 pandemic caused the closure of many kitchens, and so for some time there was no business. Even after the crisis, the post-Covid era was still a challenge. Additionally, the current struggles

with inflation and increased cost-of-living and business costs has meant kitchens and / or companies have other priorities than addressing food waste. However, this is an opportunity to demonstrate that combatting FW is a cost-cutting measure to address rising business costs. Also, collaboration between industrial kitchen staff is voluntary, thus may make it challenging to maintain comprehensive supervision of food waste practices and progress.

12. Sustainability of the Action: Not available.

13. Available Datasets: None currently available.

14. Identified Research and Innovation Hotspots: Recipes and food waste as well as portion sizes and food waste.

15. Concluding Statement (including quality, validity, consistency): SODEXO Waste Watch initiative seems to be very promising as a tool to reduce food waste, targeting a specific sector, industrial kitchens. There is the potential for significant amounts of food being saved from going to waste. The action also has a clear mission to reduce FW by 50% (reduce the carbon footprint) which is crucial for the environment, economy, and sustainability. This action is strong in quality and consistency. The evidence of validity is assessed to be at level IV.

Waste Watcher International Observatory

https://www.sprecozero.it/waste-watcher/

1. Name of the Action: Waste Watcher International Observatory

2. Food Chain Stage: Households

3. Country: Italy (national and international)

4. Duration: 2013-on-going

5. Actors Involved: The implementing actor is Waste Watcher International Observatory. The target audience is the general public.

6. Description (including goals/objectives): The Observatory aims to provide the community with tools for understanding the social, behavioural and lifestyle dynamics that generate and determine household waste. An Observatory capable of generating common and shared knowledge to guide policies and actions to prevent food waste by public and private actors. Waste Watcher is research carried out with a scientific method, based on opinions and self-perceptions.

7. Role (according to Food Waste Hierarchy): Prevention

8. Overall Impacts:

- Brief Summary: Eight surveys (in over ten countries) between 1,000 and 2,000 respondents per year per country.
- Food Waste Prevented: In 2022, 46,883kg and in 2023 (incomplete), 26,600kg. Composition included all types of food from the five largest grocery stores chains.
- Environmental Impact: Not available.
- Economic Impact and Cost-Benefit: Not available.
- Social Impact: Not available.
- Nutritional Impact: Not available.

9. Investments and Pay-Back Period: Not available.

10. Social Norms and Behavioural Aspects Impacted:

- Motivation: No
- Opportunity: No
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: The main challenges remain funding and the need to still implement a survey adaptable to different contexts.

12. Sustainability of the Action: The activity resulted in positive dialogue and relationships with companies which nudges the sponsor to provide positive impacts.

13. Available Datasets: Dataset and data protocols are not public.

14. Identified Research and Innovation Hotspots: Possibility to expand questions on social norms.

15. Concluding Statement (including quality, validity, consistency): The activity contributed to enrich the research on food waste drivers and support the monitoring of food waste quantities at household level. The evidence validity is assessed to be at level IV.

Yhteinen Pöytä (Shared Table)

https://bin.yhdistysavain.fi/1592855/rfQzH5AYnQ3zNB163CUW0SwCEM/yhteinenpoyta_abc_kirja_english.pdf, https://www.yhteinenpoyta.fi/en/

1. Name of the Action: Yhteinen Pöytä

2. Food Chain Stage: Redistribution

3. Country: Finland (municipal-Vantaa)

4. Duration: 2015-on-going

5. Actors Involved: The implementing actors are the municipality of Vantaa (financing and managing), Vantaa Parish Union (financing), donors, and network operators that utilize the redistributed food (community canteens, etc.). The target audience are the over 5,000 low-income residents of Vantaa who participate in the program.

6. Description (including goals/objectives): Sets up a surplus food terminal, "Shared Table", connecting food factories, wholesalers, and retailers to a large network of food aid distributors.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The activity's redistribution lines of effort aim to reduce environmental impacts associated with food loss and waste (FLW) by preventing 500 tonnes per year of FLW while simultaneously addressing food poverty with the goal of reaching 5,000 beneficiaries per week. The activity is supported from the municipal budget.

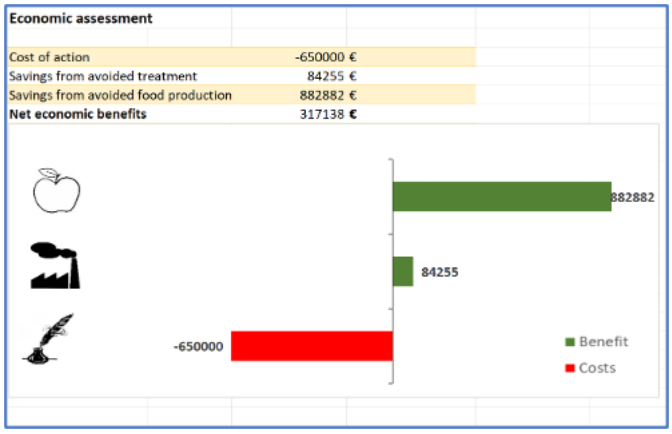
- Food Waste Prevented: The activity has achieved a weekly average of 10 tonnes per week of prevented FLW. In 2022 over 500 tonnes of FLW was prevented. The composition has been varied due to the wide range of surplus food providers, including dairy, bread, fruits, and vegetables. The surplus food entering the terminal is weighed upon intake and reweighed at out-take for deliver to a network operator.

- Environmental Impact:

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	1.92E+05	1.58E+06	**1.77E+06**
Ozone depletion	kg CFC-11 eq	0.00E+00	2.03E-03	2.40E+00	**2.40E+00**
Human toxicity, non-cancer effects	CTUh	0.00E+00	2.40E-01	1.30E+00	**1.54E+00**
Human toxicity, cancer effects	CTUh	0.00E+00	7.94E-03	1.86E-02	**2.65E-02**
Particulate matter	Disease incidences	0.00E+00	3.70E-03	1.72E-01	**1.75E-01**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.30E+03	2.89E+04	**3.02E+04**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	2.26E+02	2.70E+03	**2.92E+03**
Acidification	mol H+ eq	0.00E+00	5.76E+02	2.34E+04	**2.40E+04**
Terrestrial eutrophication	mol N eq	0.00E+00	2.32E+03	1.01E+05	**1.03E+05**
Freshwater eutrophication	kg P eq	0.00E+00	4.57E+01	2.95E+02	**3.41E+02**
Marine eutrophication	kg N eq	0.00E+00	3.34E+02	8.79E+03	**9.12E+03**
Freshwater ecotoxicity	CTUe	0.00E+00	1.72E+07	5.53E+06	**2.28E+07**
Land use	Pt	0.00E+00	6.91E+05	1.63E+08	**1.63E+08**
Water use	m^3 world eq. deprived	0.00E+00	5.98E+03	2.81E+06	**2.81E+06**
Resource use, fossil	MJ	0.00E+00	-1.05E+05	8.58E+06	**8.48E+06**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-8.80E-03	1.31E+00	**1.30E+00**
Single Point	Pt	0.00E+00	7.31E-07	3.75E-06	**4.48E-06**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact: The activity has led to the creation of five long-term municipal job positions as well as 25 subsidized job positions.



Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Cost-Benefit analysis: 1.48

ACTION	TOTAL COST (EURO)	TOTAL BENEFITS (EURO) S = Savings from avoided treatment P = Savings from avoided food production	COST-BENEFIT RATIO[68]
Yhteinen Poyta	650,000	84,255 (S) + 882,882 (P) = 967,137	1.48

- Social Impact: Not available.

- Nutritional Impact:

B. What is the nutritional value of the FLW?

1. OTHER

			person/day - equivalents
Energy	##########	(kcal)	1,588,750
Protein	-	(g)	-
Carbohydrate	##########	(g)	833,167
Fiber	-	(g)	-
Calcium	2,500,000	(mg)	2,500
Choline	750,000	(mg)	1,364
Copper	17,500	(mg)	8,750
Food folate	-	(mg)	-
Iron	150,000	(mg)	8,333
Magnesium	-	(mg)	-
Manganese	10,000	(mg)	5,000
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	5,000,000	(mg)	1,429
Riboflavin	47,500	(mg)	27,941
Selenium	1,500,000	(mg)	21,429
Sodium	2,500,000	(mg)	1,042
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	##########	(mg)	1,475,926
Vit K	##########	(µg)	250,000
Zinc	25,000	(µg)	1,667

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: The investment cost EUR 650,000 per year.

[68] Total Cost is based on data obtained from the interview, while the Total Benefits are based on calculations from the on-line European Commission food waste prevention calculator, to ultimately obtain the necessary numbers to achieve the cost-benefit ratio.
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

10. Social Norms and Behavioural Aspects Impacted: The activity has raised general awareness among the citizens of Vantaa, especially from a social perspective (i.e., benefits for the most economically vulnerable). The activity's participants and food-aid beneficiaries have questioned the origin of the food aid and the nature of a food chain that seems to produce so much food waste. Some surplus food donors have paradoxically streamlined their processes (e.g., purchases, production), which has reduced the amount of food waste generated and, hence, the amount donated for food-aid.

- Motivation: No
- Opportunity: Yes
- Ability: No
- Injunctive Social Norm: No
- Descriptive Social Norm: No

11. Implementation Challenges: Most have to do with capacity and infrastructure. A centralized redistribution model requires a constant availability of human resources and staffing as well as an advanced logistics model with cooling facilities.

12. Sustainability of the Action: The activity is highly sustainable. The budget is allocated annually. It has successfully developed into a systematized FLW-tackling action from a municipal perspective.

13. Available Datasets: Not available.

14. Identified Research and Innovation Hotspots: **"**food redistribution and food waste", "food waste and municipal".

15. Concluding Statement (including quality, validity, consistency): The activity's impact is very strong due to its systematized and integrated lines of effort into local-level and municipal policy. There is a clear monitoring framework and a high volume of activity (both in terms of avoided FLW and number of benefited citizens). Measurements are carried out in a systematic way, which produces good quality of data. This is due to consistent action, which is replicated regularly in collaboration with a leading research organization. The evidence validity is assessed to be between levels II and III.

Foodie Save

https://foodiesave.com

1. Name of the Action: Foodie Save

2. Food Chain Stage: Retail

3. Country: Ireland (national)

4. Duration: 2020-on-going

5. Actors Involved: The implementing actor is Foodie Save (company/app). The target audience are consumers.

6. Description (including goals/objectives): The app connects surplus food from retailers to consumers for a lower price. Via research Foodie Save has found out that the majority of users of the app are "eco-friendly driven" as well as "price driven" (about 70%) people. This demographic includes single mothers. Third level students make up about 10% of users.

7. Role (according to Food Waste Hierarchy): Re-use (Human Consumption)

8. Overall Impacts:

- Brief Summary: The activity connected surplus food from retailers to consumers at reduced prices in real time via its app, thus preventing food waste and benefiting individuals and households vulnerable to food insecurity. Currently there are about 15,000 users of the app (at time of interview in 2023).

- Food Waste Prevented: Since July 2022 to May 2023 have prevented nearly 7,000kg of food waste. The amount of food waste prevented comes from the app itself, which tracks it in accordance with how much surplus food is sold via the app.

- Environmental Impact: The app provides content (tips) on the environmental cost of food waste for users.

Environmental assessment					
	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	0.00E+00	2.74E+03	2.22E+04	**2.49E+04**
Ozone depletion	kg CFC-11 eq	0.00E+00	2.96E-05	3.36E-02	**3.36E-02**
Human toxicity, non-cancer effects	CTUh	0.00E+00	2.81E-03	1.82E-02	**2.10E-02**
Human toxicity, cancer effects	CTUh	0.00E+00	1.12E-04	2.60E-04	**3.72E-04**
Particulate matter	Disease incidences	0.00E+00	6.21E-05	2.40E-03	**2.46E-03**
Ionizing radiation, human health	kBq U^{235}	0.00E+00	1.99E+01	4.04E+02	**4.24E+02**
Photochemical ozone formation, human health	kg NMVOC eq	0.00E+00	3.48E+00	3.78E+01	**4.12E+01**
Acidification	mol H+ eq	0.00E+00	1.01E+01	3.28E+02	**3.38E+02**
Terrestrial eutrophication	mol N eq	0.00E+00	4.07E+01	1.41E+03	**1.45E+03**
Freshwater eutrophication	kg P eq	0.00E+00	7.80E-01	4.14E+00	**4.92E+00**
Marine eutrophication	kg N eq	0.00E+00	4.19E+00	1.23E+02	**1.27E+02**
Freshwater ecotoxicity	CTUe	0.00E+00	2.04E+05	7.74E+04	**2.81E+05**
Land use	Pt	0.00E+00	1.14E+04	2.28E+06	**2.29E+06**
Water use	m^3 world eq. deprived	0.00E+00	3.92E+01	3.93E+04	**3.93E+04**
Resource use, fossil	MJ	0.00E+00	-2.62E+03	1.20E+05	**1.18E+05**
Resource use, minerals and metals	kg Sb eq	0.00E+00	-2.38E-04	1.83E-02	**1.81E-02**
Single Point	Pt	0.00E+00	9.15E-09	5.25E-08	**6.16E-08**

Source: European Commission (JRC) Food Waste Prevention Calculator
https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/resource/show/859

- Economic Impact and Cost-Benefit: The impacts have assisted lower-income and food-insecure families with more affordable food. Definite economic benefits for retailers as well (e.g. lower disposal costs, extra income, reaching more customers, etc.). Cost-Benefit analysis: Not available.

- Social Impact: The app revealed that a significant portion of users are single mothers. Other impacts include educational content from the app, such as tips on how to better plan shop, store, cook, and compost with practical information for users.

- Nutritional Impact:

B. What is the nutritional value of the FLW?			
1. OTHER			
			person/day - equivalents
Energy	##########	(kcal)	22,243
Protein	-	(g)	-
Carbohydrate	3,499,300	(g)	11,664
Fiber	-	(g)	-
Calcium	35,000	(mg)	35
Choline	10,500	(mg)	19
Copper	245	(mg)	123
Food folate	-	(mg)	-
Iron	2,100	(mg)	117
Magnesium	-	(mg)	-
Manganese	140	(mg)	70
Niacin	-	(mg)	-
Panto acid	-	(mg)	-
Phosphorus	-	(µg)	-
Potassium	70,000	(mg)	20
Riboflavin	665	(mg)	391
Selenium	21,000	(mg)	300
Sodium	35,000	(mg)	15
Thiamin	-	(µg)	-
Vit A	-	(IU)	-
Vit B6	-	(mg)	-
Vit B12	-	(µg)	-
Vit C	-	(mg)	-
Vit D	-	(µg)	-
Vit E	557,900	(mg)	20,663
Vit K	280,000	(µg)	3,500
Zinc	350	(µg)	23

Source: Food Loss + Waste Protocol – FLW Value Calculator
https://flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/

9. Investments and Pay-Back Period: EUR 100,000 to get started the first year of operations, which was backed by another EUR 60,000.

10. Social Norms and Behavioural Aspects Impacted: Most evident behaviour impacted (i.e. that could directly notice) was with the retailers who want to engage with Foodie Save due to the benefits: not paying for the food disposal costs, earning more income, and reaching more customers. The surplus food is no longer seen so much as a burden. Separate to retailers, the app is making it more acceptable to eat surplus food (i.e. less stigmatized).

- Motivation: Yes
- Opportunity: No
- Ability: Yes
- Injunctive Social Norm: Yes
- Descriptive Social Norm: Yes

11. Implementation Challenges: The main challenge was raising initial financing to kick-start the app and continuing to raise money.

12. Sustainability of the Action: The action appears to be sustainable in that Foodie Save is currently working on raising funding, continually working on improving the app (technology), and is set to hire more staff and expand across Ireland, the U.K. and into the U.S. market.

13. Available Datasets: None currently available to cohesively present as the activity only started up again in July 2022 post-Covid.

14. Identified Research and Innovation Hotspots: **"**Technology and food waste", "apps and food waste".

15. Concluding Statement (including quality, validity, consistency): Foodie Save is making tremendous strides in combating food waste as well as providing socio-economic benefits. It appears to be a sustainable app, with increased funding, partners, users, as well as expanding to other geographic locations. Cohesive data is not yet available. The action is strong on quality and consistency. The evidence validity is assessed to be between levels III and IV.

CHORIZO PROJECT