



## Document information

<b>Type of Document</b>	Project Deliverable
<b>Document Version</b>	V6
<b>Dissemination Level</b>	
<b>Date</b>	06/07/2023
<b>Deliverable A2.D10</b>	Report on the assessment of existing foodwaste and agrowaste prevention programs and initiatives and their relevance/transferability at local and national level
<b>Sub-Action A2.4</b>	A2.4 Review of existing foodwaste and agrowaste prevention programmes (measurements/ estimations/ existing monitoring platforms and practices)
<b>Action A2</b>	Preparatory, Technical and Economic Studies, Permits and Licensing for Demonstration projects
<b>Project</b>	LIFE-IP CYzero WASTE European LIFE Programme
<b>Project Title</b>	Intelligent Monitoring and Efficient Waste Reduction in Cyprus Island
<b>Project Website</b>	<a href="https://cyzerowaste.com/">https://cyzerowaste.com/</a>
<b>Project email</b>	<a href="mailto:lifecyzerowaste@gmail.com">lifecyzerowaste@gmail.com</a>
<b>Communication Officer</b>	PhD Panayiotis Dalias

This deliverable was produced under co-finance of the EC LIFE Program for the Environment and Climate Change, in the framework of Action A2 "Preparatory Technical & Economic Studies for Demonstration projects" of the project with the title "Intelligent monitoring and Efficient Waste Reduction in Cyprus Island" and the project acronym LIFE-IP CYzero WASTE and Reference: LIFE20 IPE/CY/000011.

The LIFE20 IPE/CY/000011 team would like to acknowledge the European financial instrument for the Environment (LIFE program) for the financial support.

The information included herein is legal and true to the best possible knowledge of the authors, as it is the product of the utilization and synthesis of the referenced sources, for which the authors cannot be held accountable.

## Table of Contents

<b>DOCUMENT INFORMATION</b>	<b>1</b>
<b>1</b>	<b>122 143 173.1 173.2 233.3 263.4 293.5 314 324.1 324.2 354.3 394.4 424.5 444.6 474.7 514.8 534.9 574.10 594.11 614.12 654.13 684.14 724.15 754.16 774.17 794.18 874.19 874.20 894.21 924.22 944.23 964.24 984.25 1014.26 1034.27 1074.28 1104.29 1194.30 1224.31 1244.32 1264.33 1284.34 1324.35 1354.36 1424.37 1445 1475.1 1475.2 1485.3 1575.4 1616 1646.1 1646.2 1687 170</b>

## List of Tables

Table 1. Number of actions reported for each stage of the food supply chain and action sub-type in the United States of America	21
Table 2. Number of actions reported for each stage of the food supply chain and action sub-type in Asia	24
Table 3. Number of actions reported for each stage of the food supply chain and action sub-type in Africa	26
Table 4. Number of actions reported for each stage of the food supply chain and action sub-type in Australia	28
Table 5. Number of actions reported for each stage of the food supply chain and action sub-type in Austria	32
Table 6. Number of actions reported for each stage of the food supply chain and action sub-type in Belgium	36
Table 7. Number of actions reported for each stage of the food supply chain and action sub-type in Albania	39
Table 8. Number of actions reported for each stage of the food supply chain and action sub-type in Bosnia	41
Table 9. Number of actions reported for each stage of the food supply chain and action sub-type in Bulgaria	44
Table 10. Number of actions reported for each stage of the food supply chain and action sub-type in Croatia	48
Table 11. Number of actions reported for each stage of the food supply chain and action sub-type in the Czech Republic	50
Table 12. Efficiency of CHRISTMAS SURPLUS, Denmark in terms of economic and environmental benefits	52
Table 13. Number of actions reported for each stage of the food supply chain and action sub-type in Denmark	54
Table 14. Number of actions reported for each stage of the food supply chain and action sub-type in Estonia	56
Table 15. Number of actions reported for each stage of the food supply chain and action sub-type in Finland	58
Table 16. Efficiency of “Fight against food waste and precariousness”, France in terms of economic and environmental benefits	60

Table 17. Number of actions reported for each stage of the food supply chain and action sub-type in France	62
Table 18. Number of actions reported for each stage of the food supply chain and action sub-type in Germany	66
Table 19. Efficiency of BOROUME, Greece in terms of economic and environmental benefits	69
Table 20. Number of actions reported for each stage of the food supply chain and action sub-type in Greece	70
Table 21. Number of actions reported for each stage of the food supply chain and action sub-type in Hungary	73
Table 22. Number of actions reported for each stage of the food supply chain and action sub-type in Iceland	75
Table 23. Number of actions reported for each stage of the food supply chain and action sub-type in Ireland	77
Table 24. Efficiency of Buon Fine Coop, Italy in terms of economic and environmental benefits	80
Table 25. Efficiency of Avanzi popolo 2.0, Italy in terms of economic and environmental benefits	81
Table 26. Efficiency of Local Food Waste Hub, Italy in terms of economic and environmental benefits	82
Table 27. Number of actions reported for each stage of the food supply chain and action sub-type in Italy	85
Table 28. Number of actions reported for each stage of the food supply chain and action sub-type in Latvia	87
Table 29. Number of actions reported for each stage of the food supply chain and action sub-type in Lithuania	89
Table 30. Number of actions reported for each stage of the food supply chain and action sub-type in Luxembourg	91
Table 31. Number of actions reported for each stage of the food supply chain and action sub-type in Malta	93
Table 32. Number of actions reported for each stage of the food supply chain and action sub-type in Montenegro	95
Table 33. Number of actions reported for each stage of the food supply chain and action sub-type in Netherlands	98
Table 34. Number of actions reported for each stage of the food supply chain and action sub-type in North Macedonia	100
Table 35. Number of actions reported for each stage of the food supply chain and action sub-type in Norway	104
Table 36. Number of actions reported for each stage of the food supply chain and action sub-type in Poland	106
Table 37. Efficiency of Transformar.te, Portugal in terms of economic and environmental benefits	109
Table 38. Efficiency of Zero Desperdiço, Portugal in terms of economic and environmental benefits between 2013 and March 2019	111
Table 39. Efficiency of Rede de apoio alimentar, Portugal in terms of economic and environmental benefits	111

Table 40. Number of actions reported for each stage of the food supply chain and action sub-type in Portugal	114
Table 41. Number of actions reported for each stage of the food supply chain and action sub-type in Romania	117
Table 42. Number of actions reported for each stage of the food supply chain and action sub-type in Serbia	119
Table 43. Number of actions reported for each stage of the food supply chain and action sub-type in Slovak Republic	121
Table 44. Number of actions reported for each stage of the food supply chain and action sub-type in Slovenia	123
Table 45. Efficiency of Alimentos Sin Desperdicio, Spain in terms of economic and environmental benefits	125
Table 46. Number of actions reported for each stage of the food supply chain and action sub-type in Spain	127
Table 47. Number of actions reported for each stage of the food supply chain and action sub-type in Sweden	130
Table 48. Efficiency of Integrated approach to increasing redistribution in the UK in terms of economic and environmental benefits	133
Table 49. Number of actions reported for each stage of the food supply chain and action sub-type in United Kingdom	136
Table 50. Number of actions reported for each stage of the food supply chain and action sub-type in Andorra	138
Table 51. Efficiency of Partage, Switzerland in terms of economic and environmental benefits	139
Table 52. Number of actions reported for each stage of the food supply chain and action sub-type in Switzerland	140
Table 53. Results of overall food waste production in Cyprus (year 2018)	142
Table 54. Food and Vegetables in kilograms saved by Zero Food Waste Cyprus program in 2021	144
Table 55. Food and Vegetables in kilograms saved by Zero Food Waste Cyprus program in 2022	145
Table 56. Actions reported for each stage of the food supply chain and action sub-type in Cyprus by a qualitative analysis of interviews	153
Table 57. Number of actions reported for each stage of the food supply chain and action sub-type in Cyprus	157

## List of Figures

Figure 1. Monthly rescue of food and vegetables of the Zero Food Waste Cyprus project in 2021	144
Figure 2. Monthly rescue of food and vegetables of the Zero Food Waste Cyprus project in 2022	145
Figure 3. People benefited from the Zero Food Waste Cyprus in 2021 and 2022	146
Figure 4. Infographic of the “Save our Food” project.	151
Figure 5. Monthly rescue of edible food.	151



## Abbreviations and Acronyms

ACG	American College of Greece
AFRI	Agriculture and Food Research Initiative
BC	Behavior Change
BiH	Bosnia and Herzegovina
BMK	
CENER	Center for Energy, Environment and Resources
CNCDA	National Commission for Combating Food Waste
DRS	Deposit Return Scheme
EPR	Extended Producer Responsibility
EWWR	European Week for Waste Reduction
FEAD	Fund for European Aid to the Most Deprived
FEBA	European Food Banks Federation
FMFA	Federal Ministry of Food and Agriculture
FSC	Digital tools Food Supply Chain
FSIS	Food Safety and Inspection Service
HaFS	Hospitality and Food Service
HHFW	Household Food Waste
IFAD	International Fund for Agricultural Development
KPI	Key Performance Indicator
MADR	Ministry of Agriculture and Rural Development
MoESD	Ministry of Economy and Sustainable Development
MSMEs	Micro, Small and Medium-Sized Enterprises
MSW	Municipal Solid Waste
NGOs	Non-Governmental Organizations
NWMP	National Waste Management Plan
NWPP	National Waste Prevention Program
OSCE	Organization for Security and Cooperation in Europe
R&D	Research and Development
SCP	Sustainable Consumption and Production



SERD	Selective Estrogen Receptor Degradar
SPW	Service Public of Wallonie
SCE	Supply Chain Efficiency
UNDP	United Nations Development Programme
USDA	United States Department of Agriculture
VAT	Value Added Tax
WFD	Waste Framework Directive
WPP	Waste Prevention Program
WRAP	Waste and Resources Action Program

## Executive Summary

The present report was prepared in the framework of the co-financed European LIFE Program with the title "Intelligent monitoring and efficient waste reduction in Cyprus island" and the project acronym LIFE-IP CYzero WASTE. It is part of the deliverables of Action A2 "Preparatory Technical & Economic Studies for Demonstration Projects", of this project. Responsible for its preparation is the Agricultural Research Institute (ARI).

The LIFE-IP CYzero WASTE project aims to provide solutions and strategies for complying with the waste targets, as these are set in the EU directives, within the 8 years of its duration, while at the same time, the results of its actions will be replicated in the country through the mobilization of funds from Structural Funds, the Recovery and Resilience Facility and other sources.

The aim of this report was the assessment of existing foodwaste and agrowaste prevention programs and initiatives. These are presented systematically together with the summary of the findings of Sub-Action A2.4 "Review of existing foodwaste and agrowaste prevention programs (measurements/ estimations/ existing monitoring platforms and practices)". The main objectives of this Sub-Action were to:

- review the foodwaste and agrowaste prevention programs implemented at EU and international levels
- review and assess the foodwaste and agrowaste prevention programs, implemented at national level

To this end, all continents were investigated separately, starting from their general strategy and their food and agrowaste reduction levels. The main focus of the study was Europe, for which all 37 countries were examined, separately. In total, 209 actions were listed from all countries and continents studied. The majority of the reported actions were from Denmark (16), Italy (19) and Portugal (22). Some notable outcomes have arisen from this research that could either provide ideas about programs that might be applied in Cyprus or help in avoiding inefficient practices that have already taken place.

Although several programs and initiatives have been launched throughout the world, only a few have been thoroughly evaluated, thus the main barrier is the lack of assessment methodologies. Some programs could not be assessed due to a lack of data, as the projects reported are still ongoing.

Another barrier was that most actions did not set clear objectives or provide any baseline values against which, one could measure the actions' performance.

However, several success stories were identified from which a few were considered as potential replication studies for Cyprus. In this context, this holistic approach may lead to engrossing outcomes that can lead to a more efficient planning methodology in Cyprus.

## 1 Introduction

Article 4 of the Waste Framework Directive (WFD; Directive 2008/98/EC on waste and repealing certain Directives) established the waste hierarchy as the overarching principle of waste policies in the EU and EU Member States. According to this, waste prevention has the highest priority, followed by preparing for reuse, recycling and other recovery methods, and finally disposal as the least desirable option. Thus, tackling foodwaste and agrowaste is a key priority in the context of circular economy and Sustainable Development. EU is committed to achieving a 50% reduction of food waste by the year 2030. Cyprus has for the first time established a national waste prevention program (2015-2021) and recently has prepared a draft of the Municipal Waste Management Strategy 2021 – 2027. However, the performance, long term effectiveness and transferability of waste prevention programs have not been fully assessed. Also, there is a lack of information on progress monitoring and required tools to maximize the effectiveness when adopting best practices.

Sub-action A2.4 is in line with Target 12, Measure Chapter VII, Table VII-3, of the NWMP, and in line with measures 1.1, 1.3 and 1.4 of the National Waste Prevention Program (NWPP).

Its purpose is to identify best practices in foodwaste and agrowaste prevention and to map waste prevention programs at local, national, EU and international level. Data will be collected and existing foodwaste and agrowaste prevention schemes that already exist in Cyprus, the EU, and internationally will be mapped. From the national and international experience, the best practices and the best performing programs will be identified, as well as any measurement and monitoring methods. Furthermore, the project will conduct a transferability assessment of the best practices and programs.



DELIVERABLE A2.D10

LIFE-IP CYzero WASTE



The LIFE-IP CYzero WASTE project has been awarded a grant by the European Climate, Infrastructure and Environment Executive Agency, CINEA, under the Agreement Number - LIFE20 IPE/CY/000011

## 2 Methodology

In order to collect all the necessary data, extensive scientific and literature research was conducted. In an effort to present the outcomes of the research in a uniform way, that would facilitate the assessment process, the evaluation framework of food waste prevention actions and their assessment developed by the European Platform on Food Loss and Waste was adopted. This has been established to support members of the Platform in sharing best practices, information and learning outcomes related to food waste prevention initiatives and their results. In accordance with the roadmap of this platform, key recommendations for action will be developed addressing all stages of the food supply chain:

- Primary production.
- Processing and manufacturing.
- Retail and other distribution of food.
- Hospitality and other food service sectors and households.

A classification system was also put in place to categorize the actions and identify common traits. This was based on two main levels: the goal of the action and the means to achieve the goal. The actions were grouped in five classes according to their goal:

### 1. Redistribution of food for human consumption

- 'Surplus food redistribution' redistributing surplus food fit for human consumption either for profit or by donating it to people in need
- 'Gleaning' collecting leftover crops from farmers' fields after they have been commercially harvested or on fields where it is not economically profitable to harvest
- 'Digital tools' using digital tools to manage the redistribution of food

### 2. Food valorisation

- 'Value added processing' processing it into other food products such as juices or jams.
- 'Animal Feed' using surplus food to produce animal feed.

### 3. Consumer behaviour change

- 'Awareness/educational campaigns' implementing campaigns and providing tips.
- 'Digital tools' developing digital tools to guide consumers.
- 'School programs'.
- 'Awards' assigning awards to virtuous households/students based on food waste reduction achieved.

### 4. Improvement of the supply chain efficiency

- 'Process innovation' implementing more efficient processes and technologies.
- 'Training and guidelines' at production/processing/distribution stages.
- 'Digital tools Food Supply Chain (FSC)' enable the implementation of the aforementioned food waste reduction measures.

- ‘Price discount’ discounts for products close to the end of shelf-life.
- ‘Imperfect product sale’ to products that were rejected due to cosmetic reasons.
- ‘Innovation of products - packaging’ e.g., reducing the perishability of products, creating new packaging sizes.
- ‘Innovation of products – date marking’ optimize and clarify the use of date labels to avoid that products are discarded prematurely.
- ‘Public procurement’ to increase their efficiency.
- ‘Certification schemes’ to companies (manufacturers, distributors or food services).

## 5. Food waste prevention governance

These actions can also be described as crosscutting actions, as they encompass all voluntary and mandatory initiatives affecting actors towards food waste reduction, by facilitating the implementation of one - or more likely a combination – of the action types belonging to the remaining groups. Actions classified under the type ‘Food waste prevention governance’ include all those voluntary or mandatory initiatives that promote/facilitate the uptake of the prevention measures belonging to the other three groups. These include:

- ‘Voluntary agreement’ aiming at improving resource efficiency and reducing food waste within the food sector.
- ‘Regulatory frameworks/policies’ including fiscal incentives to simplify/promote the redistribution or reuse of surplus food and to promote the implementation of measures to increase the supply chain efficiency .
- ‘National food waste prevention programs’ large-scale programs coordinated at national level.
- ‘Fiscal incentives’ for businesses that put in place measures to prevent food waste or redistribute/reuse surplus food.

To evaluate an action, it is crucial to define Key Performance Indicators (KPIs). The following KPIs were adopted, based on the recommendations of the European Platform on FLW:

- *Quality of the action design* reflects to which extent the action was well planned.
- *Effectiveness* reflects to which degree the action was successful in producing the desired result, i.e., in reaching the objectives.
- *Efficiency* reflects the capacity to reach a desired result with the least time/cost/effort.
- *Sustainability* of the action over time reflects the potential of the action to be sustained over time.
- *Transferability and scalability* reflect to which extent transferability (possibility of being transferred or implemented in another context or place) and scalability (ability to be applied on a different scale, compared to the initial case, e.g., to be made larger) were considered during the design of the action.

- *Intersectoral cooperation* reflects if the action was the result of a cooperation represented by a partnership between the private and the public sector and/or between different actors and stakeholders along the supply chain.

In order to improve the quality of information derived, where necessary, questionnaires were developed and communication with stakeholders was established, complemented by interviews where relevant. This was mainly applied at the national level research.

More specifically, regarding the interviews performed, representative actors in all stages of the food supply chain in Cyprus were selected, following the same pattern as in the classification system presented above. Although the interviewer had a general plan for the structure of the discussion, the questions allowed for flexibility and were often open-ended (semi-structured interviews). Interviewees were selected at random, but in most cases, they represented big enterprises or group of enterprises or professional unions.

### 3 Review of existing programs at international level

#### 3.1 United States of America

The amount of food thrown away by Americans each year is staggering. In 2018 alone, EPA estimates that about 63 million tons of wasted food were generated in the commercial, institutional, and residential sectors, with about 32% being managed as animal feed, bio-based materials/biochemical processing, co-digestion/anaerobic digestion, composting, donation, land application, and sewer/wastewater treatment.[1] EPA estimates that more food reaches landfills and incinerators than any other single material, constituting 24% of landfilled waste and 22% waste combusted (with energy recovery).

The U.S. Department Of Agriculture (USDA) has developed guides for programs that could potentially provide funding for food loss and waste reduction projects as well as for research on food loss and waste.[1] Some of the main actions that have been implemented in the United States are described below.

Since consumers account for a large share of food loss and waste in the United States, efforts towards their education have been made. To this end, the USDA Center for Nutrition Policy and Promotion has developed a new infographic, “Let’s Talk Trash”, with information on food loss and waste facts and reduction tips. Moreover, a new section on “MyPlate.gov” aims to educate consumers about reducing food waste to help stretch household budgets. The potential audience for this outreach is large. Since the launch of MyPlate in 2011, it has become a popular federal resource for consumers seeking information on nutrition and health. The number of visitors has grown from 6.5 million in 2011 to 50.6 million in August 2015 and the site received more than 288 million page views. Facts about food waste and tips to help consumers reduce will be a valuable addition to MyPlate.gov as USDA strives to motivate food waste reduction.[1]

Furthermore, some consumer-level loss arises from consumers or retailers throwing away wholesome food because of confusion about how to safely store it or about the meaning of dates stamped on the label. USDA, through the Food Safety and Inspection Service (FSIS), educates consumers about the importance of safe food storage as a means of reducing the risks of acquiring a foodborne illness. As part of its food waste reduction outreach, USDA recently updated the safe-storage and date-labeling information on the FSIS website and updated and expanded online FoodKeeper Resource. In spring 2015, USDA also launched (in partnership with the Food Marketing Institute and Cornell University) a FoodKeeper App to provide consumers with easy access to clear, scientific information on food storage, proper storage temperatures, food product dating, and expiration dates. [1]

On-farm storage can also help reduce post-harvest loss by providing farmers with effective, safe and readily accessible storage for crops. In August, 2015, USDA expanded the Farm



Storage Facility Loan program to provide producers of milk, cheese, butter, yogurt, meat, eggs, seafood, flowers, rye, maple sap and hops low-cost loans for on-farm storage facilities. These newly eligible commodities joined corn, sorghum, rice, soybeans, oats, peanuts, wheat, barley, pulse crops, hay, honey, fruit, vegetables, nuts and renewable biomass that were already in the program. The loans are designed to assist a diverse range of farming operations, including small and mid-sized businesses, new farmers, operations supplying local food and farmers' markets, non-traditional farm products, and underserved producers. Since 2000, the Farm Storage Facility Loan program has disbursed \$2 billion in loans to farmers, facilitating the purchase of storage capacity sufficient for approximately 1 billion bushels of grain.

Through a Rural Utilities Service grant, USDA is funding the Rural Iowa Food Waste Reduction Project. This project assists businesses in reducing food waste generation rates. Assistance includes on-site visits to determine food waste generation baselines; strategies for reducing food waste; training in reduction strategies; and an exploration of local options for composting, bio-digesting, donation of edible food, or commercial companies that offer organic waste diversion services. Through a Rural Utilities Service grant, USDA is also funding the Food Waste Composting Education Program for Iowa Landfills. This program promotes food waste composting in rural counties, targeting both landfills and the general public through on-site technical training and regulatory assistance related to composting food waste. In addition, the project has created fact sheets, guides, regulatory summaries and videos. The main goal of the project is to reduce the amount of food waste discarded in Iowa landfills by assisting landfills and the general public in expanding or implementing composting operations. The goal of the food waste reduction project is to reduce the annual amount of food waste by a modest 10%. Implemented across the state of Iowa, this would result in a potential annual food waste reduction of 19,388 tons.

Recognizing that misbranded products are often safe and wholesome, USDA streamlined procedures for donating wholesome misbranded meat and poultry products by allowing establishments to donate such products without temporary label approval provided that the bills of lading for the product include certain information for Agency verification activities. (Notice 68-13 Verifying Donation of Misbranded and Economically Adulterated Meat and Poultry Products). Since the new regulations were enacted, new donations are starting to flow, including, for example, 84,310 pounds of misbranded sausage and thousands of pounds of pizza, soups and other meat products.

USDA has worked to help increase donations of wholesome fresh imported products that are subject to destruction or rejection because they do not meet the same or comparable federal marketing order standards as domestic products. USDA compiled a list of charitable organizations (with permission from the organizations) and posted and shared the list of exempted outlets with employees at major ports. Employees were requested to provide this information to importers who have fresh products that are not inspected or do not meet

certain marketing order requirements. In early 2015, importers donated 604,000 pounds of produce to the Houston Food Bank, 380,780 pounds to Feeding America San Diego (and Foodbank of Southern California), and 192,174 pounds to the Food bank of Rio Grande Valley and Jesus El Pan de Vida.

Through the Agriculture and Food Research Initiative (AFRI), USDA's National Institute of Food and Agriculture competitively funded a first of its kind conference (2014) on food loss and waste in the US. The conference, entitled "The Last Food Mile: A Conference on Food Loss and Food Waste in the United States," intended to define the state of knowledge, understand the factors affecting the behavior, identify critical control points, and build a network of research and intervention strategies to address the issue. The conference's impacts include: 1) the formation of a knowledge network to exchange ideas, learn from each other, and engage and mobilize around the issue, 2) a book was published with the title "The Last Food Mile: Food Loss and Waste and Its Reduction, Recovery, and Recycling in the United States - A 2015 Status Report", and 3) expanded outreach through research and education efforts, e.g. incorporating food waste and food security into the curriculum, engaging students in and out of classroom settings, and conducting focus studies on consumer food behavior through grants from the University of Pennsylvania Research Foundation as well as PURM (Penn Undergraduate Research Mentoring Program).

USDA has also identified innovation as a major driver in increasing the reduction, recovery, and recycling of food waste. Innovation helps to make reducing, recovering and recycling food waste economically viable for businesses, organizations and households by increasing the feasibility or reducing the cost of better food waste management. Innovation can also help stimulate economic development and job growth by turning food waste into an economic opportunity. USDA's Agricultural Research Service supports innovation by conducting, often in collaboration with industry and academic partners, research on new technologies for reducing spoilage of fresh foods and the development of new products from waste materials at food processing facilities. This research stream, which is primarily conducted within ARS's National Program on Quality and Utilization of Agricultural Products, is reviewed/renewed in five-year cycles. Other recent research projects include:

- Development of a fruit- and vegetable-based powder to inhibit spoilage of fresh-cut produce.
- Investigation of genetic/breeding options for inhibiting sprouting of potatoes during storage.
- Development of active packaging to extend fruit and fresh-cut produce shelf life.
- Development of a technology to utilize olive-mill waste-water in body-care or beverage products.
- Development of a process to produce new oils and dietary-fiber products from fruit and vegetable seed byproducts.

- Development of a grape-seed flour, a byproduct of wine making, as a healthy food ingredient that helps to lower the risks of heart disease and obesity.
- Development of a 2-stage anaerobic digestion process for potato-processing waste to produce a substitute for peat moss, an imported non-renewable matrix for potting and garden soils.
- Development of a digester process for coffee grounds to substitute for peat moss and imported non-renewable materials.
- Development of a new design and operational procedures for retail grocery store open-air, lighted and refrigerated produce display cases to reduce spoilage, and extend shelf-life and nutritional quality.
- Development of new food and feed ingredients from fish processing waste.
- Development of a small-scale peanut dryer and peanut sheller that is suitable for use in remote areas of Haiti, where as much as 50 percent of the peanut crop is lost due to poor moisture control.
- Development and commercialization of novel nutritious gluten-free fruit and vegetable wraps.
- Development of a licensed technology for forming 100 percent fruit health bars.
- Commercialization of an ARS-developed process to create a product from sweet potato culls.
- Development of an optical property analyzer to help growers assess crop maturity and quality of food products, and thus help determine optimal harvest time and appropriate postharvest handling/processing procedures to minimize food loss and enhance marketability.
- Development of an automated in-orchard apple sorting technology to enable apple growers to remove inferior fruit in the orchard and better manage the harvested fruit in postharvest handling, thus avoiding potential devastating product loss during postharvest storage/handling.
- Development of value-added food products from rice hulls, including products (such as ground beef and catfish patties) utilizing antioxidants from rice hulls to reduce lipid oxidation.

USDA has also taken a number of steps to measure plate waste in school meal programs and to develop innovative approaches to reducing it:

- Completed the design and school recruitment for a study on the amount of plate waste in schools with respect to the type of foods wasted, student and school characteristics.
- Worked with the Cornell Behavioral Economics Center to develop and then disseminate Smarter Lunchroom training to over 2,400 school professionals. Funded 12 subgrants to university researchers examining the impact of behavioral economics approaches in school cafeterias.

- Conducted approximately 60 trainings from January to October 2014 to school food service personnel to reduce in-kitchen food loss, reaching over 3,500 participants.

Additionally, USDA completed a variety of activities to increase the recovery or recycling of wholesome food that is removed from commerce:

- Conducted a one-year meat composting pilot program for meat samples submitted for chemistry analysis, diverting 8,800 pounds of meat from solid waste disposal to recycling (at the Food Safety and Inspection Service's Western Laboratory). This successful program is now in use at two of FSIS's three labs (Western Laboratory and Eastern Laboratory). The labs continue to track monthly quantities of meat composted and explore options for expanding and enhancing the Meat Sample Composting Program to include the Midwestern Laboratory.
- Began working with the California Desert Grape Administrative Committee to specify alternative exempted outlets for fresh table grapes that are not inspected or that do not meet certain federal marketing order requirements.

In view of reducing and recycling food waste at USDA headquarters, all food waste at USDA headquarters cafeteria is sorted and composted. Additionally, the cafeteria reduces pricing before closing time to encourage employees to buy food to take home, reducing the amount of food that is discarded at the end of the day.

Several other food waste prevention programs have been reported across the United States but few information on their efficiency has been noted. [21]

All the initiatives and programs reported are categorized in a more uniform way in the following table. Thus, Table 5 presents, for each action sub-type, the total number of actions reported for each stage of the supply chain.

Table 1. Number of actions reported for each stage of the food supply chain and action sub-type in the United States of America

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	1		1	3	3
	Gleaning					
	Digital tools R					
Food valorization	Value added processing	2	2	2	2	10
	Animal feed					
Behavior change (BC)	Awareness/educational campaign	1	1	2	4	5
	Digital tool BC					3
	School programs					2
	Awards					
	Innovation of products - date marking		1			5
Supply chain efficiency (SCE)	Process innovation	3	2	2	2	10
	Innovation of products - packaging	2	2			1
	Training & guidelines			2	2	1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy	2	2	3	2	2
	National FW prevention program	1	1	1	1	1
	Fiscal incentives					

### 3.2 Asia

In China, more than 35 million tons of food – six per cent of China’s total food production – are lost or wasted annually, enough to feed 30 to 50 million people. About half of it – between 17 and 18 million tons annually – is wasted at the last stage of the supply chain: at retail or consumption. From a global perspective, China is home to 20 per cent of the world’s population but only seven per cent of the world’s arable land. By reducing food loss and waste and promoting responsible and sustainable production and consumption, China can significantly contribute to the global battles against poverty, hunger and climate change, and thus it is essential to promote waste prevention actions.

Mitigation measures would need to target each stage of the supply chain. For instance, promoting the adoption of mechanized agriculture and more efficient farm machinery to ensure that crops are harvested efficiently may reduce food loss during the production (harvesting) phase. Increasing the number, capacity and functionality of storage facilities could help reduce food loss during the storage phase. Improved road connections and a more efficient logistics system could reduce food loss during distribution. Digitalization can improve overall efficiency along the entire value chain. International Fund for Agricultural Development (IFAD) supported initiatives by providing financial resources to construct feeder roads and improve road connectivity, build storage facilities, and improve the overall efficiency of agricultural value chains throughout China, thus directly or indirectly contributing to reducing the country’s food loss and improving its food security.

Chinese President Xi Jinping has recently launched a “Clean Plate” campaign targeting food waste, which, among other goals, seeks to remind everyone that “we should still maintain a sense of crisis about food security”. Food security has in fact always been an important strategic objective of China’s policy.

“Pride on our Plates” focuses on strengthening China’s Micro, Small and Medium-sized Enterprises (MSMEs) through proven food waste solutions and behavioral insights. The Chinese government has been taking measures in recent years to improve its waste management system nation-wide by calling for “**Zero-Waste City**” pilots. The main objectives of this project are to catalyze the prevention, reduction, and diversion of food waste among MSMEs in China's hospitality sector. More specifically, the project aims to:

- Promote adoption of more resource-efficient processes and services among MSMEs, including an actual reduction of food waste.
- Develop a Food Waste Policy Proposal to increase awareness on Sustainable Consumption and Production (SCP) and distill knowledge for wider replication, enhance policy dialogues, and support strengthening policies related to curbing food waste.

- Support sustainable consumption and consumer awareness on SCP by training MSMEs to use a Behaviour-Centred Design (BCD) approach to food waste reduction, and widely disseminating information to businesses and consumers.

Targeted MSMEs in China's hospitality and food services sector will be empowered to implement solutions to reduce and better manage food waste, and momentum will be created for replication in the wider sector. By 2024, at least:

- 350 MSMEs staff will be trained on food waste prevention, reduction and diversion practices.
- 100 MSMEs will be applying Sustainable Consumption and Production Practices.
- 50 MSMEs in the hospitality and food services sector will have reduced their food waste by 10% and above.
- Industry associations in the wider hospitality and food services sector will endorse the MSME Food Waste Practical Guide, recommending its use to their members, and inspiring wider replication [3].

Table 2. Number of actions reported for each stage of the food supply chain and action sub-type in Asia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				2	2
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation	1				
	Innovation of products - packaging					
	Training & guidelines	1	1	1	1	1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE	1	1	1	1	1
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					



### 3.3 Africa

Across Africa, an estimated 100 million people faced catastrophic levels of food insecurity in 2020; the latest data show that 40.2 million people in Central and Southern Africa, 32.9 million in East Africa, and 24.8 million in West and Sahel Africa faced food crisis and starvation. This is due to conflicts, successive crop failures (as a result of climate change and extreme weather events), pre-existing and COVID-19 related economic shocks, and soaring food prices.[4]

In a continent where so many people are starving, and many more, particularly children and women, are undernourished, it is unconscionable to lose and waste food at this scale. Yet, it has been reported that significant volumes of food are lost after harvest in sub-Saharan Africa each year — estimated at \$4 billion worth for grains alone. This exceeds the value of the total food aid received in sub-Saharan Africa over the past decade and equates to the annual value of cereal imports. Thus, reducing food loss and waste could be one of the leading strategies for Africa for achieving a sustainable food future. [4]

As of specific food waste programs, FLAWLESS (Halving Food Loss And Waste by Leveraging Economic Systems) is a network of global Voluntary Food Agreements set up to halve food loss and waste by leveraging economic systems. This project aims to set the world on the trajectory to halving food loss and waste by accelerating commercially viable models and transforming the economics of food system partnerships around the world, addressing the barriers with viable solutions. [5]

Within South Africa collaborative working groups have been established on key topics to address food loss and waste with the supply chain – food waste measurement, food donation and policy, standards and regulation. Signatories to measure and report food waste have been enabled to allow a forthcoming baseline for the voluntary agreement to be set. [5]

Smaller initiatives regarding food and agricultural loss in Africa have also been reported. [6]

More specifically, FANRPAN project aims to increase food security of smallholder farmers in SSA through reduced post-harvest losses at farm and community level by increasing food self-sufficiency and incomes of smallholder men and women. The three main outcomes of the project are to improve the handling and storage options within the grains and pulses value chains; compile good practice options for reducing postharvest losses for scaling up; and to introduce regulatory frameworks on reducing post-harvest losses in food supply chains at national and regional levels. [6]

21 June 2018, Rome - Food that 'disappears' from the food chain after harvest owing to spoilage could feed an estimated 48 million people in Sub-Saharan Africa. A project by the UN Food and Agriculture Organization (FAO), the African Union and The Rockefeller Foundation

aims to help countries drastically reduce these post-harvest losses by 2030 through strengthening policies and strategies.

"Our work with The Rockefeller Foundation and the African Union to make food supply chains more efficient will benefit the livelihoods of family farmers in Africa and mean less pressure on the environment, which both contribute to our vision of a Zero Hunger world," said FAO Director-General Jose Graziano da Silva. [7]

Table 3. Number of actions reported for each stage of the food supply chain and action sub-type in Africa

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement	1	1	1	1	1
	Regulatory framework/policy	1	1	1	1	1
	National FW prevention program					
	Fiscal incentives					

### 3.4 Australia

Every year, 7.6 million tons of food are lost or wasted in Australia. Although 70% of this food is still perfectly edible, one out of six Australian adults haven't had enough to eat in the last year. On top of this, 1.2 million children have gone hungry during the same period [6].

According to the National Food Waste Strategy Feasibility Study produced by Food Innovation Australia Limited, food waste is a major problem in Australia. More precisely, the report mentions that:

- Food waste costs the economy around \$36.6 billion each year.
- Each year around 7.6 million tons of food are wasted across the supply and consumption chain – this wastage equals about 312kg per person, equivalent to around one in five bags of groceries or \$2,000 to \$2,500 per household per year.
- Food waste accounts for approximately 3% of Australia's annual greenhouse gas emissions.
- Australia uses around 2600 gigalitres of water to grow food that is wasted – this equates to the volume of water in five Sydney Harbours.
- The amount of land used to grow wasted food covers in excess of 25 million hectares, a landmass larger than the state of Victoria.

Based on the above outcomes, the Australian Government has set a goal to halve its food waste by 2030, aligning with the UN's Sustainable Development Goal 12.3. [8]

Actions to be undertaken to reduce food waste are laid out in the National Food Waste Strategy, Roadmap and the National Waste Policy Action Plan of the country. Some of these actions include, but are not limited to:

- Establishing "Stop Food Waste Australia" to support the National Food Waste Strategy. A \$4 million investment to establish Stop Food Waste Australia aims to implement the Australian Food Pact, sector action plans, and other initiatives to reduce food waste across the supply chain.
- Developing the Australian Food Pact voluntary agreement for industry. The Australian Food Pact shall bring together organisations from all parts of the food chain to identify solutions to reduce food waste and increase productivity.
- Diverting more food to the food rescue sector. Redistributing food that would otherwise be wasted shall help feed more than one out of five Australians who do not have enough access to food.
- Support for education campaigns. Increasing public awareness about the scale of the food waste problem and its negative impacts, particularly in households.
- Research and technological improvements. Investment in agricultural efficiency and innovation, waste treatment infrastructure, and ways to create value from food waste aimed to reduce the amount of food waste ending up in landfill.

Table 4. Number of actions reported for each stage of the food supply chain and action sub-type in Australia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	1	1	1	1	1
	Gleaning					
	Digital tools R					
Food valorization	Value added processing	1				
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					1
	Digital tool BC					
	School programs					1
	Awards					
Supply chain efficiency (SCE)	Process innovation	2	1	1	1	1
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
Digital tools SCE						
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program	1	1	1	1	1
	Fiscal incentives					

### 3.5 Cross-continental initiatives

Apart from the general strategy of every continent aimed to target and mitigate its main problems concerning foodwaste and agrowaste, there are also a few initiatives that include more than one continents. These transcontinental initiatives were launched with the aim of simultaneously targeting... To the best of our knowledge, these initiatives are as follow:

**“Too good to go”** (2015 – ongoing) is a world leader application putting in contact consumers with restaurants and retailers that sell their surplus food for very low prices before closure. At this moment 25,000 food retailers and over 10,000,000 registered consumers saved food from being wasted in over 1 countries, Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Netherlands, United Kingdom and United States The success factor that was identified, was the fast escalation of the market place combined with a good commitment between partners and clients.

1. **“Toast Ale”** (UK, USA, South Africa, Brazil, Iceland) (2016 – ongoing) is a certified social enterprise, which produces beer made with surplus fresh bread collected from bakeries and sandwich manufacturers. All profits go to charities campaigning to reduce food waste. Key to their success is demonstrating their positive environmental and social impact. Specifics about charitable donations, emissions savings, and utilized surplus fresh bread are publicized on their website and detailed in impact reports. The more beer they produce and sell, the more surplus fresh bread that can be diverted from landfills and the more profit that can be donated to charities to end food waste. The 39 tons of surplus bread diverted from landfill are equal to one million slices, 1.5 times the height of Mount Everest. The barley needed to produce the same amount of beer without using surplus bread would have required 7 football pitches of land to grow.
2. Several initiatives have also been promoted by Nestlé. Firstly, **“Nestlé food donation activities in Europe”** is a collaboration with food banks to distribute in-date, quality surplus food to vulnerable people. The **“Every Crumb Counts challenge”** was put in place to raise the awareness on the issue of food waste and to assess food waste behavior amongst Nestlé employees from 6 Research and Development (R&D) sites. Based on its results, Nestlé would be able to prioritize actions aiming to reduce consumers’ food waste. By the program **“Measuring and reporting food waste and by-products”**, Nestlé aims to measure the food waste and by-products generated at the manufacturing sites and to report these quantities in Nestlé’s annual report.

## 4 Review of existing programs at EU level

### 4.1 Austria

Austria's waste prevention program focuses on planned measures that aim to prevent waste and related environmental burdens. Already implemented measures have been recorded and analyzed in a specific evaluation report [7], with the following main axes:

- Pilot projects optimizing the food waste mitigation potential.
- Collection of best practice examples and their dissemination via the internet.
- Studies on the potential of preventing food waste during production and processing.
- Surveys on the potential avoidable food waste in the processing industry.
- Gathering information on avoidable food waste in the commercial and household sectors.
- Awareness-raising activities to prevent food waste (e.g., the food initiative 'Food items are precious').
- Preparation of a quality standard for welfare organizations that pass on foodstuffs.
- Promotion of the Austrian ecolabel in group catering, trade and accommodation services.
- Measures to prevent food waste in the context of public procurement.
- National and regional awareness campaigns targeting households on the topic of preventing food waste.
- Information campaigns related to food expiry dates (e.g., best before date vs use by date).
- Prevention of food waste during production, processing, in trade and consumption away from home.
- Process innovation, training & guidelines, digital tools for supply chain efficiency, surplus food redistribution.

Apart from the national policy of the country, independent actions have also been implemented in the last decade, with a significant impact. Some of these independent actions include, but are not limited to:

The '**Lebensmittel sind kostbar!**' (**Food is precious!**) program which was launched by the Federal Ministry for Sustainability and Tourism, in cooperation with food producers, trading companies, state representatives, social institutions and all Austrian social partners in 2013 was evaluated and updated. The purpose of the update was to set out the new roadmap to meet international targets, taking into account the achievements of the Waste Prevention Program (WPP) 2017. According to the action program 'Food is precious!', 157,000 tons per year of avoidable food waste are generated in Austrian households, around 175,000 tons through to-go services and catering, 121,800 tons in the food production sector, and about 74,000 tons in the retail sector [9].

The initiative '**United against Waste**', launched in 2014, was a broad network of partners from business, federal, state and NGOs, and science. It aimed to promote

Careful handling of food in restaurants, hotels and catering. The initiative has provided comprehensive information and services for businesses and, as part of these measures, has developed methods for reducing food waste more effectively in everyday life in the kitchen [10]. Over the years, **'United Against Waste'** has developed numerous solutions that help kitchens from care institutes in the fight against food waste. The food ordering process proved to be a key factor in this – a complex system in which patients/residents, nursing staff, dietetics, kitchen and IT systems interact. More precisely, 821 employees, mainly from the care sector, were surveyed and evaluated possible solutions for ordering processes and avoiding food waste.

1. **'United Against Waste'** recommends that patients or residents should be allowed to be part of the ordering process. In particular, almost six out of ten employees (57%) think that it makes sense to have a free choice, as long as their state of health allows it. Patients/residents should be able to individually order or cancel soup, dessert or side salad and to adjust their portion sizes. Otherwise, food waste is inevitable if, for example, children are given a standard portion size. Currently, at the end of the day, there is often too much food on the wards, which is ultimately thrown away. The solution, according to this program, is to keep reserved food available in the kitchen and only deliver it when it is actually needed, or at least deactivate automatic orders and repeatedly select them manually in the IT system. In 2018, the (BMK) launched the school competition **'Abfallvermeidung macht Schule'** (Waste Avoidance in Schools). Students were encouraged to design projects and evolve ideas regarding waste prevention and resource conservation, including food waste. The initiative was open to all schools in Austria and the competition was continued in 2020.

All the initiatives and programs reported are categorized in a more uniform way in the following table. Thus, Table 6 presents, for each action sub-type, the total number of actions reported for each stage of the supply chain.



Table 6 . Number of actions reported for each stage of the food supply chain and action sub-type in Austria

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC				1	
	School programs					1
	Awards					
Supply chain efficiency (SCE)	Innovation of products - date marking					
	Process innovation				1	
	Innovation of products - packaging					
	Training & guidelines				1	
	Price discount					
	Imperfect produce sale					
	Certification					
Food waste prevention governance	Public procurement					
	Digital tools SCE					
	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program		1			
	Fiscal incentives					

## 4.2 Belgium

The new National strategy on Waste Prevention Program (NWPP) of Belgium was adopted on the 22th of November 2018, with a five-year duration. The main priority of this strategy was the development of local food production (in Brussels and its periphery) in an ecological and innovative approach, to reach 30% of self-sufficiency in fruits and vegetables by 2035. Following that, raising awareness and involvement of citizens from an early age, reducing food waste by 30 % by 2020, and taking into account the social and multicultural specificities of the capital in the development of actions were also identified as key factors in reaching Belgium's NWPP goals. Within the NWPP, different targets were set in the suburbs of Belgium based on the needs of each area. Flanders' (the Dutch-speaking northern portion of Belgium and one of the communities, regions and language areas of Belgium) goals are mentioned below:

- Establish a consultation platform at a local level, where various stakeholders can get to know each other and work together.
- Organize round-table discussions at Flemish and local levels to find good practice examples.
- Create a practical guide for local authorities about good practices and existing measures.

Through the implementation of this program, the Flanders Region focuses more on waste prevention, reuse and material recycling. Therefore, the main objective was to reduce incineration and landfilling of household and industrial waste as much as possible. The prevention and reuse of waste were priority fields in the region's waste management. In Wallonia (one of the three regions of Belgium—along with Flanders and Brussels) quantitative targets for food waste have been proposed for 2025, among others:

- Reduce food waste in households by 33 % by 2025, compared with 2013.

Define and measure the amount of food waste and establish monitoring indicators. During the European Week for Waste Reduction (EWWR) in 2021, several initiatives took place and are presented below as follows:

- **'Online exchange of regional good practices'**. The Delegation of the region of Navarra in EU (Brussels) organized this online exchange of good practices between regions on the topic of food waste [12].
- **'Zero waste tips & tricks for traders and catering businesses' / 'Conseils zéro déchet pour les commerces et horeca'**. Wide distribution during the EWWR of 2 videos on the subject Zero Waste: one for traders and one for catering businesses. Active broadcast during the Selective Estrogen Receptor Degrader (SERD) of 2 videos on the subject of zero waste: one for merchants and one for catering establishments [13].
- **'Zero Waste Influencer Campaign'** aimed to provide greater visibility on the inspiring practices of cities and towns registered in a zero waste approach, to approach the subject of zero waste in a different way, to approach a different audience from that which can be reached via traditional communication channels,

and then also to make people want to find out about local initiatives, to be inspired by them and to carry out experiments individually or in groups.

- The **‘Service Public of Wallonie (SPW)’** Environment launched an influence campaign, in partnership with 5 Walloon influencers. Each influencer went to meet an eco-advisor from their province, in order to learn about the zero waste actions offered to residents, families in nurseries, pupils in schools, students, traders; to participate in the zero waste tour with local merchants or at the Un pas Vert Demain fair organized in Hainaut; to learn information on waste reduction practices introduced in nurseries of Liège, or on the implementation of composting schemes in the province of Luxembourg; and to disseminate his/her experiences in stories on social networks for his/her community. The five municipalities taking part in this campaign were Mouscron (Province of Hainaut); Namur (Province of Namur); Rixensart (Province of Walloon Brabant); Liège (Province of Liège); and Marche-en-Famenne (Province of Luxembourg), and the five influencers to follow during European EWWR were: Melissa.nmrk, Kitten Family, Celine\_Idoitmyself, Amandine\_Belgica, Curvybluemarine [14].

**‘Accounting food losses in the Flemish food industry’** is a project that was led by Fevia Vlaanderen, the Flemish food industry professional organization, in 2012. It aimed to improve the knowledge on quantities and causes of food losses in the food industry by performing audits and questionnaires and identifying possible solutions to reduce such losses. The main challenge was to convince companies to participate in the audits, even though it was free for them. A way to overcome this was to use different channels and address the topic as "material efficiency" instead of "food loss". The findings of this work were presented in a brochure, providing tips and practical steps to achieve a food waste reduction, which was distributed among the food companies involved and published online. The research showed that 2/3 of all farmers are not able to sell part of their products in the intended sales channel, since the required cosmetic quality standards are not met. On average, a sales loss of about 10% is indicated. More than half of all misshapen fruits and vegetables, accounting for just under 120,000 tons of the major crops, disappear from the human food chain, which causes food losses [15]. Another initiative reported in Flanders was the **‘Food supply chain roadmap on food loss’**. The Government of Flanders and the food supply chain sectors worked together in the Flemish Food Supply Chain Platform for Food Loss, a dynamic platform for coordinated actions on the prevention of food losses. In 2014, both parties signed the declaration of commitment **‘Together against food losses’**. Their vision was based on three principles: 1) shared responsibility, 2) prevention as a starting point and the food waste hierarchy as guiding principle, and 3) collaboration and consultation. The partners committed to producing a Food Supply Chain Roadmap 2020, to deliver concrete actions. The roadmap was launched in 2015. The 2020 Report details key achievements in the food and drink sector. Since 2019, 57 new food businesses have signed the commitment with 19 other supporting organizations from the waste management sector. In addition, 171 businesses had provided

evidence that the program was implemented, around 80% of those committed to the Roadmap with the combined turnover of over £200bn, representing 50% of the overall turnover for UK food manufacture, retail and hospitality and food service. Additionally, 45 businesses publicly reported 17% reduction in food waste and more than 180,000 tons of food saved (around £300 million) [16].

**'Food donations'** by Colryut is another initiative where a retailer donates surplus food to charitable organizations.

**'No food waste campaign'** is a checklist and training program, run by Horeca Vlaanderen organization, providing tips to reduce food waste distributed amongst all the members of Horeca Vlaanderen (trade association for the hospitality industry in the Flanders region).

Table 7. Number of actions reported for each stage of the food supply chain and action sub-type in Belgium

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R			1	1	
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	1
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines	1	1		1	
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement	1	1	1		
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

### 4.3 Albania

The first Albanian Waste Prevention Plan (WPP) was implemented in 2010. However, municipal waste generation per capita increased significantly between 2013 and 2018. This trend shows that economic growth in Albania affected the rise in the amount of Municipal Solid Waste (MSW) generated.

As of specific initiatives, the **LESS-WASTE-II project** (2014-2020) involved the development of an action plan for the management of bio-waste in the cross-border region of Albania and Greece. The Ministry of Environment, in cooperation with the Japanese International Cooperation Agency, has begun a project of waste management with the promotion of reuse, reduction and recycling in some municipalities, including but not limited to: Tirana municipality, Himara, Peqin, Cërrik municipality, and Vau Dej municipality. The project's direct results relate directly to the program's overall result indicator on "Population served by improved waste management" and are summarized as follows:

- **Environmental Results:** Better management of bio-waste with actions that target directly about 18% of the residents, but benefit the whole population of the combined area of Florina (3 municipalities, 51,831 residents) and Resen (1 municipality, 16,825 residents), specifically catering to the characteristics of rural, semi-rural and urban residents accordingly (more than 100 settlements, mostly rural and semi-rural).  
**Result Indicators:** Less waste going to landfilling; a 20% increase in compost production and better quality at both rural communities and at household and neighborhood level in semi-rural and urban communities.
- **Capacity Building Results:** a) Residents of the 4 municipalities located at the western end of the region have better access to information relating to the bio-waste. b) Local public officials have the opportunity of training for better management of bio-waste.  
**Results Indicators:** Demonstrations of using equipment for the management of bio-waste for rural residents; open calls for home-composting bins to all residents; trainings for related municipal and other stakeholders.
- **Socio-economic Results:** A unit in place for food waste prevention in collaboration with 33 restaurants provided food for at least 36 households living in extreme poverty and assisted to provide food in further 80 households that are at-risk-of-poverty level.  
**Result Indicator:** 116 households benefited from better management of food waste.

'**Food Bank Albania**', founded in 2015, is a non-profit organization dedicated to the fight against food waste in Albania. It's the first national initiative to address this issue, as it raises awareness of food waste throughout Albanian society. The organization combines the goal of reducing food waste with that of eradicating poverty, based on the assumption that these two issues are strongly linked, i.e. the distribution of food surpluses (instead of wasting them) contributes to improving the living conditions and food security of low-income households in

Albania. To address food surpluses, the Food Bank works with businesses (e.g., supermarkets, farmers), the Albanian Red Cross, institutions and individuals to collect food donations and raise awareness about food waste. The collected food is provided to over 40 nongovernmental organizations, 10 social soup kitchens and the state social services involved in the fight against poverty. It also provides information to Albanian households to support them in reducing food waste, saving money and protecting the environment.

Table 8. Number of actions reported for each stage of the food supply chain and action sub-type in Albania

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	1	1	2		
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	1
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives	1	1	2		



#### 4.4 Bosnia

In Bosnia, the UN Development Programme (UNDP) UNDP Accelerator Lab in Bosnia and Herzegovina (BiH), and the city of Sarajevo announced a call for proposals in November 2019, using the city's Consul platform and invited all interested individuals and teams to nominate ideas for practical, applicable and innovative solutions that could address food waste problems. The winners of the challenge were the following:

- **Tanjir više** — a mobile app that connects caterers and households with food donation recipients, and educates households to reduce the amount of food thrown away.
- **FudVej (FoodWay)** — a conceptual set of activities aimed at achieving zero food waste in Sarajevo.
- **7 Days** — a food management system that puts food items close to their expiry dates out for sale at a cheaper price, by setting up dedicated sales departments in supermarkets and connecting such sales points to an online platform (UNDP Bosnia and Herzegovina, 2020).

The '**Action for food waste reduction in Canton Sarajevo: One plate more**' is another action implemented in Bosnia. According to research performed by the University of Sarajevo in 2014, 2,000 to 3,000 tons of food waste is produced in restaurants, hotels and catering services in Canton Sarajevo. The total amount of food waste is disposed of at the landfill Smiljevići. One of the strategic goals of the waste management plan for Canton Sarajevo 2015 – 2020, is the reduction of waste for the final disposal using resources more efficiently. In June 2018, an informal group of citizens started the initiative '**One plate more**' with the aim to prevent the surplus food wasting and to donate the food to people in need. Through a network of partners the amount of food donated to the people in need shall increase. The main outcomes of this initiative were:

- The coordinators invited a diverse group of participants to join a collective brainstorming session and map the root causes and triggers for the food waste problem in BiH.
- The priority issues identified from the discussion, served as food for thought in designing the innovation challenge.
- In collaboration with the City of Sarajevo, the interested parties announced a 1-month innovation challenge on their Consul platform, inviting people to share ideas that can offer a practical, scalable and innovative answer on how people may disrupt food waste routines.

Table 9. Number of actions reported for each stage of the food supply chain and action sub-type in Bosnia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	1
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation				1	1
	Innovation of products - packaging				1	
	Training & guidelines					
	Price discount				1	
	Imperfect produce sale				1	
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

## 4.5 Bulgaria

The NWPP for the period 2021-2028 is the second program for waste prevention of the country. Given the high priority of food waste prevention at the global level and the requirements of Directive (EU) 2018/851 of 30 May 2018 amending WFD 2008/98/EC, a separate sub-program for the prevention of food waste was prepared, following the steps for development and the philosophy of the current waste prevention program. As a result, the food waste management targets are the following:

- Develop and disseminate a guide for preventing the generation of household food waste.
- Develop a municipal waste management program, including goals and measures for food waste prevention, and their implementation into practice.
- Apply a procedure for financing and implementing projects focused on technologies/product design that leads to the reduction and prevention of food waste generation in the food industry.
- Implement continuous targeted campaigns to clarify and provide information on food waste at central and municipal levels, including the importance of distinguishing between the 'best before date' and 'date of expiry' of commercial food products (at least four 6-month campaigns to be conducted at national level and 50 campaigns at municipal level).
- Implement demonstration projects for food waste prevention.
- Voluntary agreements between the Ministry of Agriculture and Food, and branch organizations, in the field of food production and processing, and between the Ministry of Tourism and branch organizations in the field of restaurants and tourism, for cooperating on reducing food waste and implementing the related measures.
- Eliminate the requirement for labelling food from commercial establishments/public catering establishments, if they wish to donate food before the expiry date (amendment of the regulations).
- Support for the activities of institutions that organize and carry out food donation before the expiry date (based on the 'Food and basic material support program 2021-2027', a grant agreement with organizations in the field of donating food before the expiry date, including an extensive information campaign).
- Increasing food donation opportunities by overcoming barriers to food donation through Value Added Tax (VAT) enforcement mechanisms.

The '**Bulgarian Food Bank**' was established in 2012. It is currently the leading national organization in the country specializing in the collection, storage and distribution of donated food products with a short shelf life, in accordance with all food safety standards. With the help of a network of partner organizations and volunteers across the country, food is distributed to thousands of people in need.

In line with global goals and EU food waste policies, the Ministry of Agriculture, Food and Forestry has begun developing a comprehensive national program to prevent and reduce food loss, which will include measures targeting food loss and generation of waste from the farm to the table. [17]

Table 10. Number of actions reported for each stage of the food supply chain and action sub-type in Bulgaria

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning	1				
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement				1	
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

## 4.6 Croatia

According to the data provided by the Ministry of Environment and Energy, it is estimated that approximately 400.000 tons of food waste are disposed of annually at landfills in Croatia [15]. Croatia, together with other EU Member States, has committed to achieving the goal set out in the UN 2030 agenda for sustainable development with the relevant sustainable development goals. It aims to ensure sustainable consumption and production patterns, with the specific aim to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains. For this reason, the Government of the Republic of Croatia adopted a food waste prevention and reduction plan (2019-2022) in 2019. The Ministry of Economy and Sustainable Development (MoESD), as the national competent authority for waste management, is responsible for monitoring and measuring food waste, and the Ministry of Agriculture is the competent authority for food waste reduction and prevention.

The food waste reduction and prevention plan contains six main measures and related activities that apply to the entire food value chain, which were designed in cooperation with relevant actors. The planned activities, some of which have already been implemented, include:

- drafting of sectoral guidelines for food waste reduction,
- the promotion of short supply chains,
- the launch of a platform to share experiences and best practices,
- the establishment of voluntary agreements with stakeholders to reduce food waste,
- the definition of criteria for the most successful food waste fighters and the organization of an award ceremony,
- a campaign to raise awareness of the issue,
- the development of educational material for pre-school and school-age children,
- providing financial support to innovative and research projects in the field of food waste, and
- activities related to monitoring food waste levels.

The Republic of Croatia firstly wanted to establish a food donation/redistribution system to emphasize under which conditions food can be donated, which organizations can redistribute food, and who are the final recipients (people in need) who can receive donated food. To this end, the **'Ordinance on conditions, criteria and modalities of donating food and feed'** was adopted. Based on this, the food that can be donated is: a) any type of food under the condition that it is safe for consumption; b) food which is not suitable for the market due to errors in packaging, labelling, weighing or for other similar reasons; c) food that is close to the expiry date; d) food produced/prepared in mass caterer - excluding food that has already been served to customers. After prescribing which food can be donated, in order to encourage food donation, tax incentives were added to the legislative package. The Ministry of Agriculture together with the Ministry of Finance arranged fiscal incentives that were incorporated in the 'Ordinance on Value Added Tax'. Fiscal incentives refer to donation of

above-mentioned food. According to this Ordinance, VAT is not imposed when food is being donated to the registered charity organizations, within the limit of 2% of the donor's income.

**'Legislative change regarding the possibility of donating and consuming food after the expiration of "best before date"'** by the Ministry of Agriculture and Ministry of Finance Short is another program implemented in Croatia. The aim of this measure is to clearly define that food after its "best before date" is still suitable for consumption for a certain time, in order to raise awareness, especially among consumers, that consumption of such food is possible and safe.

Furthermore, the Ministry of Agriculture launched an **IT system** to facilitate food redistribution, with the aim of improving communication between donors and charities. Moreover, a food bank feasibility study was conducted. In line with the food waste reduction and prevention plan, the Ministry of Agriculture has published sectoral guidelines for retail and for hospitality and institutional kitchens. The next step, according to the ..., is the publication of guidelines for the primary production and food processing sectors.

An effort to raise consumers' awareness on the issue of food waste included: a video explaining the difference between date markings, a brochure 'Understanding food information and consumer attitudes about food waste', a short animated film to encourage consumers to use surplus food, a consumer campaign (2020) under the slogan 'Eat and share! #Food is not waste!', etc. Tips for reducing food waste are usually published before holiday seasons, on the Ministry of Agriculture website to increase efficiency.

The MoESD has also developed and maintains a **waste prevention portal**, which contains general information related to waste prevention and prescribed waste prevention measures. This portal provides basic information on ways to prevent bio-waste and reduce food waste, as well as examples of food waste prevention activities conducted by local self-governing entities and companies. **A new web page** dedicated to food waste prevention is being planned by the end of 2022. The project is led by the Ministry of Agriculture, in the framework of Croatia's national recovery and resilience plan.

University of Zagreb launched the **'Nutritional and technological utilization of old bread' project**, the aim of which was to develop a new process to treat unsold bread and use it as a component of animal feed for broilers.

**Hrana i zajednica - "Food and Community"** aimed to implement lifelong learning programs on food donation and food prevention at the University of Rijeka.

The **'Food waste cookbook and TV show'**, developed by the University of Applied Science Velika Gorica, aimed to raise the awareness campaign by providing educational material on the issue of food waste, and giving tips on how to prepare new meals from leftovers.

Another initiative implemented in Croatia by the University of Applied Science Velika Gorica, was an **awareness campaign** providing educational material on the issue of food waste to school pupils, by developing a cartoon book for kids between 4 and 15 years old (**Cartoon book and puppet show: Harry the hedgehogs and his friends** Organization).



Table 1 1. Number of actions reported for each stage of the food supply chain and action sub-type in Croatia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	1	1	1		
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed				1	1
Behavior change (BC)	Awareness/educational campaign				1	5
	Digital tool BC				1	2
	School programs					3
	Awards					1
	Innovation of products - date marking					1
Supply chain efficiency (SCE)	Process innovation				1	
	Innovation of products - packaging					
	Training & guidelines				1	1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					1
	Regulatory framework/policy	1	1	1		
	National FW prevention program					
	Fiscal incentives				1	

#### 4.7 Czech Republic

Some of the **measures set out in Czech's current WPP**, effective from 2014, were dedicated to decreasing the amount of food waste generated, and aimed to provide technical support for the dissemination of information and awareness-raising programs focused on reducing the amount of food waste produced; acquire and improve primary data and monitor the effectiveness of the preventive measures, based on developing a methodology for performing qualitative and quantitative evaluations of the food waste streams and also on preparing an expert study of these waste streams and provide an analysis of waste prevention in the food sector, including catering.

In 2018, an **amendment to the Czech Food Act** came into force, requiring all supermarkets over 400 square meters to donate unsold but still consumable food to charities. Based on this regulation, Czech retailers donate food with deformed packaging, incorrect labelling or expired 'best before' dates, which do not pose a threat to human health.

**Food banks** are an important and well-functioning measure contributing to reducing food waste and improving the use of food that would otherwise be wasted [18]. They are grouped into the Czech Food Bank Federation, a member organization of the European Food Bank Federation. The food banks collect food free of charge, store and allocate it to humanitarian or charity organizations, which in turn distribute the food to people in need. Currently, there are 15 food banks sourcing food mainly from farm producers, food manufacturers, food chains, retailers or food collections and they have over one thousand recipient organizations.

The '**Czech Food Law**' by the National government is an active program which started in 2018. According to it, all retail outlets with a sale surface of more than 400 square meters are from the 1st of January 2018, obliged to donate food that does not fully comply with the requirements of this law or the EU regulations, but is safe, to the local food banks, charities and non-profit organizations.

Table 12 . Number of actions reported for each stage of the food supply chain and action sub-type in the Czech Republic

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy			1	1	
	National FW prevention program					
	Fiscal incentives					

## 4.8 Denmark

The Waste Prevention Strategy of Denmark (**Denmark without Waste II - A Waste prevention strategy**) aims to reduce wastage of resources and to prevent valuable resources from becoming waste in households and businesses, by using a wide range of approaches: i) training programs for public and private food services, ii) an assessment of waste generated in fisheries and aquaculture sector, iii) the development of a protocol for measuring and reporting food waste, iv) the improvement of the regulation on shelf life labelling, development of awareness campaigns, etc. The avoidable food waste generated by households shall be monitored to track progress.

In Denmark, **'ONE\THIRD'** is a think tank operating as an independent organization under the Danish Ministry of Environment and Food. Its' five focus areas are:

- supporting civil society's battle against food loss and food waste;
- contributing to general business opportunities relating to food waste prevention;
- offering insights on how to overcome barriers to preventing food waste and food loss;
- improving data collection and impact assessment;
- international cooperation on know-how and sharing of experiences.

The **REFOOD label** is a scheme for companies and organizations in the food and service sector aimed at minimizing and recycling food waste. Members are required to choose three food waste reduction initiatives and to have a scheme for recycling food waste. In 2021, 1,320 organizations held the REFOOD certificate.

The NGO **Stop Spild Af Mad (Stop Wasting Food)**, Denmark's largest movement against food waste, organised the first 'National Day of Food Waste' on 29th of September, to raise awareness on the issue. The NGO has launched a food bank called Gratis Mad (Free Food).

**Eat GRIM (Eat Ugly)** delivers food boxes of organic and 'ugly' fruit and vegetables that do not fit supermarket's 'beauty' standards, nor the EU's quality standards. By buying whatever farmers cannot sell, they have saved around 572 tons of food and created over USD 1 billion (EUR 0.87 billion) income for farmers.

**Food Sharing Copenhagen** is a volunteer-based organization that distributes unsold food in Copenhagen. In 2019, its collective efforts helped save over 13,000 tons of food waste and feed over 16,000 people. Every week, volunteers collect surplus food from businesses, including bread and dry goods, that would have been thrown out and share it with hundreds of people.

European Week for waste reduction created the **School conference – No Space for Waste**, an interactive conference for schools teaching children about ways of reducing their waste and about their outlook for the future.

The annual **CHRISTMAS SURPLUS** national initiative was founded by the Stop Wasting Food movement. Every year, on the 23rd of December, surplus Christmas food is collected by more than 900 volunteers from Stop Wasting Food in collaboration with Danish People’s Aid and other NGOs from more than 300 supermarkets in Denmark and redistributed to food insecure families. This food, traditionally consumed at Christmas, would otherwise go to waste. Therefore, in each of the supermarkets involved, a team of volunteers meets with approximately 10 food insecure families and donates them the surplus food worth 80-90 Euros per family.

The implementation of a monitoring plan within this initiative enables to keep track of: (a) the amount of food donated, (b) the number of food insecure families reached, and (c) the outreach of the initiative (e.g., number of media articles and TV features). The action was 100% effective in terms of reaching 10,000 food insecure families in 2016, 2017 and 2018 and is scheduled for 2022. For four Christmas days (2015-2018), 75 tons of food waste were prevented with zero cost, but with the aid of 900 volunteers per year. Table 13 presents the economic and environmental benefits that derived from this action.

Table 13 . Efficiency of CHRISTMAS SURPLUS, Denmark in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	1 006 550	305 917	623 393
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	14 475	34 512	2 402

This initiative is an example of an easy and tangible way to raise awareness about food waste, save food and feed food insecure families. One success factor of this initiative is the cost-effectiveness, thanks to the support of retailers and volunteers. The only thing that is needed, is 5-6 months of planning ahead. Furthermore, it attracts a lot of positive media attention and thus has good potential for collaborations and sponsors. A lesson learnt from this initiative was that it is important to collaborate with professional NGOs, who have access to approved data of citizens below the poverty line, in collaboration with municipalities and authorities, to ensure that the surplus food is only given to the citizens below the poverty line. The annual "Christmas Surplus" national initiative can be replicated at any other holiday where the

supermarkets are closing for public holidays - and it can be replicated all over the EU and the world.

Moreover, the Danish Veterinary and Food Administration and the Danish Consumer Council conducted in 2014 a **two-month campaign** to increase consumers' knowledge on the different meanings of the two date marks: "**use by**" and "**best before**". The campaign was repeated also in 2015 and 2017 and 2022. Potential reasons for not achieving a larger increase in the awareness of consumers on this topic are: a) that due to a low availability of resources, the information was not spread enough, b) that the media channels used were not effective, or c) that the information was not communicated in an understandable way [19].

The Ministry of Environment and Food also set up the following initiatives:

- **'World Food Summit - Better food for more people'**, a yearly conference on food related topics including food waste.
- **'The food waste hunters'**, a training program to help food services reduce food waste in professional kitchens through the implementation of targeted reduction measures and food waste monitoring before and after their implementation.
- **'Partnership for Less Food Waste'**, a partnership between businesses, organizations and authorities sharing information and experiences, identifying barriers in legislation and developing new ideas to reduce food waste.
- **'The abolition of a national prohibition to sell best before products past their durability'**. Abolition of the national legislation preventing food business operators from selling food after its "best before" date.
- **'From food waste to food resources'** is a Toolbox to support commercial kitchens to measure food waste levels and implement reduction measures, developed by HORESTA (trade association for the hospitality industry in Denmark).

Table 1 4. Number of actions reported for each stage of the food supply chain and action sub-type in Denmark

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	1
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				2	5
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking				2	
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines				2	2
	Price discount					
	Imperfect produce sale					
	Certification				1	
	Public procurement				2	
	Digital tools SCE				2	
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy				1	
	National FW prevention program					
	Fiscal incentives					

#### 4.9 Estonia

**Estonia's food waste prevention plan** was published in February 2021 after consultation with a wide group of stakeholders. The plan is directly related to the national waste management plan 2014-2020, extended until the end of 2022. The food waste prevention plan was integrated into the new waste management plan and the WPP. It is about encouraging food donation and other redistribution for human consumption, prioritizing human use over animal feed and reprocessing into non-food products.

The main objectives of the WPP are to reduce the generation of food waste in primary production, in processing and manufacturing, in retail and other distribution of food, in restaurants and food services, as well as in households, as a contribution to the UN Sustainable Development Goal.



Table 15 . Number of actions reported for each stage of the food supply chain and action sub-type in Estonia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	1
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

#### 4.10 Finland

At the beginning of 2021 the **'Finnish food waste roadmap', a plan for reducing food waste in Finland** (20), was published . The food waste roadmap forms part of the national waste management plan. The WPP encouraged the idea of unsold food in retail shops to be directed primarily in organizations that distribute food aid for human consumption. The food aid guide by Finnish Food Safety has clarified the practices and made it easier to direct food to charities. Many stores have agreed to work with charities by providing unsold food to those in need. By now, the retail sector has hundreds of partners in food distribution. The Natural Resources Institute of Finland and the Ministry of Agriculture and Forestry are responsible for promoting and monitoring the food waste roadmap. In Vantaa city, the centralized distribution of food for waste has been developed in cooperation with the city, the parish association, shops and industry. Food is collected daily from nearby shops and taken to a collection point, where products can be quickly distributed to organizations. This saves resources for small organizations, which often rely on volunteers, and avoids unnecessary driving.

Moreover, various education and awareness-raising campaigns, for instance through the Saa syödä!! (May eat!) website [20], have been developed in partnership with public institutes, which contain versatile information and guidance to reduce food waste and are intended to reach consumers, schools, etc.

**'Reducing food waste in restaurants'** by the MaRa - Finnish Hospital Restaurant Association is another interesting initiative. Brochures distributed amongst the members of the Finnish Hospital Restaurant Association MaRa, aim to raise awareness on the importance of preventing food waste in restaurants and to give them practical tips and examples.

Table 16 . Number of actions reported for each stage of the food supply chain and action sub-type in Finland

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	1	1	1	1	1
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	1
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines				1	1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE			1		
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program			1		
	Fiscal incentives					

#### 4.11 France

France's specific **food waste prevention measures** aim to act against food waste throughout the food chain and include the following:

- Support operators in the food chain who are obliged to carry out a waste diagnosis and reduction measures;
- Promote food donation and recovery of unsold food;
- Deploy a national anti-waste label;
- Clarify information on the use-by dates of food products by developing the display of the additional statement clarifying the 'date of minimum durability'.

The **anti-waste law for a circular economy**, issued in February 2020, sets the objective to halve food waste by 2025 for the retail and collective catering sectors, and by 2030 for the other sectors (compared with 2015), by bringing together all stakeholders along the food chain. It lists 10 state commitments expressed in 19 measures, and many partners are working alongside the state to meet these measures. Some examples of these measures are listed below:

- Measure 4A: Facilitate donation agreements between distributors and associations by requiring food retailers with a store area of more than 400 square meters to donate surplus food to aid organizations.
- Measure 4B: Ensure a tax reduction of 60 % of the value of donation to the agricultural producer in cases where the donation has passed through a processing and/or packaging intermediary.
- Measure 5A: Maintain the fight against food waste and support its understanding as a priority of the national food program and the national waste prevention program, e.g., promote financial support through direct or national/regional projects.
- Measure 5B: Make information on food waste prevention available to all stakeholders of the food chain by creating a website with the most innovative actions, e.g., websites such as [gaspillagealimentaire.fr](http://gaspillagealimentaire.fr)
- ] provides documents, information on local initiatives and projects on food waste.
- Measure 6A: Promote awareness-raising activities on food waste in schools, secondary education institutions and leisure centers e.g., in 2020 a national 'zero waste' challenge in secondary and high schools was created.
- Measure 7: Strengthen efforts to raise consumer awareness of the fight against food waste through public communication campaigns, documents and tips, e.g., the communication campaign 'Jeter moins c'est manger mieux!' (Throwing away less means eating better!) raises awareness through tales from a childhood in a world without food waste.
- Measure 8B: Work with representatives of the catering industry to encourage the implementation of actions to combat food waste within companies, e.g., since 2021 French restaurants have been obliged to offer take-out bags.

Another program implemented by Banques Alimentaires (association of French food banks) is **Fight against food waste and precariousness** (1984 - ongoing). The French federation of Food Banks coordinates 79 Food Banks. Every day, volunteers collect surplus food from supermarkets and redistribute it to partner associations. In order to provide a varied and balanced diet to the beneficiaries, it is essential to ensure the nutritional quality of the products donated and that the relative share of the different food types follows the national nutritional recommendations. To this end, in the last 5 years, the share of fruit and vegetables donated increased from 18% to 25% of the total donations. From the evaluation of the program in 2017, it can be estimated that 147 million meals were donated, helping 2 million food insecure people. More precisely, 6070 volunteers were involved, and 276 people were employed with a subsidised contract for long-term unemployment/professional reintegration, rendering the cost of action 22 million € and indirect cost of volunteer hours up to 35 million €. Table 16 presents the economic and environmental benefits that derived from this action.

Table 1 7. Efficiency of “Fight against food waste and precariousness”, France in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	232,969,100	297,962,453	606,839,360
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	11,300,469	24,948,721	2,359,622

**De mon assiette à notre planète** (2012-ongoing) is a nonprofit association that organizes educational workshops on food waste reduction in schools, universities, social and medical institutions, as well as businesses. The association trains staff to avoid food waste and better match the needs of guests. It also teaches and promotes taste education as a resource to reduce food waste. In collaboration with **SIGIDURS**, an organization based in Sarcelles (Val d’Oise – France) collecting and treating waste in a number of cities in Val d’Oise and Seine-et-Marne departments, they run a project on the **prevention of food waste in 30 schools**.

**‘Less food waste in restaurants’**, run by ADEME, is a training program intended to help business owners and their employees to reduce food waste in restaurants. It lasted from 2015 to 2018 and covered twenty restaurants in Brittany (France). ADEME also participated in the construction of national and local ecological transition policies. For this, they relied on their teams, present throughout France, and on a budget dedicated to their means of intervention. Their missions, their organization, and their operation were set by the Environmental Code. A supermarket cut its losses and waste by half in one year and saved €300,000/year that way. The 20 households studied by ADEME in 2014 reduced their food losses and waste by half based on relatively simple actions during three weeks and they saved about €60/person/year. A departmental (French administrative division) council managed to reduce by a third food losses and waste within its 96 middle schools. They estimated a reduction in purchases of one million euros every year, which they could re-invest in products of better quality [20,21].

Table 18 . Number of actions reported for each stage of the food supply chain and action sub-type in France

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	2
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines				1	1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy	1	1	1	1	
	National FW prevention program					
	Fiscal incentives	1	1	2	2	

#### 4.12 Germany

The German government undertakes various measures to prevent the generation of food waste. For instance, it provides around 16 million EUR for research programs that investigate resource efficiency, food processing operations and the way consumers throw out food. In March 2020, a voluntary agreement was signed between the Federal Ministry of Food and Agriculture (BMEL) and associations from the food industry, agriculture and the hospitality sector aiming to reduce food waste. The BMEL also organizes the ‘ **Too good for the bin!** ’ **program** (2012-ongoing). It is a consumer awareness campaign on food waste reduction launched in March 2012. Since then, it has been providing targeted information to increase consumers' awareness on the true value of food.

Furthermore, in early 2019, the Federal Cabinet adopted the **national strategy for food waste reduction** [23]. This strategy identifies potential drivers of food waste and pinpoints challenges and spheres of activities to reduce food waste along the entire food supply chain. The strategy presents the reduction of food waste as a task for the whole of society, and stakeholders from civil society, entrepreneurs and scientists are called on to contribute. This is to be achieved through participation in sectoral dialogue forums. Through cooperation between these sectors, specific measures for the reduction of food waste and sector-specific targets are to be established. Representatives of the sectoral dialogue forums will participate in one overarching national dialogue forum to exchange experiences and views across sectors and assess the measures and progress resulting from the dialogue forums.

In early January 2021, the dialogue forums on reducing food waste in primary production and in food processing were launched. An intensive exchange of information and experiences were organised via ‘Round tables’ for the individual product groups. The dialogue forums, in cooperation with the companies, identified specific measures for reducing food waste in primary production, processing and at the interfaces with upstream and downstream sectors; these measures shall then be tested and evaluated in demonstration farms. This will be used as a basis to conclude target agreements for reducing food waste in primary production and processing.

The dialogue forum for wholesalers and retailers was launched in September 2019. The companies came together for working meetings to identify and discuss particularly effective measures to cut food waste. Two public online meetings together with other stakeholders took place in June 2020 and March 2021. Additionally, the dialogue forums on primary production, processing and trade held an overarching digital workshop in autumn 2021. The core focus was on artificial intelligence applications and what they can contribute to food waste reduction at the interfaces between the different sectors.

After three years of work, the dialogue forum adopted a target agreement coordinated by WWF Germany. In the agreement, the undersigned associations declared their willingness to reduce food waste by 30 % by 2025 and by 50 % by 2030. The agreements covered the whole



of the sector, including staff canteens, hotels, hospitals, retirement homes and schools. The aim in the future will be to have as many companies in the away-from-home catering sector take part in the implementation of the target agreement as possible.

Through the European week for waste reduction, the Building/Housing/Energy and ‘ Food and Nutrition’ departments and the ‘ Consumer Strengthening in the Quarter’ project, developed an initiative through which they provide information on the topics of energy saving, avoiding food waste and unwanted letterbox advertising [28].

Furthermore, the Schleswig-Holstein consumer advice center works **on food waste with students from the secondary school**. Around 12 million tons of food end up in the garbage in Germany every year. Households account for a large proportion of these waste volumes. With this lecture they give an introduction to the topic of food waste and show what everyone can do about it. This includes tips on hygiene as well as storage and handling of food in the household and the correct handling of best-before and use-by dates [29].

Additionally, the famous vegan brunch takes place one month every year as ‘ **Low Waste Brunch**’ . For this, as little packaging waste as possible is produced and food waste is avoided by saving food through food sharing and similar initiatives [30].

‘**Eating in Hesse**’ (2017 – ongoing) is a pilot project aiming at increasing the sustainability of the catering service, and at the same time reducing food waste in canteens (focusing on company canteens, prisons and vocational training centers) runs in the Federal State of Hesse. This project is the first to combine a range of instruments enabling the analysis, assessment and optimization of both food waste avoidance and sustainable nutrition (focusing on low impact and healthy dietary choices). Moreover, the project takes a holistic view of health, environmental and economic effects and communicates these effects in ways that are specific to the different target groups. Via this action it was clear that a successful strategy against food waste requires the training of all protagonists.

In the workshops ‘ **Reduce food waste, save costs**’ , in addition to the theory (appreciation of food, ecological footprint, resource consumption), concrete solutions for the long-term reduction of food-waste were suggested. In interdisciplinary working groups, the participants developed their own measures that contribute to the efficient utilization of food. The great response to the workshops confirms the need to integrate food waste into the training of cooks and service workers.

Table 1 9. Number of actions reported for each stage of the food supply chain and action sub-type in Germany

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	2
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					1
	Training & guidelines				1	1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE				1	
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

### 4.13 Greece

The first Greek NWPP came into force in 2014 and included some indicators for food waste prevention as presented below:

- Action 2.1. Investigate barriers/constraints to food donation with proposals to address them and develop specifications/criteria for the suitability of food for donation;
- Action 2.2. Establish national guidelines and/or further legislation on food donation;
- Measure 3. Promote food waste reduction in the primary sector;
- Measure 4. Activate the food processing, manufacturing and trading sectors to reduce food waste;
- Measure 5. Implement circular economy principles in the catering and related services sector (e.g. restaurants, hotels, cafeterias), including canteens (e.g. in schools, universities, hospitals, courts, public services) to reduce food waste;
- Action 4.3. Implement training programs for employees in food supply businesses;
- Action 4.7. Organize thematic workshops and establish a 'food waste reduction' award;
- Action 5.2. Implement training programs for employees in the catering and related services sector;
- Measure 6. Inform and raise awareness of households and the catering sector on changing behavior in food consumption and management.

With reference to develop and support information campaigns, to raise awareness about waste prevention and littering, in the updated NWPP for the period of 2021-2030 the following are included:

- I mprove knowledge about food waste production;
- S upport food donation for human consumption;
- P romote food waste reduction in the primary sector;
- E nable the food processing, manufacturing and trading sectors to reduce food waste;
- I mplement the circular economy principles in the catering and related services; sector (e.g., restaurants, hotels, cafeterias), including canteens (e.g., in schools, universities, hospitals, courts, public services) to reduce food waste;
- I nform and raise awareness among households and the catering sector about changing behavior in food consumption and management. [31]

In 2018, Greece published the national circular economy strategy and the national operational action plan on circular economy 2018-2019, which included further actions for reducing food waste. There were four actions relevant to food loss and waste, specifically: i) reduce food loss, ii) develop methodology to measure and monitor food waste, iii) adopt circular tax incentives, and iv) develop programs for informing consumers and raising awareness on food waste [32].

According to Article 20 of Law 4819/2021, and in order to measure food waste and food surpluses donated, a specific electronic platform was set up and operated, where the entities obliged to do so must submit the relevant data annually, starting in 2022. This obligation refers to meat markets, fish markets and vegetable markets, supermarkets, catering companies, hotels with more than 100 beds, healthcare facilities, hostels (e.g., youth hostels) and nursing homes.

Greece also launched a national **'Alliance for the Reduction of Food Waste' in 2020**, an **initiative** of the Boroume organization and AB Vassilopoulos. Under the auspices of the Ministry of Environment and Energy, the Alliance brings together key stakeholders, such as professional and industry associations, companies from across the food supply chain, civil society organizations, and the academic and research community [28]. Around 35 stakeholders signed this voluntary cooperation agreement. Boroume aims at bridging the gap between the large amounts of food wasted in Greece and the growing number of people facing food insecurity by connecting selected donors (farmers, supermarkets, food manufacturers, and caterers) with nearby recipient charities and municipal social services that help food insecure families. Its main activities include: i) coordinating on a daily basis charities that collect surplus food from a variety of donors and then redistribute it to people in need; ii) maintaining and constantly enlarging a network of donors and recipient charities; iii) training new volunteers to provide support to the program; iv) organizing events to raise awareness on the issue of food waste amongst the public; v) save and offer directly to local charities food from farmers markets; vi) inform and inspire kids to reduce food waste and volunteer through a specialized educational program; vii) advocate on national and supranational level changes aiming at reducing food waste and increasing food donations. A monitoring plan is implemented to track the action impact, using a set of key performance indicators, including: a) the total number of portions of food redistributed, and b) the ratio between the amount of food redistributed and the total operational costs . [34]

In March 2021, the American College of Greece (ACG) presented the first report, which included a total of 57 actions, best practices and initiatives to prevent and reduce food waste. A key learning point of this activity was that it is crucial to make it as easy as possible firstly for the donor and secondly for the recipient charity to donate and receive food. In other words, the donations must take place at a local level to ensure that it will be easy for the donor to give and the recipient charity to collect them. [36]

Since its start, Boroume has held a number of **' Feeding the 5000' events, numerous local events, two food saving festivals** together with the WWF, hundreds of **presentations** and through its **website and social media** has been the focal point of the food waste discourse

in Greece. Worth mentioning is that a part of the awareness raising campaign consisted of an educational programme that reached 16,000 pupils in three years.

During a 6-year period, more than 10,000 tons of food waste were prevented by which 28 million meals were prepared and donated, necessitating 3500 volunteer hours and 600,000 €. Table 20 presents the economic and environmental benefits that derived from this action. [33]

Table 20 . Efficiency of BOROUME, Greece in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	28,877,316	41,196,846	83,950,292
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	1,151,400	7,693,142	131,254

Before the Boroume initiative, nobody was concerned about food waste in Greece, with the exception of a food bank in Athens. No-one was redistributing or donating surplus food. Although there is no research on behavioral change regarding food waste in Greece and not even a comprehensive research on the levels of food waste generated, in the last few years a change in people's behavior has been noticed. For example, it has become common practice for restaurants to give customers their leftovers. Furthermore, thousands of people follow Boroume on social media, and use this platform to donate their surplus food. [35]

Table 21 . Number of actions reported for each stage of the food supply chain and action sub-type in Greece

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	4
	Digital tool BC					
	School programs					1
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE				1	1
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy				1	
	National FW prevention program			1	1	1
	Fiscal incentives					

#### 4.14 Hungary

Hungary's first WPP was developed in 2014. Apart from the independent initiatives/projects that have taken place in the past, **two surveys** were also conducted, as well as **publications** on household food waste generation and food waste in Hungary during the timespan 2016-2020. In parallel, **the Hungarian Food Bank Association** and its partner organizations distributed around 11,000 tons of food with a total value of around 7.5 billion HUF to people in need in 2019.

In 2016, the public awareness-raising project '**No Leftovers**' [34] from the National Food Chain Safety Office was launched and since then, it has provided practical advice on how to effectively reduce food waste in households. The 'No Leftovers' education program materials have reached more than 400,000 children, and more than 800 teachers have been involved in the program [37].

**Direct food surplus redistribution** organization was in charge of putting directly in contact donors of surplus food and charitable organizations, coordinating the collection and distribution, ensuring quality control to minimize risks related to food safety.

'**Wasteless**' is a Hungarian program (2016 – ongoing) also created by the Hungarian national government against food waste in households, funded by the EU LIFE program. It includes:

- (1) The identification and development of good practices for food waste prevention in the food chain.
- (2) Public awareness campaigns and dissemination of the results.
- (3) Development of educational material delivering knowledge on food waste prevention to primary schools. 274,450 copies of the Wasteless students' book (with an extra awareness-raising poster attached) were transported into all (2666) primary schools of Hungary. The Teachers' guide and the Workbook were also available online.
- (4) School Program and Summer Camp. Within the framework of the Wasteless School Program, the first online quiz competition (based on the content of the students' book) was undertaken. 44 primary schools, 1,314 children of 61 classes participated in the quiz and 40 short food waste related videos were produced.
- (5) Transfer of knowledge. The results of the baseline study were published in the British Food Journal, thus becoming the first study on actual food waste measurement in the region. [38]

An international LIFE Food Waste Platform Meeting was held on 8 –9 October 2018, Budapest. Remarkable projects of food waste prevention, mitigation and reduction were presented at the conference, to provide concrete suggestions to tackle food waste generation in the different sectors, based on the shared experience of the participants. The event supported the engagement between the different projects and the experts of INTERREG, LIFE and H2020 to help joint work in the future. Amongst LIFE projects, the Italian FishScale, the

Portuguese FrutaFeia, the British TRiFOCAL, and the Italian NOW introduced themselves. The experts discussed four comprehensive topics during a common consultation in the afternoon: commerce, hospitality services, waste management, household food wastage [38].

As a commitment, awareness-raising videos were produced and shared, however no professional actor was employed at the National Food Chain Safety Office of Hungary. Therefore, official employees of the Office were involved in the shooting of the short movies.



Table 2 2. Number of actions reported for each stage of the food supply chain and action sub-type in Hungary

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	3
	Digital tool BC					1
	School programs					1
	Awards					
	Innovation of products - date marking		1			
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines				1	
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

#### 4.15 Iceland

In the draft action plan for reducing food waste, published on 25 August 2021, the responsible working group defined 24 actions divided between the public and private sector. The action plan included actions focusing on monitoring, education and awareness, food donations and efficient use of by-products.

In June 2020, a working group on food waste published its 24 proposals for measures to reduce food waste. The working group included representatives from Matís, the Consumer Federation, the Federation of Icelandic Municipalities, the Association of Employers, the Environment Agency, environmental organizations, the Association of Trade Unions, the Farmers' Association of Iceland, the National Association of Icelandic Students, the Federation of Icelandic Graduate Students, the Student Union of Iceland, and the Young Environmentalists Association. The government is responsible for 14 actions and 10 are in the hands of the business sector. Among the proposed measures for the government are: (1) better support for innovation, (2) promoting education and training on food waste, (3) encouraging economical means of food waste prevention, (4) revising regulations, and (5) regular monitoring of food waste. Actions for the business sector include: (1) awareness raising, (2) better synchronization of supply and demand in retail, (3) organizing food trucks to distribute leftover food, and (4) improving the open markets for by-products. Some activities included in the action plan have commenced, even though the plan has not yet been officially approved by the authorities.



Table 2 3. Number of actions reported for each stage of the food supply chain and action sub-type in Iceland

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					



#### 4.16 Ireland

Waste prevention in Ireland is measured at a project level with indicators set out in the NWPP. Available data are verified as appropriate and aggregated by sector or by other means to indicate:

- the volume of resources conserved, with measurements made before and after the intervention (e.g., production of residual waste per person)
- the quantity of waste prevented (tons of waste generated), with measurements made before and after the intervention
- money saved (the difference in euros in waste, water and/or energy costs after the intervention or change).

All specific prevention projects undertaken under the NWPP have built-in metrics. Indicators are quantitative where possible and qualitative where appropriate. Examples of such indicators also include the number of businesses or communities contacted by the different waste prevention projects. More specifically, as a national campaign, **'Stopfoodwaste.ie'** raises awareness to households on food waste issues. Additionally, via the **Food Waste Charter**, businesses are encouraged to prevent and report food waste in Ireland. With its social media initiatives, the campaign gained a 57 % increase in social media followers, enabling it to reach a wider audience on food waste among consumers. In addition, a media campaign on food waste ran for 2 weeks, on both radio and social media, reaching over 1.6 million listeners.

The EPA's **'Stop Food Waste'** is the national food waste prevention campaign, providing guidance and resources to help consumers reduce food waste. Through a combination of education, training, local champions and national media and social media promotions, the program aims to raise consumer awareness and empower citizens to change their behavior and reduce food waste. The EPA also hosts the **'Forum on Food Waste'**, bringing together key actors across the food chain, to discuss the issues and challenges in relation to food loss and waste in Ireland.

**'Smart farming'** program includes a partnership between the Irish Farmers' Association and the NWPP. It makes assessments of on-farm resource efficiency and identifies potential savings and efficiencies.

**'National Food Waste Separation Roadshow'** was a project where a food waste segregation and recycling roadshow was organized aiming to distribute food waste starter packs to members of the public. In 2019, these starter packs were distributed in three different towns and a massive 20% increase in the amount of food waste disposed of correctly and a very impressive 56% decrease in contamination of the food waste bin were recorded [39].

Table 2 4. Number of actions reported for each stage of the food supply chain and action sub-type in Ireland

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					2
	Digital tool BC					1
	School programs					
	Awards					
	Innovation of products - date marking					1
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

#### 4.17 Italy

In 2010, Last Minute Market and the Department of Agricultural and Food Sciences of the University of Bologna, Italy launched the campaign ‘**One year against waste**’. This is a repeated communication campaign aiming at raising awareness among citizens, institutions and companies about the causes and consequences of food waste. The campaign targets different audiences. It includes a number of communications tools and initiatives such as publications, books, conferences, public meetings, theatrical performances and food waste prevention awards.

In 2013, Last Minute Market and the municipality of Bologna launched the voluntary agreement “**Zero Waste Charter**”. This charter sets out various measures to reduce food waste along the food supply chain.

The measures on raising awareness include:

- raising awareness and promoting the campaign “One year against waste”
- establishing nutrition education courses (e.g., in schools, companies)
- simplifying the expiry date information on food labels and clarifying the difference between ‘best before’ and ‘use by’ dates
- establishing an observatory or national agency for reducing food waste
- developing a manual for reducing food waste production in households

The measures to promote and create incentives include:

- supporting public and private initiatives that aim to (re-)distribute food, reduce food waste and manage food waste
- favoring companies in governing public contracts that ensure free redistribution of recovered food waste for the benefit of less affluent citizens
- promoting concrete actions to reduce food waste further up the supply chain
- promoting discounted sales when a product is about to expire or has a defect [41].

The measures regarding donation include:

- donating food surpluses for social solidarity purposes
- permitting donations of perishable food worth less than 15,000 EUR to be made without following official procedures
- reducing waste tax for entities doing food donation [42,43].

In 2016, Italy passed a **law against food waste throughout the whole food supply chain** that simplifies the donation and distribution of surplus food. Instead of coercive measures, the law focused on incentives (e.g., tax reduction) for entities to donate or distribute surplus food. The law includes products in supermarkets but also agricultural products.

As part of the project **'The pleasure not to waste'**, products close to their expiry date are set out and sold at a discounted price. The project involves 275 large-scale retailers in the Piedmont and Acosta Valley regions. In large-scale retail trade, food waste is often linked to warehouse management and mainly comprises unsold products close to their expiry date and products with damaged packaging. These can be intercepted before they become waste and usefully distributed to social canteens or solidarity supermarkets [44].

**'Buon Fine Coop'** is another project conducted by the Italian association ANCC-Coop, the National Cooperative Association of Consumers- Coop, at national level. ANCC is an association that represents all the consumer cooperatives that are distributed in the Italian territory under the Coop brand (a supermarket chain). This project started at the end of the '90s with the aim of reducing food surpluses from Coop supermarkets and donating them to social voluntary associations who then donate them as ingredients or use them to prepare meals (soup kitchens) to support people in need. Since then, the action has been repeated every year. All the goods redistributed maintain their nutritional qualities and are safe to eat, but are withdrawn from the supermarket shelves because they no longer comply with quality standards (caused by alterations due to transport damages) or because they are approaching their expiry date.

The aim of this initiative is to reduce food waste and support citizens in need of food assistance. The surplus food generated by 647 Coop supermarkets was collected and donated to more than 930 charitable organizations over the Italian territory. All the food donations are collected and stored according to a set of guidelines to ensure their safety. Each cooperative (coordinating supermarkets at regional/local level) is in charge of maintaining the relationship with the local charitable organizations that receive the food donations and promote the project at regional/local level (these operations are conducted by volunteers that collaborate with the cooperatives). Each cooperative is responsible for training the supermarket's staff on all the procedures to be followed in the (A) selection (considering the needs of the beneficiaries and the shelf-life of products), (B) storage (to ensure food safety), (C) deliver the goods to the voluntary associations, and (D) record the quantity and quality of goods donated. At national level ANCC monitors on a yearly basis the outcomes of the project, based on a number of KPIs including: quantity of goods donated, economic value of donations, number of charitable organizations involved, number of meals equivalent donated. This information is then used to produce a report and published on the website of the initiative.

According to research conducted by the ANCC association, Coop supermarkets waste on average 1.26% of their food, while the other Italian supermarket chains waste on average 2.3% of their food. Assuming that the waste levels of Coop prior to the implementation of this

action were aligned with national averages, this and other actions focusing on improving the efficiency of logistical operations, have enabled Coop to almost halve the amounts of food waste generated, and can therefore be considered effective.

Additionally, a web platform was created to present the outcome of this initiative and related information on food waste reduction. Consumers, social voluntary organizations and companies that collaborate with Coop can find useful information on how to prevent food waste and exchange experiences and best practices. The website registered in six months 2,212,748 accesses and 31,907 single users.

From the evaluation of the program in 2017, it can be estimated that 8,200 thousand meals were donated, preventing 7,000 tons of food waste. The cost of the action was calculated equal to 914,760€. Table 25 presents the economic and environmental benefits that derived from this action.

Table 2 5. Efficiency of Buon Fine Coop, Italy in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	33,250,000	28,571,742	58,190,076
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	1,083,607	3,337,389	87,707

The key learning points derived from this action are the following: (1) the importance of training the staff in charge of selecting, storing and preparing the food donations, of teaching them to carry out these operations independently in compliance with the existing regulations, and (2) the importance of raising awareness across the volunteers and the voluntary associations to increase the number of voluntary associations involved in the project. The main barriers that were encountered are: (1) the limited capability of some voluntary associations to collect all the food available (due to lack of funds and human resources, for which they might not be able to collect the surpluses every day, or they might be limited in the types of goods they can collect due to a lack of refrigerated storing facilities), (2) difficulties encountered by these associations in monitoring and reporting their activities, that makes it hard for the cooperatives to report on the social impact of this initiative. Additionally, at the beginning of the action (before 2016), the main barrier was the high costs due to the time spent by the employees to prepare the food packages due to the excessive bureaucratic requirements. Thanks to the new anti-waste law mentioned above, the activities have been



significantly simplified and therefore the process has become much simpler and less expensive.

**‘Avanzi popolo 2.0’** (2015 – ongoing) is a project managed by the volunteering association “Farina 080” Onlus, which aims to activate Bari’s citizens against food waste. Its main goals are to prevent food from being wasted at primary production, food services and household level, and to raise awareness on the problem of food waste, and give access to fresh food to people in need.

The main activities of this action are: 1) to manage a food sharing web-platform where anybody can post information on food not consumed at home; 2) to save food that risks to be wasted (from fields, weddings, and conferences buffets) and redistributing it to associations supporting families in need; 3) to manage the installation of community fridges and public social stores in suburbs where families in need can buy food using a virtual currency; 4) to educate, train and raise awareness on food waste (including activities with kids). Key performance indicators such as the amount of food redistributed, the number of businesses donating surplus food, the number of charities receiving food, and the number of volunteers are tracked in time.

In 2017, 6985 kg of food were redistributed, 115 businesses were donating surplus food, 37 charities were receiving food and 50 volunteers were involved. The cost of the action reached 27,540€ including the need for 7,280 volunteer hours. Against such a baseline , the following targets were set: to increase by 10% the amount of surplus food redistributed and to increase by 20% the number of businesses involved, charities and volunteers by 2019. The most important result of the action is the creation of a stable network of businesses, charities, citizens, and local municipalities addressing the problem of food waste. Table 2 6 presents the economic and environmental benefits that derived from this action.

Table 2 6. Efficiency of Avanzi popolo 2.0, Italy in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	35,000	28,500	58,100
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	1,081	3,330	87

A key success factor of this action is the availability of potential stakeholders to be involved in the network. As fighting food waste needs mostly a cultural revolution, the main barrier is the resistance to change; most private businesses don't know the fiscal benefits coming from the new national law against food waste and are worried that they will be considered responsible for potential food contamination that could occur after the donation; many charities are not properly organized to efficiently manage large quantities of food and relate with businesses; most people have to overcome a cultural barrier before considering food-sharing (that is giving and taking food from strangers) as a real and feasible option. Being conscious of these problems, this association acts as an intermediary who understands that businesses and charities are not used to communicating and sometimes speak different languages, needing a "translator". They also organize educational activities in schools to spread the message and to give people a chance to experience food-sharing in different ways.

**'Local Food Waste Hub'** (2019 – ongoing) is a pilot project that redistributes surplus food in two local neighborhoods of Milan. This initiative started in January 2019, when, in order to support food recovery under the framework of circular economy by small and local players, the Municipality of Milan, Politecnico di Milano, the private sector union "Assolombarda" and the philanthropic Cariplo Foundation decided to design a model and data analysis for food losses and waste management. The "Local Food Waste Hubs" are hosted in a space owned by the Municipality of Milan and managed by a local food bank. Municipalities can act on the food system by facilitating the relations between the players involved and playing the role of community leader and not just of administrative power. The Food Policy Office works for the integration among departments, agencies, urban and multilevel actors engaged in the Food System. Furthermore, it engages the relevant local stakeholders (horizontal integration) and it connects with Metropolitan and Regional authorities (vertical integration), in order to better identify innovative intervention areas. The Local Food Waste Hub is proving to be a successful model for neighborhood redistribution of surplus food and will be scaled up in other 4 districts around the city thanks to new funding actors. [40]

During the course of the pilot year of implementation (2019), the incoming and outgoing donations in the hub were monitored and the knowledge was spread among 35 local organizations, mapped by the Food Policy working on food donations. Each hub was able to gather and redistribute approximately 60 tons of food per year (160 kg per day). The goal is to scale up the model to all 9 neighborhoods of the city, using the lessons learned in the pilot project, to connect the institutional drivers of the main partners of the initiative. From the evaluation of the program in 2019, it can be estimated that 60 tons of food waste were prevented. 2,600 volunteer hours were necessary, rendering the cost of action up to 40,000 €. Table 27 presents the economic and environmental benefits that derived from this action. [40]

Table 2 7. Efficiency of Local Food Waste Hub, Italy in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	380,000	190,000	337,000
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	10,111	16,000	303

‘**Chef Save the Food**’ (2017 - ongoing) is an Italian project run by three consumer associations: Casa del Consumatore, CODICI Centro diritto per il cittadino, AU Assoutenti. It aims to teach families how to avoid wasting food through a 10-episode cooking show where professional chefs create meals out of leftovers found in people's kitchens. The best recipe is then voted by the audience. In total, 500,000 people voted in the first season. [40]

A list of some more actions/initiatives that have taken place in Italy is as follows :

- ‘**Rete Banco Alimentare Onlus**’ by Fondazione banco alimentare ONLUS, a redistribution organization that aims to recover surplus food from the food supply chain and redistribute it to charitable organizations across the country.
- ‘**Solidarity bread**’ by the Italian Red Cross, is a local project in charge of redistributing surplus food (mainly bread and baked products) from 8 shops to families in need.
- ‘**The bread of everyday, Brother Galdino, Emporiums**’ by Caritas diocesi Biella is a local project in charge of redistributing surplus food to families in need in 4 solidarity stores.
- ‘**Cibus**’ by Caritas diocesana Matera-Irsina, is a local project in charge of redistributing surplus food to families in need.
- ‘**Operazione Quattro Province**’ by Charitable association Joseph ONLUS, is a regional project in charge of redistributing surplus food from producers, wholesalers and retailers to charitable organizations donating it to people in need. [40]
- ‘**Una sola famiglia umana, cibo per tutti**’ by Caritas diocesana Oristano, is a project in charge of conducting awareness raising activities on the topic of food waste and redistributing surplus food from wholesalers and retailers to people in need.
- ‘**Life food waste stand up**’ by Federalimentare (association of Italian food manufacturers). The main objective of this initiative is to raise awareness on surplus food management and food waste prevention among three key actors of the food supply chain, agro-food

companies, food retailers and consumers through a coordinated information campaign carried out at national and European level. [40]

- **‘Emporio della Solidarietà’** Caritas diocesana Prato is a solidarity store donating surplus food to families in need.
- **‘Mercato amico & caritas agrigento: no waste’** by Caritas Agrigento aims at the weekly collection of unsold fruit and vegetables from the street market in order to be used in soup kitchens and distributed to people in need. [40]
- **‘Recupero del pane invenduto e produzione di birra’** is an ongoing project coordinated by Fiesa Conferescenti, a trade association of Italian food stores, including bakeries. This initiative foresees the development of a brewery to produce beer using unsold bread collected across the Italian territory.
- **‘Doggy bag for restaurants’** Lunch boxes are given to consumers for them to take home leftovers (practice that is not common in Italy), to raise their awareness on the importance of not wasting food. [40]

The following table summarizes the number of actions reported for each stage of the food supply chain and action’s sub-type as identified in Italy.

Table 28 . Number of actions reported for each stage of the food supply chain and action's sub-type in Italy

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	3	2	4	7	4
	Gleaning					
	Digital tools R					
Food valorization	Value added processing				3	1
	Animal feed					
Behavior change (BC)	Awareness/educational campaign	1		2	3	5
	Digital tool BC					
	School programs					1
	Awards					
Supply chain efficiency (SCE)	Innovation of products - date marking				1	
	Process innovation				2	2
	Innovation of products - packaging					
	Training & guidelines					1
	Price discount				1	
	Imperfect produce sale					
	Certification					
Food waste prevention governance	Public procurement					
	Digital tools SCE					
	Voluntary agreement					
	Regulatory framework/policy				1	
National FW prevention program						
Fiscal incentives						

#### 4.18 Kosovo

To the best of our knowledge, no measures to prevent food waste have been reported in Kosovo.

#### 4.19 Latvia

Latvia has set the target to reduce food waste by 30% by 2025 and to reach a 50% reduction by 2030 (as compared to the 2022 baseline) in its **national food waste prevention program** (2021-2028). This foresees the following measures:

- to improve the food donation system (changes to the regulatory framework, development of food donation guidelines, a study to evaluate the operations of food bank, campaigns to promote food donation etc.)
- to prevent food waste
- to raise awareness and inform about food waste (establishing dialogue and agreements with producers, processors, and traders on the obligation to reduce food waste; promoting good practices in food waste prevention etc.)
- to measure and monitor food waste levels
- to support research and innovation aimed at reducing food waste. [45]

In 2019, a national methodology for measuring food losses and food waste was developed, including provisions for food business operators and for households. Handbooks for food waste measurement have been developed for enterprises and for households.[45]

There has been a number of studies previously conducted in order to determine the different types of waste, including food waste, such as the study **‘Assessment of food waste management generated by food production and catering companies in Latvia’**.

**‘The Food Bank Paedusai Latvijai (For a fed Latvia)’**, (The Project is placed online on: 01.01.2015 - Project completed 31.12.2015) was a food program run by the Latvian Samaritan Association, which helps those in need by issuing food parcels. The parcels contain food donated by producers, processors and traders. It accepts an unlimited number of high-quality, usable products that do not require special temperatures for storage. According to this program, perishable products with a short shelf life at room temperature are accepted only if they can be delivered quickly to the beneficiary. The Food Bank also accepts hygiene and household items such as toothpaste, toothbrushes, soap, washing powder, shampoo, baby nappies and other items. Food parcels are distributed to residents throughout Latvia, in cooperation with local charities and municipal social services. No brokerage or commission is charged on donations and all donations are used in food parcels. [45]

The following table summarizes the number of actions reported for each stage of the food supply chain and action’s sub-type as identified in Latvia.

Table 2 9. Number of actions reported for each stage of the food supply chain and action's sub-type in Latvia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program	1	1	1	1	1
	Fiscal incentives					

## 4.20 Lithuania

The **draft waste prevention program** of Lithuania for 2022-2027 lists measures relating to a systematic review of the legislation on food use, redistribution and waste prevention, and the review and removal of barriers to food redistribution. More specifically, it:

- reviews the legal framework for the use and distribution of food for human consumption and sets requirements to prevent food waste and waste generation
  - re-establishes a platform for inter-institutional cooperation to find the latest, most advanced, rational solutions for food production and ensures the sustainable use of food, finding food-sharing ideas and practices
  - provides tax incentives and financing measures to promote food sharing and food donation opportunities (e.g., installing common refrigerators in dormitories to share unused food, food sharing initiatives for those in need)
  - provides funding opportunities to continue and expand the initiatives for sustainable food consumption in public catering establishments, school canteens, kindergartens and workplaces, promoting buffet-based catering
  - initiates educational campaigns for the population to promote economic shopping, sustainable food consumption and reducing household food waste
  - initiates a cooperation platform to promote and develop regular dialogue and cooperation between producers and importers of food
  - encourages voluntary business cooperation agreements and encourages companies to report on food waste generated and to seek new solutions
  - improves the legal framework for the use and distribution of food for human consumption, promotes measures for the efficient use of food in the catering sector and ensures measures for the use of unused food for animal feed.
- 
- The waste prevention program of Lithuania for the period 2022-2027 outlines various actions, focusing on food use, redistribution, and waste prevention. These measures include:
    - Conducting a review of the existing legislation on food use and distribution, with an aim to prevent food waste .
    - Establishing a collaborative platform among different institutions to explore innovative solutions for food production, promoting sustainable food practices, and sharing ideas.
    - Introducing tax incentives and financial measures to encourage food sharing and donation opportunities. This may involve initiatives such as installing communal refrigerators in dormitories to share unused food and implementing food sharing programs for those in need.
    - Offering funding opportunities to sustain and expand initiatives promoting sustainable food consumption in public catering establishments, school canteens, kindergartens, and workplaces, with a focus on buffet-style catering.



- Launching educational campaigns to raise awareness among the population about the importance of economical shopping, sustainable food consumption, and reducing household food waste.
- Establishing a cooperation platform to foster regular dialogue and collaboration between food producers and importers.
- Encouraging voluntary business cooperation agreements that include reporting on food waste generated and actively seeking new solutions.

Enhancing the legal framework governing the use and distribution of food for human consumption, promoting efficient food utilization in the catering sector, and ensuring appropriate utilization of unused food for animal feed.

**Maisto bankas** operates across Lithuania as a mediator collecting surplus food donated from retailers, producers, farmers or general public and providing it to the poor through the network of social non-profits, which donate it to people in need.

Maisto bankas functions across Lithuania as an intermediary, gathering excess food contributions from retailers, producers, farmers, and the general public. It then distributes this food to individuals in need through a network of social non-profit organizations. [46]

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Lithuania.

Table 30 . Number of actions reported for each stage of the food supply chain and action's sub-type in Lithuania

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	1	1	1		
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program	1	1	1	1	1
	Fiscal incentives					

#### 4.21 Luxembourg

In Luxembourg, a food waste volume of 70,800 tons disposed of each year by the catering, retail and hospitality sectors and households is estimated. The total amount of food waste in all sectors increased by about 4.8 % compared with 2016. The majority of food waste is produced by households.

In June 2008, the Ministry of Sustainable Development and the Environmental Administration jointly implemented the project '**Clever lessen**' (Clever eating), which encourages sustainable consumption and aims to reduce food waste through the use of the ECOBOX. The ECOBOX is a reusable container, available in two sizes, which allows customers to take home food from restaurants, canteens, take-away and other places after paying a deposit of EUR 5. In 2019, 117 restaurants and 60 canteens were participating and there were approximately 13,500 500 mL containers and more than 38,000 1,000 mL containers in circulation.

The Ministry of Sustainable Development and Infrastructure also sponsored a new **TV series 'Manner assmi' (Less is more)** about food waste, packaging waste, etc., to raise awareness. Another awareness- raising campaign '**Ensemble contre le gaspillage alimentaire**' (Together against food waste) provides information about ways to reduce food waste [40]. In addition, support for initiatives involving the donation and redistribution of food and feed for human and animal consumption is expected. [47]

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Luxembourg.

Table 3 1. Number of actions reported for each stage of the food supply chain and action's sub-type in Luxembourg

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed				1	
Behavior change (BC)	Awareness/educational campaign				1	2
	Digital tool BC					1
	School programs					
	Awards					
	Innovation of products - date marking				1	1
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

## 4.22 Malta

Malta has several awareness-raising initiatives to prevent food waste, such as numerous articles, television and radio adverts, and supermarket events aiming to promote food waste reduction in radio, television and newspaper interventions, and to seek strategic alliances with supermarkets to have authorized personnel available on their premises in order to advise customers on consumption patterns and wiser food purchases. These initiatives promoted the reduction of food waste by creating awareness about purchasing and consumption habits and advising customers at supermarkets on smarter food practices. Food waste prevention messages are also communicated through a roadshow at various locations with the support of a well-known chef who demonstrates how food scraps and leftover food can be used in new recipes to reduce waste.

Another action implemented in Malta is the **‘Collaborate with farmers, volunteers and civil society organizations to encourage the practice of ‘gleaning’**’. This involves voluntary organizations collecting unsold or surplus food from farms to redistribute to communities in need.

The Ministry for the Environment, Climate Change and Planning will work towards developing legislation to divert food away from landfill, with the food going to food giveaways and food banks instead, and it will also focus on overcoming existing legislative barriers regarding the redistribution of food. Research will be conducted to identify the source and reason for food waste occurring at the primary production level, including farms, fish farms and food factories. Food prevention initiatives will also be undertaken through digital channels and applications. [48]

The **‘TRiFOCAL’** program took place in 2019 and comprised three overall goals:

- i. reducing citizens’ avoidable food waste
- ii. increasing citizens’ food waste recycling
- iii. reducing the Maltese population’s meat consumption [40].

Wasteserv, Marsaskala local council and food and hospitality establishments conducted a **pilot project** of daily organic waste collections. The activities of the project were successful in meeting the objectives of understanding the potential of food waste collection and the challenges and opportunities for commercial food waste recycling. The project yielded positive results by diverting 2.7 tons of food waste from landfill, giving an indication of the levels of food waste generated by hospitality businesses and providing a clearer understanding of where waste collection services can be improved. [48]

The following table summarizes the number of actions reported for each stage of the food supply chain and action’s sub-type as identified in Malta.

Table 3 2. Number of actions reported for each stage of the food supply chain and action's sub-type in Malta

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning	1				
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation				1	
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE	1	1			
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy	1	1			
	National FW prevention program					
	Fiscal incentives					

### 4.23 Montenegro

Montenegro's **waste prevention program** is under development and will be integrated into the national waste management plan to be launched in late 2022. No details are currently available about the content. [49]

However, **the Waste Management Plan for the period 2015- 2020** listed the following actions (European Environment Agency, 2017):

- Public awareness activity on waste reduction and minimization involves promoting eco-products, reuse opportunities and waste minimization techniques
- Training for competent authorities including mandatory training on methods of waste prevention for Environmental Protection Agency employees
- Raising awareness on waste management in Montenegrin schools was organized by the OSCE (Organization for Security and Co-operation in Europe) Mission to Montenegro, in cooperation with the NGO 'Environmental Movement Ozone' in 2014.

Zero Waste Montenegro was founded in March 2015 by Alexandra Aubertin, French environmental consultant and activist and Azra Vuković, now a director at the well-known Montenegrin environmental NGO Green Home, and formerly director of the National Parks of Montenegro. Together they decided to create an entity focusing on one of the largest environmental issues in Montenegro: waste management. For the first 3 years, several motivated volunteers worked on small projects with a big impact to create awareness on waste issues and initiated the first coalition of NGOs working together on a common goal of raising awareness on the sources and dangers of single-use plastic pollution in Montenegro: Cleanupmontenegro.me. Now ZWMNE has grown and its team of full and part-time employees is now led by a Steering Committee.

'**Zero Waste Montenegro**' aims to establish a comprehensive set of resources in English and Montenegrin on its website to educate citizens on the concept of the circular economy (Zero Waste Montenegro, 2020a). [50]

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Montenegro.

Table 33 . Number of actions reported for each stage of the food supply chain and action's sub-type in Montenegro

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					2
	Digital tool BC					2
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					1
	Innovation of products - packaging					1
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					



#### 4.24 Netherlands

The Netherlands national agenda on food waste reduction ‘**Samen Tegen Voedselverspilling**’ consists of four lines of action, in which different measures are taken:

- i. monitoring and impact: measure progress quantitatively
- ii. working together against food waste in the chain: joining forces, networks and knowledge to better implement (existing) solutions
- iii. together against food waste at the consumer level: sustainable behavioral change among households
- iv. changing the rules: initiate or adapt laws and instruments, so that they contribute to the development of the circular economy. [51]

Financial incentives are also set to encourage food donation. **Food donations are tax deductible for companies**, i.e., they can deduct the donation from their profits to reduce corporate income tax, as long as the food is no longer suitable for the market and the value of the donation stays within the limit of 50 % of 100,000 EUR of the total profit.

The ‘**Waste at School**’ program targets the reduction of food waste in schools. Behavioral science knowledge is applied in practical projects. Knowledge is shared with professionals in municipalities, schools and companies through courses and online tools and knowledge products.[40]

The **consumer campaign ‘#wastefree’**, launched in 2019, had the main theme ‘Best Before’. By better managing the best-before date, the average Dutch person could save about 5 kg of food waste each year. To make the difference even clearer, the **#Verspillingsvrij campaign** continued in 2020 with TV and online coverage explaining the difference between ‘use by’ and ‘best before’ dates on food labels and giving tips on how to use them. The **#waste free week** each September aims to inspire Dutch people to produce less waste through challenges. [40]

In 2018, the Taskforce Circular Economy in Food, in the Netherlands, consisting of various companies, research institutes, civil society organizations, and government entities, launched the ‘United Against Food Waste’ project. The primary goal aims to reduce food waste levels by half till 2030 compared to 2015. The Dutch Ministry of Agriculture, Nature and Food Quality funds with a 7 million EUR budget, for the 4-year period, to support this objective via investments in innovation, research, monitoring and education.

‘**NoFoodWasted**’ is an application that gives live updates to users on offers on food put by supermarkets on products close to their expiry date. It has won the award for most impactful start up in the Netherlands in 2017. This was mainly because it increased awareness on the

food waste problem, so people are more willing to contribute and the application was an easy tool for consumers to directly waste less food.

**'Food waste challenges'** is an awareness campaign launched by Consumentenbond (a Dutch non-profit focusing on consumer protection) to reduce food waste in households based on consumers taking part in a challenge, and in return being provided with tips and tools to reduce their food waste generation at home.

Last but not least, **'Food Banks of the Netherlands, Voedselbanken Nederland'** (2014 – ongoing) organized collection of surplus food from the food industry and retailers and redistribution of it to people in need. More specifically, in 2020 they helped 160,500 people. That is almost 3 times the Arena full. 44 million products were distributed, with a value of approximately 74 million euros. Much of it would otherwise be wasted.

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in the Netherlands.

Table 3 4. Number of actions reported for each stage of the food supply chain and action's sub-type in the Netherlands

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution		1	1		1
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	3
	Digital tool BC				1	1
	School programs					1
	Awards					
	Innovation of products - date marking		1			
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging	1	1	1	1	1
	Training & guidelines					1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy				1	
	National FW prevention program					
	Fiscal incentives				1	

#### 4.25 North Macedonia

The impact of the waste prevention program of North Macedonia, drafted for 2018-2024, is not yet visible in terms of decreasing amounts of waste generated.

An NGO-driven **experiential learning program** about food waste for school students has been implemented. The aim of this learning program was to empower young people to understand the implications of food waste, in order to lead the next generation in the changes required to address food insecurity and food waste.

Web platforms have also been created that connect businesses with NGOs, by redistributing surplus food within 'Let's do it Macedonia'. **The surplus food distribution system, 'Site Siti'** aimed to save 60 tons of food and provide 200,000 meals in 2019. According to the evidence of the State Statistical Office, in 2017 450,000 people suffered from lack of food in the country. On the other hand, annually 10 tons of safe food worth 15 million euros, ended up as waste. The goal of this presentation was to learn first-hand about the ways how companies can get involved in the efforts to reduce food waste and support those who are food insecure [52,53].

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in North Macedonia.

Table 3 5. Number of actions reported for each stage of the food supply chain and action sub-type in North Macedonia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					1
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE				1	
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

#### 4.26 Norway

The Norwegian environmental and statistical authorities are responsible for the development of indicators for food waste. The government aims to initiate mandatory collaboration with stakeholders in the food value chain to prevent food waste. Many stakeholders in the sector have already taken the initiative to reduce food waste through a five-year collaboration project '**ForMat**' program. The Government has already contributed with funding for 6 more food banks and the industry is delivering far more food now than before the agreement.[40]

The '**Guidelines for safe reuse of food**' aim to reduce food waste. As part of the KuttMatsvinn2020 research project, Matvett (the food industry's organization for food waste prevention and reduction) and the research institutes Nofima and Østfoldforskning developed a guide with practical tips and advice on how to ensure the safe reuse of food. The purpose of this guide is to provide professional support and inspiration to those who produce and sell prepared dishes. Through this assessment, sellers can be confident about whether dishes that have been produced can be used again or should be discarded.[54]

Additionally, '**CutFoodWaste2020**' is a three-year project led by Matvett, a Norwegian company that aimed to prevent and reduce food waste in the food and catering industry. This project started in 2017 and aimed to engage the hospitality sector in measuring and preventing food waste. Based on feedback from the hospitality sector, the two most critical factors to succeed in preventing food waste are to engage the employees (which is the focus of action S3) and to involve the guests (which is the focus of this action). To this end, Matvett decided to run an awareness campaign towards food services' guests. The campaign was divided into two main stages: the first phase was focused on the canteen sector, while the second targeted the hotel and restaurant sectors. In June 2018, approximately 1,700 sites from hotel chains, canteen chains and restaurants, had joined the program. A key success factor was that a project group including people from hotels and restaurants was involved in developing the training program. To be part of the CutFoodWaste2020 project, daily measurement of food waste and number of guests is mandatory. The training program addresses the reason why and how to do this. CutFoodWaste2020 ended in 2020, after four years. It was estimated that the food waste in the hospitality industry in 2019 was 27,700 tons including hotels, canteens, restaurants, convenience stores, nursing homes, kindergartens and after-school programmes. This food waste amounts to a value of 160 million Euro and greenhouse gas emissions of 96,520 tons of CO<sub>2,eq</sub>. CutFoodWaste2020 succeeded in recruiting 36 % of the hospitality industry (measured in turnover). The participants studied over 2,500 eating places and achieved a food waste reduction of 15 % or 390 tons, which corresponds to 2.4 million Euro and 1400 tons of CO<sub>2,eq</sub>. The project acted as a driving force for the actors in the hospitality industry in Norway to work according to specific reduction targets, and to be ahead of potential fees or regulations from the authorities.

Before CutFoodWaste2020, there were no statistics on the extent of food waste in this industry and the importance of reducing it, in contrast to today. Furthermore, more and more companies have gained increased insight and awareness among their employees. [40]

In 2019, a **'Cut Food Waste'** week was arranged by Matvett to mobilize actors in the food service industry to make their efforts to reduce food waste. The initiative gained attention on social media, both through examples of how some of the participating food businesses communicate with their guests to throw away less food and in connection with a 'Look, smell, taste' campaign that Matvett conducted on social media.

The initiative garnered significant social media traction, with participating food businesses showcasing effective ways to encourage guests to minimize food waste. Additionally, Matvett conducted a social media campaign titled 'Look, Smell, Taste,' which further contributed to the initiative's visibility. A festival was arranged in collaboration with the Municipality of Oslo's Agency for Urban Environment, Oslo European Green Capital, a network of actors working to reduce food waste in Norway, such as 'Too Good To Go', the network of Norwegian food banks, and the movements 'Eat your food!' and 'Foodlist', as well as several food service businesses.

**'Systematic price discount for food close to the expiry date'** was another project initiated by Matvett. More specifically, price discount for food items approaching the expiry date, implemented by all retail chains in Norway, since 2016. The food waste rates were measured through time, showing a reduction in food waste following this initiative, in particular for high value items (fresh meat, sausages and fresh ready-made food).

To reduce food waste and encourage food donations, the Norwegian government introduced a **VAT exemption on food redistributed to charities**. It is also worth noting that the Norwegian government and the food industry have signed an agreement (#Envision2030) to reduce food waste in Norway by 50 % by 2030.

**'Brukopp-leksikon' -A consumer guide on how to store and reuse food** (2017 – ongoing) is another action implemented in Norway. According to Matvett, 2/3 of the edible food waste comes from households. The main reason for wasting food is that it has passed its expiry date, and the most wasted food items are, in terms of percentage of the total waste:

- Fruit and vegetables (13 %)
- Bread (27 %)
- Leftovers from cooking at home (31 %)

For this reason, a book titled **"Kunsten å ikke kaste mat"** (the way not to waste food) was launched in 2017, providing a photo collection of 70 different food items close to their expiry date with clear guidance on how to store and reuse them. Matvett took part in the production

of this book, and bought the rights to transform it into a digital guide to be published on their website. For each food item presented, there are three main sections: general tips, durability, and storage. Furthermore, all the ingredients are linked to a database of leftovers recipes. An instruction video on how to use the guide is promoted on Facebook to increase the number of visitors to the website and the guide.[55]

Matvett also introduced '**Additional date labelling**' (2018 – ongoing). The use of additional date labelling was first introduced in 2017 by the dairy company, Q Meieriene. Matvett has been leading a project for aligning the initiative across the food sector and for developing a common, consistent sentence to be used: "Best before ... often good after". It was key to involve some leading companies to be first to implement the additional labelling system. A challenge was to make all companies agree on a common sentence to use for the additional labelling.[40]

Another project was '**Improved shelf life**' (2015), by Nofima (research institute) and Norges Gruppen (retailer). In 2015, a minced meat manufacturer changed the packaging gas from high oxygen (70% O<sub>2</sub>/ 30% CO<sub>2</sub>) to a mix of carbon dioxide and nitrogen (60% CO<sub>2</sub>/40% N<sub>2</sub>) to prolong the shelf life of the products, which increased from 9-10 days to 18 days. The high oxygen mixture gives the meat a bright red color. Therefore, in practice it is not possible for a manufacturer alone to change the package gas, since most consumers will choose the product that is packed with high oxygen because of the color. A large retailer in Norway (Norges Gruppen) registered data of food wastage before and after the change of packaging gas in 629 stores across the country, to document how the amount of food waste was affected by the prolonged durability [56].

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Norway.



Table 3 6. Number of actions reported for each stage of the food supply chain and action sub-type in Norway

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					1
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					2
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					1
Supply chain efficiency (SCE)	Process innovation				1	
	Innovation of products - packaging			1		
	Training & guidelines				1	
	Price discount			1		
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE				1	
Food waste prevention governance	Voluntary agreement	1	2	1	1	1
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

#### 4.27 Poland

The **national waste management plan** 2022 foresees the following measures with an impact on food waste:

- educational activities on food waste prevention
- cooperation between the food manufacturing and the food processing sectors
- public awareness activities to prevent and reduce food waste (tips for shopping, planning meals and food waste management). [57]

The research project '**Development of a food waste monitoring system and effective program for loss rationalization and food waste prevention**' (**project PROM**) developed a methodology to estimate the amount of food wasted across the Polish food supply chain and investigated the causes for food waste. Based on the results of the project, a national strategy for preventing food losses and waste was developed (currently subject to public consultations). This strategy will indicate directions for intervention and recommend priorities for action aimed at reducing food waste in the country, including legislative and self-regulatory solutions.

Moreover, in 2021, as a part of **the PROM project**, a campaign called '**Eat without throwing away**' was conducted. Its main goal was awareness raising to prevent food waste, especially in households. The campaign received widespread coverage on Facebook and other social media platforms. [58]

**Statistics Poland** collects and transfers data on waste, including on food waste, derived from the database operated by the Ministry of Climate – Central Waste System. Poland has undertaken legislative measures to prevent food waste and facilitate the provision of food for social objectives, which are simultaneously supported by national programs and strategies.

The Federation of Polish Food Banks organizes initiatives, such as information and awareness-raising campaigns. In 2018, for example, the campaign with the slogan '**By wasting food, you are wasting the planet**' was launched together with Advalue, Clear Channel and Tesco. The campaign highlighted the ecological impact of food waste and raised people's awareness through television adverts, radio announcements, publications on the internet, etc., in and around the largest cities in Poland. Another campaign is called '**Save food that is a dream for others**'. The campaign focuses on the existing paradox between wasted food and malnourished children in Poland. The Federation of Polish Food Banks tries to provide food to people in need and has created a television spot to try and highlight the amount of food waste that can be avoided, e.g. through donation [59].

**'EFFECT'** is a two-year European project aiming at developing an innovative multifunctional platform, hosting informative and educational content to raise awareness on food waste and encouraging citizens to actively reduce their food waste generation.

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Poland.

Table 37 . Number of actions reported for each stage of the food supply chain and action sub-type in Poland

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					2
	Digital tool BC					2
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation		1			
	Innovation of products - packaging					
	Training & guidelines				1	1
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

#### 4.28 Portugal

Portugal has a national strategy and action plan to combat food waste, approved by Ministerial Order 46/2018. The strategy was developed by the National Commission for Combating Food Waste (CNCDA) who has established an advisory panel with representatives of the whole food supply chain, as well as from research, academia, and non-governmental organizations, in order to receive advice on food waste related matters. The national strategy follows a vision of 'sustainable production for responsible consumption', having three major strategic objectives: to prevent, to reduce and to monitor food waste. CNCDA's targets include:

- Diagnosis, evaluation and monitoring of food waste in Portugal
- Identification of good practices
- Systematization of food waste measurement indicators
- Involvement of civil society
- The development of an electronic platform for managing food products at risk of being wasted
- Proposal of measures to reduce food waste.[60]

The **'Refood' project** started with the identification of potential food source partners, beneficiary partners and a study of the logistics involved in collecting surplus food daily – on a bicycle with baskets fore and aft. On March 9, 2011, Refood was launched with 30 restaurant partners and two churches (who helped by identifying potential beneficiaries), in 7-block area in central Lisbon. Two shifts of 15 restaurants each produced 1,000 meals a month – enough to ensure high quality meals for 50 people, 5 days a week

It is a volunteer movement organized in local communities which takes leftover food to those in need. It is dedicated to recovering unsold food in good condition and using it to feed people in need. Volunteers collect the food from canteens, restaurants, patisseries and supermarkets on a daily basis, divide it into portions and distribute it to citizens experiencing economic difficulties.[61]

**'Dose Certa'** is promoted by LIPOR, which reduces the portion size served in participating restaurants so as not to generate waste. The Dose Certa project aims to reduce and combat food waste by raising awareness and encouraging consumers to change their eating habits, focusing on economic, environmental and health aspects. Currently, this project is under way in restaurants, school canteens and mass canteens. By recording and characterizing the food waste generated in restaurants and canteens, it is possible to identify which food groups are being wasted and correct the quantities served to customers, thus reducing food waste. The Dose Certa project can reduce food waste in restaurants by up to 30 %.[62]

In 2014, the formal **commitment 'Combating food waste: a commitment for everyone'** came into force as a national common strategy for all stakeholders in the food chain. The

strategy intended to change attitudes and develop waste-free practices and management systems across the food supply chain.[63]

The **Festival Alimenterra** focused on healthy and sustainable nutrition, food waste and the future of the food system. The festival included short movies, debates, guided tours and waste-free cooking workshops on these topics. Panelists, such as chefs, academics, farmers and entrepreneurs, were invited to the festival to discuss issues of production, distribution, consumption and food waste. It was organised by Circular Economy Portugal, Câmara Municipal de Lisboa and Lisboa Green Capital 2020 and it took place in 27-29 March 2020. [64]

**'FLAW4LIFE'** (Reference: LIFE14 ENV/PT/000817) is a project co-funded by the EU LIFE program. The idea of the project was to save tons of ugly-shaped but good-quality food that farmers throw away every year and avoid the unnecessary use of resources such as water, land, energy and labor in production. On a weekly basis, ugly-shaped food is purchased from local growers and then packed into boxes to sell to affiliated consumers who can pick it up at the end of the day. The pilot project was successfully launched in Lisbon, and new delivery points with the same concept have been opened [65]. Other similar projects sell boxes with ugly vegetables and fruits, on a pick-up or home delivery basis. The key barriers at national level were to collect the necessary funds for the initial investment and gain the trust of the older farmers. A key learning point was that to ensure the financial sustainability of the project, all the delivery points need to be located in one of the two main regions of the country – Lisbon and Porto – and that a minimum number of customers in each delivery point should be ensured.[66]

**'Fruta Feia'** is a Portuguese cooperative founded in 2013 that purchases weekly from local producers the too small, big or misshaped products that they cannot sell in the regular market and organizes a delivery service of seasonal fruit and vegetable boxes with these products. The users of the service pick them up at the end of the day at fixed delivery points, for a fixed price (depending on the size of the box).[67]

**'GoodAfter.com'** is an online supermarket dedicated to the sale of products that are close to the end of their preferred consumption period, or even beyond that period. A discount of up to 70 % is applied to all items sold, for reasons such as changes in packaging, seasonal packaging, defective packaging or items that are close to or have exceeded the 'best before' date, but are still suitable for consumption, as they have not passed their 'use by' date.[68]

The **'Embrulha' project** provides biodegradable packaging free of charge to participating restaurants so that customers can take away the leftovers of their meal, allowing the food to be used instead of being thrown away.[40]

In December 2021, Porto introduced 'FoodLoop,' a circular entrepreneurship contest. The aim of it is to gather innovative ideas and projects that foster the transformation of the food system and support the transition towards a circular economy in Porto. FoodLoop serves as one of the demonstration actions within the CityLoops project. Porto has outlined five key objectives for the FoodLoop contest. These goals include:

- Stimulate the creation, development and growth of innovative Circular Economy initiatives with high impact potential, promoting their formation and implementation
- Promote the analysis and implementation of circular practices in companies, public bodies and civil society organizations
- Promote and create collaborations between existing initiatives / entities / companies and the contest participants, to stimulate symbiosis and mutual cooperation in order to develop the participants
- Strengthen the local, socially and environmentally responsible economy and encourage the transition to a healthy and sustainable food system
- Streamline the practice of prevention and reduction of waste production, recovery and reuse of food and recycling/composting of organic and/or food waste. [69]

**'Transformar.te'** is a project based on the implementation of a range of actions to prevent in-store food waste, reuse food items that cannot be sold for other purposes, and raise awareness on the issue of food waste across Sonae's employees, customers and suppliers. The first aim is pursued by: (1) preventing in-store food waste (e.g. through repackaging when part of a unit is not commercially attractive, depreciating products close to their expiry date etc.) and (2) reusing food surpluses (to create value added products like jams and chutneys, to prepare meals served in internal canteens, internal and external catering services, and by donating it to charitable organizations). To raise awareness on the topic of food waste the following activities take place: educational/awareness campaigns, participation in TV shows, conference and events, preparation and distribution of guidelines giving tips on how to reduce household food waste. Such activities are currently ongoing thanks to a dedicated team within the company that has been working on food waste prevention in the last 12 years. A monitoring system is in place to track progress towards both objectives by registering all the food waste generated (both the origin and destination). [70]

From the evaluation of the program, it was estimated that in the years 2016 and 2017 3.6 million meals were donated (equivalent to 1,512 tons of food waste was prevented). The cost of the action reached 250,000 € for the two-year period. The people reached by the awareness campaigns amount to approximately 20% of Portuguese population (equal to about 2 million people) plus 20,000 employees. 500,000 copies of the 'Guide to fight food

waste' were distributed. Table 38 presents the economic and environmental benefits that derived from this action.

Table 3 8. Efficiency of Transformar.te, Portugal in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	6,000,000	6,159,132	12,550,984
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	172,140	1,150,163	19,623

However, the main barrier is that, it is much easier to throw away than to rescue the wastage. Doing so implies a lot of will, creative solutions, simplification of processes, and strong sponsorship. Even so, the main barriers that need to be overcome in order to upscale such a project are regulatory and fiscal.

In 2011, 9 citizens founded ‘**DARIACORDAR**’, a non-profit association with the ambition of transforming the world by preventing the increasing food waste in all areas of industry, commerce and consumption, by implementing recovery, recycling and innovation of surplus food, with a focus on cooked food and food approaching its expiry date that is channeled it to people in need [71]. Following that, in 2012, ‘**Zero Desperdício**’ was launched. Its initial work focused on the development of guidelines with the national Food Authorities to make it possible for establishments to donate perishable food as, at the time, the law was misunderstood and people believed it was illegal to donate it. Today, Zero Desperdício redistributes food products - meals, food and beverages – by connecting potential donors with NGOs and charitable organizations, who collect the surplus production and distribute it to their beneficiaries, thus complementing other forms of support such as food banks. [40]

In other words, the aim of Zero Desperdício program is to avoid the production of food waste, actively reducing the overall waste production and related CO<sub>2</sub> emissions, recovering economic value and helping people in need. According to ... the main purpose of this initiative is to be as a gateway between existing entities (donors, receivers, NGOs, Cities)



providing the logistical support and the expertise on best practices and legal requirements to enable the donation process, making sure that it is conducted according to the legislation and following the procedures necessary to guarantee food safety and hygiene[40]. All the donations are registered and categorized in a database that delivers important information and economic, environmental and social KPIs, nowadays communicated and available in the Zero Desperdício website.

This initiative has been constantly growing since the start: it started as a pilot project in 1 municipality in 2012 and now is present in 22 municipalities, and the total number of meals donated in the year 2018 was about 1.7 times higher than in the year 2013. From the data collected between 2013 and March 2019, 3,183 tons of food waste were prevented with a cost of 400,000€. More specifically, in 2018, 6,365,962 equivalent meals were donated, 3,941 families and 8,799 beneficiaries were supported and 412 volunteers were occupied. Currently, this program is implemented in all of Portugal including Madeira and Agores and at the moment it has 488 donors and 215 receiving entities [40]. Table 39 presents the economic and environmental benefits that derived from this action.

Table 3 9. Efficiency of Zero Desperdício, Portugal in terms of economic and environmental benefits between 2013 and March 2019

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	16,063,106	12,991,979	26,459,859
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	662,064	109,233	155,526

The **“Zero Waste Collection”** is a collection of 4 books that aims to prepare the next generation to fight against food waste, and change their attitude and behavior. This action completes other programs developed by Zero Desperdício/DARiACORDAR (action **R8**) focused on food redistribution, with the inclusion of a pedagogical-training component targeting at the younger generations.

The **‘Rede de apoio alimentar “Food support network”** project started in 2012 (ongoing), when the City Council of Espinho (Portugal) with the support of the Espinho Delegation of the

Portuguese Red Cross, the Espinho Parish, and the NGO CerciEspinho started to coordinate the daily collection of surplus meals from three schools canteens in the city, to serve them to people in need on the same day. The work is conducted by one salaried person supported by a group of volunteers (approximately 9). A thorough monitoring of the quantities of food redistributed is not implemented, but an estimation of the number of meals delivered daily has been provided. From an evaluation during one school year (160 days), it was estimated that around 7,800 meals were donated and thus 3,276 kg of food waste were prevented, with a cost of around 1,200€ in addition to 5,360 volunteer hours [40]. Table 40 presents the economic and environmental benefits that derived from this action.

Table 40. Efficiency of Rede de apoio alimentar, Portugal in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	10,653	15,208	30,974
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	577	2102	69

This initiative reached several members of society: a number of different entities, the city council, the red cross and the parish, that started collaborating towards a common goal; the school canteen staff members and the volunteers involved, that became more aware of the issue of food waste; and the families’ beneficiaries of the program, that thanks to it could have one full meal a day. A key success factor was the cooperation of different actors towards a common goal, giving priority to the interest of the people in need. The main barrier identified was the bureaucratic work needed to implement the action. [40]

**‘Don’t waste it! Take what's yours!’** is an initiative of Resíduos do Nordeste EIM S.A., a Portuguese waste management company. It was run for five weeks in 2014, during the European Week for Waste Reduction (EWWR). This initiative took place in two Portuguese municipalities, where 245 reusable plastic boxes were distributed across four restaurants, to enable their customers to take home their leftovers. This action had two main goals. On one side it aimed at reducing the amount of food waste generated by restaurants, and reducing the costs associated with its collection and treatment. On the other, it aimed at raising awareness amongst customers on the issue of food waste and introducing the habit of taking home and reusing leftovers, that so far has been seen as a sign of low economic resources. Finally, the decision of providing leftovers in a reusable container rather than using a conventional doggy bag was taken to avoid the production of packaging waste and introduce

the habit of using such containers also at home. The main barriers encountered were the following:

- The regional custom of serving large portions, which means that customers expected to be served more than what they can eat.
- The preconception of taking home the leftovers, and the lack of trust of some customers that did not believe that they were given the leftovers and the lunch box for free.
- The cost of reusable lunch boxes as opposed to disposable ones.
- A resistance in some restaurants staff to report information on the number of portions prepared and the cost (as it was felt as sensitive information). This was overcome by explaining them the importance of collecting accurate data. [40]

The **‘Movimento Menos Olhos que Barriga “Less Eyes than Belly”**’ campaign, ongoing since 2013, takes place in all the food outlets of the University of Minho (Portugal). It is run by the catering services at the University and involves student volunteers. The campaign consists of a set of targeted measures aimed at increasing awareness about food waste and minimizing the amount of wasted food through the University. The primary objective is to educate and inform individuals about the issue of food waste while actively working towards its reduction. However, the main challenges encountered were the following:

- Operationalization of the whole process: with three canteens and so many daily users, it was necessary to create many work teams and the overall coordination of the entire process was very challenging.
- Raising people's awareness of the food waste problem is not always easy, requiring a lot of effort and dedication.

**AGROMAIS, AGROTEJO, the Portuguese Federation of Food Banks Against Hunger (FPBACF) and ENTRAJUDA, in 2018, joined forces in the project “RESTOLHO - a Second Harvest so that nothing is lost”, a totally differentiator in the fight against food waste.** ‘Restolho’ is a gleaning activity organized by Entrajuda (NGO) in collaboration with a large group of farmers. The collected products are then donated to a number of food banks. [72]

The **‘Food Bank’** Association coordinates the operations of 21 Portuguese Food Banks. Activities focus on the logistical processes that safeguard food safety and hygiene conditions (from retrieval to distribution) and on collaborating with agricultural producers' organizations to manage and distribute withdrawals of fruits and vegetables.

**‘Distribuição de refeições que sobram em refeitórios de uma escola e da CerciEspinho’** refers to a daily collection of surplus meals from three schools in the city of Espinho, which are then served to people in need on the same day. This initiative is coordinated by the

Municipality of Espinho, with the support of the Espinho Delegation of the Portuguese Red Cross, the Espinho Parish, and the NGO CerciEspinho. [40]

The **‘Solidarity Tray’**, by Banco Alimentar, refers to awareness campaigns directed towards customers of catering companies active in universities, schools, hospitals and businesses. Following huge challenges in 2020 and 2021 resulting from the COVID-19 pandemic, the Banco Alimentar do Algarve carried out another solidarity campaign to collect food on November 26 and 27.

DECO, a Portuguese consumer association, organizes the **‘Green Chef’** project, which invites schools to produce videos with culinary recipes made from food leftovers and/or culinary recipes with better food use, with the objective to sensitize young consumers to prevent food waste and the adoption of responsible consumer behavior. [73]

The following table summarizes the number of actions reported for each stage of the food supply chain and action’s sub-type as identified in Portugal.

Table 41 . Number of actions reported for each stage of the food supply chain and action sub-type in Portugal

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	1		1	5	
	Gleaning	3				
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign	1	1	2	3	4
	Digital tool BC					1
	School programs					1
	Awards				1	
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging				1	
	Training & guidelines					
	Price discount				1	
	Imperfect produce sale					
	Certification					
	Public procurement				1	
	Digital tools SCE				1	
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy	1	1	1	2	1
	National FW prevention program					
	Fiscal incentives					

#### 4.29 Romania

The Romanian Law 217/2016 (amended in 2018), concerning the decrease of food waste, includes several measures to reduce food waste across the food supply chain. Following its evaluation in 2019, the law was modified once again to facilitate the donation of surplus food, by simplifying the donation contracts and by clarifying the type of food business operators that can redistribute food. Donated foodstuffs are excluded from the application of VAT, if redistributed within 10 days before the expiration of their date of minimum durability. [74]

The Ministry of Agriculture and Rural Development (MADR) is carrying out initiatives to educate consumers regarding food loss and waste such as awareness raising campaigns, school activities, seminars and trainings, events etc. Furthermore, the MADR collaborated with the Ministry of Education for the implementation of an information campaign called **'You can protect the planet as well! Together we start reducing food waste'**, aimed at educating and informing school students about the economic, social and environmental impacts of food waste. Following an agreement with the Food and Agriculture Organization of the United Nations, the **'Do good: Save food! - Educating future generations for a zero food waste world'** educational materials will be translated into Romanian.[40,75]

Additionally, the MADR applies and monitors the legislation related to food waste. In the context of the sectoral plan 2019-2022, the ministry financed a project on methods for food waste reduction along the food chain, at national level, in order to prevent and reduce socio-economic impacts, until 2030 (ADER project 18.1.2). [40] The project aims to:

- Conduct an impact assessment related to food waste at national level for 2020;
- Estimate the socio-economic costs of food waste along the entire food supply chain by 2030;
- Establish methods and economic models to prevent and diminish food waste along the whole food supply chain, in order to gather necessary data for the adoption of public policies;
- Conduct a study related to the new food donation methods and techniques, with the aim to reduce food waste, elaborate manuals and guides of good practices.

The project will also analyze the evolution of food waste levels as a result of different models of public policies, as well as the costs associated with the implementation of these scenarios by 2030.

The Hypermarket chain Kaufland Romania has launched the first integrated anti-food waste campaign with its **'Social Canteen' project** for low-income families and homeless people. The company provides the products necessary to prepare community meals. Some of the food comes from stocks that need to be sold quickly and the daily menu is set to make optimal use of all resources. To date, 48 tons of food have been salvaged, mainly meat, fruit and vegetables. Over 100,000 servings have been offered to those in need [48].

Romanian '**bonapp.eco**' has launched a mobile application to combat food waste. To turn the sustainability challenge around food waste into an economically feasible business opportunity, the app is used to purchase food close to its expiry date from retailers. Already, 35 businesses in Bucharest have joined the initiative, and expansion plans include rolling out the app across eastern Europe, signing up 5,000 locations and selling 30 million meals by 2023 [76].

The **Food Bank** is a project/campaign aimed at preventing disposal of edible food, which has been developed in three cities in Romania, namely Bucharest, Cluj and Roman, and in which over 15 companies are participating. The Food Bank has distributed food from traders/economic operators to disadvantaged people and has involved 72 non-governmental organizations, two food trucks and a 300 square meter refrigerated hall. Over 215 tons of food were distributed before 2018. The project continues to develop and grow and involves more donor companies and many volunteers.[77]

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Romania.

Table 4 2. Number of actions reported for each stage of the food supply chain and action sub-type in Romania

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				1	
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					1
	Digital tool BC					
	School programs					1
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement				1	
	Digital tools SCE			1	1	
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program	1	1	1	1	1
	Fiscal incentives					



### 4.30 Serbia

It is estimated that around 770,000 tons of food are wasted or lost in Serbia each year. This amounts to 110 kg of food waste per person per year and is about 80 kg below the EU average; however, exact data on food waste in Serbia do not exist

The Food Bank, known as Banka Hrane, is a significant organization in Serbia that has been connecting people who have excess food with those in need since 2006. Its primary function is to act as an intermediary between food donors, social institutions, and associations. In order to manage food near its expire date, certain retailers have implemented "discount labels" indicating reduced prices, such as 30% or 50% off.

In Serbia, the city of Belgrade implemented the 1-year pilot project 'The Food Shifters: A voluntary scheme for sustainable food waste management.' This project was launched by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany, in collaboration with the United Nations Development Program Serbia and the city of Belgrade. The primary objective of this waste management project was to establish a voluntary system for managing food waste generated by major sources in Belgrade, including retailers, restaurants, hotels, catering businesses, and public institutions like hospitals and kindergartens. The project aimed to redistribute edible food through a digital platform and an application, facilitating easy access to food for those in need. [79]

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Serbia.

Table 4 3. Number of actions reported for each stage of the food supply chain and action sub-type in Serbia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation				1	
	Innovation of products - packaging					
	Training & guidelines					
	Price discount			1		
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement			1	1	
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

### 4.31 Slovak Republic

In 2016, the Ministry of Agriculture and Rural Development of the Slovak Republic created a "plan for the prevention of food waste" with the following strategies:

- Creating a comprehensive list of factors contributing to food loss and waste within different stages of the food supply chain. This would include proposing potential solutions to minimize waste, such as optimizing production processes and implementing the best available technologies.
- Promoting the efficient use of investment subsidies, economic incentives, price signals, taxes, sanctions, and benchmarking to encourage behavioral changes that reduce food waste.
- Establishing a platform with a defined status to facilitate cooperation in quantifying and reducing food loss and waste, specifying the nature and extent of collaboration.
- Developing proposals for beneficial uses of food that would otherwise be lost or wasted, such as utilizing it as animal feed while adhering to relevant legislation.
- Evaluating the simplification of regulations regarding the donation or transfer of expired food for animal feed purposes.
- Implementing provisions to facilitate food donations for charitable causes.

These measures were implemented to address and combat food waste in the Slovak Republic.

Slovakia is considering the implementation of a **ban on food waste landfilling for food originating from the retail sector**. The positive outcomes of this law would be that retailers will find ways to donate food that has reached its expiry date to charities and producers of livestock feed. There is also a possibility of extending the measure to restaurants, food producers and the agricultural sector [79,80].

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in the Slovak Republic.

Table 44 . Number of actions reported for each stage of the food supply chain and action sub-type in Slovak Republic

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					1
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy			1		
	National FW prevention program					
	Fiscal incentives					

#### 4.32 Slovenia

In Slovenia, measures to reduce food loss and waste are included in the strategy for the entire food supply chain, developed by the Ministry of Agriculture, Forestry and Food (not yet adopted).

Training sessions are offered to public and private sector officers on strategies to reduce the 'food print' (the amount of wasted food) through the **'EAT Circular' project**, sponsored by the European Institute of Innovation and Technology — Climate Knowledge and Innovation Community. Topics covered by the training sessions include policy, best practice, processes, business models, and technologies to measure food waste/surplus, 'divert' it and avoid disposal.[40,81]

Furthermore, the non-governmental organization Ecologists Without Borders (Ekologi brez meja) carried out a project entitled **'Food waste prevention in the public sector and households — Do not throw away food!'**, co-financed by the Ministry of the Environment and Spatial Planning. The main focus of the project was to prevent food waste in hospitals and retirement homes, and its results included a toolkit for monitoring food waste, the awareness-raising campaign **'Just eat it!'** and workshops for intergenerational integration (where the elderly taught young people about good practices with food).

**A working group for food donation**, established in 2013, aims to solve the issues that humanitarian organizations face when redistributing food. The Agriculture Act includes provisions for helping humanitarian organizations that distribute donated food meet the cost of technical equipment, with contributions from the Ministry of Agriculture, Forestry and Food. Within the framework of tax legislation (the Act that defines the rules on implementing VAT), the price of donated food is equal to zero if the total value of donated goods does not exceed 2 % of the donor's revenue. [82]

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Slovenia.

Table 45 . Number of actions reported for each stage of the food supply chain and action sub-type in Slovenia

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign				1	1
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines		1	1		
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy	1				
	National FW prevention program					
	Fiscal incentives					

### 4.33 Spain

The national circular economy strategy **Circular Spain 2030** aims to reduce the generation of food waste throughout the food chain by 2030, as follows: 50% reduction at household and retail level and 20% in the production and other stages of the food supply chain. [83]

In 2019, the Catalan Food Safety Agency developed a **Guide to good hygiene practices for food waste reduction in restaurants and retail trade**. Following that, in 2020, the ELIKA-Basque Foundation for Agro-food Safety of the Basque Country developed '**Guidelines on food donation of surplus food**'. [84]

The Spanish non-governmental organization has introduced a voluntary initiative called 'Stop wasting food', which involves stakeholders at various stages of the food supply chain. The primary objective of this initiative is to make the value chain more efficient. Additionally, producers and retailers are implementing voluntary agreements like 'Feeding implies no waste, use it all!' to investigate and minimize food waste through the implementation of specific measures.

An exemplary measure introduced by the Castilla-La Mancha region is an official seal to identify companies or producers voluntarily participating in the fight against food waste.

**Alimentos Sin Desperdicio** is a redistribution program run by the corporate foundation of the Spanish retailer Alimerka (Fundacion Alimerka). The aim of this action is to reduce the food waste generated by the supermarkets involved and provide food to people in need. To this end, the foundation defined a network of neighbouring charitable organizations and assessed their needs (in terms of quality and quantities required) and put in place a food safety training program for all the recipient organizations [85]. To measure the efficacy of the action, the quantities of food redistributed and the number of recipient organizations are monitored, together with the number of supermarkets adhering to the initiative. Besides redistributing food surpluses, the foundation provides training on food safety to the recipient charities and contributes to raising awareness on food waste related issues and on advocating sustainable development. Before the start of the program (baseline situation), 35% of Alimerka supermarkets were donating surplus food to charities. At this point, the share of supermarkets taking part in the initiative has become 60%. The action can be considered effective as an almost twofold increase in the number of supermarkets taking part in the initiative and donating surplus food has been noted. Yet, the main barriers identified within this program were:

- Food safety rules and legislation does not allow to distribute different groups of food (e.g. fresh fish)
- It is not always possible to find NGOs next to the company that can pick up the surplus every day

- Some NGOs cannot receive all types of surplus food due to the lack of technology (e.g. cold chain)
- There are some barriers within the organization, as bringing attention on food waste generation could be seen as a barrier for marketing and sales activities.

It is interesting to note that the annual cost of the action is almost 32,200€ while 2,866 ton of food waste were prevented in a year’s time. Table 4 6 presents the economic and environmental benefits that derived from this action.

Table 4 6. Efficiency of Alimentos Sin Desperdicio, Spain in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	11,069,130	16,709,615	39,772,141
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	443,708	1,800,143	44,606

**Espigoladors (Gleaners)** is a Catalan, non-profit and social business that collects products left to rot in the fields (either for cosmetic criteria or overproduction etc.) and distributes it to food banks and social entities. The volunteers involved in the collection (gleaning) come from different sectors of society, including those in a situation of vulnerability. A small part (5-10%) of the produce recovered is used to make jams, pâtés, sauces, creams. This creates employment for people in social disadvantage and the profits are used to finance the rest of the project. Finally, they organize workshops and activities for all kinds of publics, but especially for kids, to raise awareness on the problem of food waste.

Success factors of this action are considered to be the following:

- Team consolidation through trust and empowerment
- Professionalisation of the team and the practice
- Networking and establishment of key partnerships
- Indicators driven: show expansion capacity, social and environmental value added
- Resilience: adaptation to changes allows to evolve and to take new opportunities.

Yet, barriers have also been identified such as:

- Funding: the initiative has been launched from almost zero investment, its speed depends on the injection of money. Grants and entrepreneurship programs allow it to grow.
- Gleaning: new activity in Spain, very sensitive in the primary sector. Overcome by the professionalism and giving guarantees and trust to the farmers. [86]



National strategy **“More food, less waste” (2013 – ongoing)** is a voluntary framework fostering the collaboration between all sectors of the food supply chain, national and regional administrations and NGOs. It was developed by the Spanish National Government to answer the requirements of the European Parliament in its "Resolution of 19 January 2012 on how to avoid food wastage: strategies for a more efficient food chain in the EU", and to address the problem of food loss and waste in Spain. The first phase of the Strategy took place from 2013 to 2016 and had five main areas of action: 1) review of studies on food loss and waste; 2) spreading and promoting good practices and awareness; 3) analyzing and reviewing regulatory aspects; 4) collaborating with other actors; and 5) promoting the design and development of new technologies. During the second phase (2017-2020), the Strategy was organized around eight thematic areas: 1) knowledge generation; 2) training and awareness; 3) fostering of best practices; 4) collaboration with stakeholders; 5) sector specific agreements; 6) regulatory aspects; 7) research and innovation; and 8) food waste, environment and climate change.

No tires la comida “Do not waste food” is an initiative launched by the Spanish Organization of Consumers and Users with the goal of promoting awareness about food waste. It offers advice to consumers on ways to reduce their food waste generation and to retailers and authorities on how to implement actions to reduce household food waste generation.

Since 1988, Mercadona, a Spanish retailer, has been running an initiative called "The Whole Tree." This program focuses on repurposing imperfect or second-rate fruits and vegetables by redirecting them to other suppliers who transform them into valuable products such as jams, sauces, and juices.

The following table summarizes the number of actions reported for each stage of the food supply chain and action’s sub-type as identified in Spain.

Table 4 7. Number of actions reported for each stage of the food supply chain and action sub-type in Spain

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution			1		
	Gleaning	1				
	Digital tools R					
Food valorization	Value added processing			1		
	Animal feed					
Behavior change (BC)	Awareness/educational campaign			1		2
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging			1		
	Training & guidelines	1	1	1		
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement	2	2	2	2	2
	Regulatory framework/policy		1		1	
	National FW prevention program					
	Fiscal incentives					

#### 4.34 Sweden

The Swedish Government has adopted two milestone targets within Sweden's environmental objectives that aim to reduce the total food loss and waste generated along the entire food supply chain, in accordance with the Sustainable Development Goal Target 12.3. These are:

- i. From 2020 to 2025, the total amount of food waste should be reduced by at least 20% by weight per capita.
- ii. By 2025, an increased share of the food production should reach retailers and consumers.

All milestone targets are followed up on a regular basis, with annual reports for the government and an in-depth evaluation once every parliamentary term. They are also part of the revised Swedish waste management plan and waste prevention program 2018-2023.

The national strategy on food waste prevention, known as "More to do more," which was introduced in 2018, has been put into action and expanded upon. The primary areas of emphasis within the national efforts to prevent food waste include:

- Establishing a national goal and creating methods for monitoring progress
- Encouraging active cooperation among all sectors involved in the food supply chain
- Promoting changes in consumer behavior
- Supporting research and innovation.

In 2020, the Swedish Food Agency, the Swedish Board of Agriculture and the Swedish Environmental Protection Agency received a new joint, 6-year government assignment to reduce food waste. As part of the national food strategy, the government is committed to a mission aimed at reducing food waste across the entire food chain. This objective aligns with the action plan titled "More to do more! Action plan for reduced food waste 2030" or "Fler gör mer! Handlingsplan för minskat matsvinn 2030." The plan encompasses various measures implemented at every stage of the farm-to-fork process. Progress on these actions is reported to the government on an annual basis, emphasizing collaborative efforts between authorities and relevant stakeholders.

The Swedish Food Agency has also co-financed a voluntary agreement in the food industry '**Cooperation for reduced food waste**', which was launched in 2020. The food industry, together with public authorities, develop measurement methods and measures to reduce food waste. Developed measurement methods will provide the knowledge needed to choose the right measures for reducing food waste.

To determine baseline information on food lost in the first part of the farm-to-fork chain, a national method for monitoring food losses has been developed. The national method is based on eight product flows: (1) beef, (2) pork, (3) milk, (4) fish, (5) wheat, (6) potatoes, (7)

carrots and (8) strawberries. The follow-up method is also expected to increase knowledge about food waste and other waste from food production, as the methods will evaluate how the food lost was used when not consumed by humans. This method is complementary to the food waste monitoring methodology.

'**Matcentralen**' is a social enterprise redistributing surplus food, started in 2015 and run by Stockholms Stadsmission (Stockholm City Mission), an NGO active in Stockholm. Through this program, surplus food donated by the industry is redistributed via food banks, social supermarkets and a food waste restaurant. In parallel, Matcentralen offers a program of labor integration. A key learning point was the need to establish easy routines to facilitate the donation process for companies.[87]

In 2016, the City of Gothenburg introduced the innovative approach known as the 'Gothenburg model.' This procedure/tool was specifically developed with the goal of achieving a 50% reduction in food waste generated throughout the entire process of procuring, storing, preparing, and serving meals (excluding plate waste). The target set was to reach this reduction by December 2018, measured against a baseline of January 2017. This model provided tips and actions to reduce food waste in the public food sector (approximately 520 public kitchens). The City of Gothenburg trained 40 key employees in all city districts to coordinate the development of the program and approximately 1200 employees to implement the model as a daily routine.

The whole process was very positive . A learning point was that the program would have proceeded more smoothly if the operative managers had been included earlier in the process and the key coordinators had been trained before the remaining employees.

The following table summarizes the number of actions reported for each stage of the food supply chain and action's sub-type as identified in Sweden.

Table 4 8. Number of actions reported for each stage of the food supply chain and action sub-type in Sweden

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution		1			
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign	1	1	1	1	1
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines				1	
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement	1	1	1		
	Regulatory framework/policy					
	National FW prevention program	1	1	1	1	1
	Fiscal incentives					

### 4.35 United Kingdom

The waste prevention program of **England** does not have any quantitative targets, but some initiatives within the program do have their own targets aimed specifically at different materials/sectors, such as the **Courtauld Agreement**. The Courtauld Commitment is a collection of voluntary agreements that have effectively reduced the carbon footprint and overall environmental impact of the food and drink industry in the UK. It was initially introduced in 2005 during a Ministerial event held at the Courtauld Gallery in London. Over time, the Courtauld Commitment has demonstrated its enduring and influential role as a catalyst for significant positive transformations within the sector.[88]

**The Courtauld Commitment 1** (2005-2009) looked at new solutions and technologies so that less food and primary packaging ended up as household waste. It brought food waste onto the agenda. Over the four-year period of Phase 1, 1.2 million tons of food and packaging waste was prevented, with a monetary value of £1.8 billion, and a saving of 3.3 million tons of CO<sub>2,eq</sub>, which is equivalent to the emissions from 500,000 round-the-world flights. As a result of actions by signatories, Love Food Hate Waste, local authorities and charity partners, 670,000 tons of food waste and 520,000 tons of packaging waste was avoided across the UK [89].

**The Courtauld Commitment Phase 2** (2010-2012) built on Phase 1, still aimed to reduce primary packaging and household food and drink waste, but also included secondary and tertiary packaging, and supply chain waste. It moved from reducing weight to reducing the carbon impact of packaging. A total of 1.7 million tons of waste was reduced through the influence of Phase 2. This impact had a monetary value of £3.1 billion and equates to a reduction of 4.8 million tons of CO<sub>2,eq</sub> [90].

The **Courtauld Commitment Phase 3** launched in May 2013 and ran until 2015. It aimed to further reduce the weight and carbon impact of household food waste, grocery product and packaging waste, both in the home and the UK grocery sector. 53 leading retailers, brands and manufacturers worked with the Waste and Resources Action Program (which operates as WRAP) to achieve over £100 million business savings by reducing food waste:

- Product and packaging waste reduced by 3%
- Recovery and recycling rate grew from 95% in 2012 to 99% in 2015
- 7% reduction in carbon impact of food and drink packaging
- A notable increase in surplus food and drink redistributed for human consumption.

The **Courtauld Commitment 2025** brought together organisations across the food system to make food & drink production and consumption more sustainable. The agreement had ambitious targets spanning food waste, water and greenhouse gas emissions. 2015-18 saw a 7% reduction in food waste (480,000 tons), 7% reduction in GHG emissions (7.1 million tons CO<sub>2,eq</sub>) and collective action projects targeting water scarcity.

The **Hospitality and Food Service Agreement** was an ambitious, three-year voluntary agreement developed by WRAP with the industry, for the industry, and supported by all UK governments. It was launched in 2012 with the aim of reducing waste and increasing recycling rates within the sector in the UK. Over 230 leading signatories and supporters signed up to support these aims, covering approximately 25% of the UK sector (calculated by food and drink sales, including wholesale and distribution). A number of these organisations are continuing to work with WRAP under the Courtauld Commitment.

The **Courtauld Commitment 2030**, the current phase of the agreement, enables collaborative action across the entire UK food chain to deliver farm-to-fork reductions in greenhouse gas emissions, food waste and water stress [91].

The **'Welsh Government' program**, in the accommodation and food services sector, is the WRAP led Hospitality and Food Service Agreement (HaFS) and its objective is to prevent food and packaging waste. They intend to publish a consultation on a new resource efficiency strategy and Route Map for Wales in the autumn. It will include consulting on a target to halve food waste by 2025, against a 2007 baseline. According to the Waste Prevention Programme United Kingdom factsheet ([https://www.waste.gov.uk/publications/40001927](#)), the aim is to convince food companies in Wales to go beyond the voluntary commitments set out in Courtauld 2025 — in terms of reducing their own waste arising and to support efforts to encourage the public to reduce food waste further. Retailers should be engaged further on these issues. The forthcoming strategy will include a clear focus on waste prevention.

Another initiative is the **'Integrated approach to increasing redistribution in the UK'** (2015 – ongoing). WRAP (a registered UK charity) is working with retailers, manufacturers, hospitality and food service providers, and redistribution organizations, together with trade bodies and governments to identify ways of increasing the redistribution of surplus food to people. This is done through the provision of new evidence, guidance and tools and a dedicated Redistribution Working Group under the Courtauld Commitment 2025 (C2025). This group seeks to address the challenge of increasing amounts of food redistributed through: (i) developing strategies for long term, high impact solutions; (ii) sharing best practice; (iii) identifying barriers and opportunities and; (iv) overseeing the development of new resources, research and approaches to monitoring progress. To date the following have been delivered: (i) A Framework for Effective Redistribution Partnerships which provides a structured approach to creating partnerships for redistribution, supports consistent exchange of key information and stimulates a structured approach to identifying surpluses suitable for redistribution; (ii) to support business behavior change; (iii) Specific guidance around food labelling, safety and redistribution; (iv) A range of case studies.

Additionally, a methodology for estimating the amount of food surplus being redistributed in the UK was developed with the C2025 Redistribution Working Group. Data were collected by a survey distributed to a list of major organisations whose primary business is redistribution of surplus food. The aim was to quantify the amount of surplus food redistributed to these organisations, and identify which business sector it arose from.

The baseline (amount of food suitable for redistribution in the UK in 2015) was estimated to be 243,000 tons. Of this quantity in 2015, 11% was redistributed (equal to 28,500 tons), while in 2017 the 17% was redistributed (equal to 43,000 tons). Therefore, this action was effective as it enabled an increase in the redistribution of surplus food by 50% compared to 2015. Assuming a linear increase in the amounts of surplus food redistributed from 2015 to 2017, the total amount of food waste prevented thanks to this action was 14,500 tons over two years. Nevertheless, there is still potential for increasing the amounts redistributed, as 83% of the estimated surplus food is still not being redistributed.

From the evaluation of the program for two years' period, it can be estimated that 35 million meals were donated, preventing 14,500 tons of food waste but with a cost of 900,000€. Table 48 presents the economic and environmental benefits that derived from this action.

Table 48. Efficiency of Integrated approach to increasing redistribution in the UK in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	50,000,000	59,184,323	120,536,585
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	2,244,614	8,022,909	296,447

Overall, to meet the C2025 food waste target and UN Sustainable Development Goal (SDG) 12.3, collaborative and concerted efforts to reduce food waste are required. These need to focus on preventing food surplus, redistributing more surplus food that does arise, and diverting more surplus (that cannot be used to feed people) into animal feed. Preventing food waste at source should always come first, but surpluses can arise for a number of reasons; for example, food incorrectly labelled, over-ordered, over-supplied or obsolete seasonal stock.



Businesses do not want to waste food, and redistribution organizations can effectively take surplus food and make sure it reaches people. Bringing together all key actors through the Working Group has been instrumental in driving change. However, there were several challenges identified through the course of this work, including:

- A lack of awareness amongst some businesses of the amounts of food surplus and waste being generated (guidance and tools aimed at implementing widespread and effective measurement were produced)
- Gaps in understanding what types of food might be suitable / safe / legally permitted for redistribution (WRAP worked with Defra and the Food Standards Agency to update guidance to address this)
- Logistical difficulties / sensitivities around branded products (partnership agreements and case studies help address these)
- Competing destinations for food surplus and waste (addressed through reinforcing the food hierarchy via multiple channels and awareness raising by the sector).

Of the amounts of surplus food redistributed reported, 57% came from the retail sector, 37% from food manufacturers, 2% from hospitality and food services sector, and 4% from mixed/other sources. All the results reported include food redistributed by charitable organizations (for free) and food redistributed by commercial redistributors (business that primarily redistribute surplus food for profit).

The UK has had large-scale national interventions in place since 2007 aimed at reducing household food waste (HHFW). The strategy that WRAP developed, for that reason, involved three main types of activity: **national/large scale communications initiatives** (2007 – ongoing) (awareness raising & enabling behavior change), community engagement & support (again awareness raising and enabling behavior change but at a local level) and changes to products, packaging and labelling to make it easier for people to waste less food. WRAP launched the consumer facing campaign Love Food Hate Waste in 2007 to help deliver practical ways to reduce food waste, and expanded an agreement with the food industry to encompass HHFW. Very little was known about the extent and make-up of HHFW prior to 2007. WRAP launched a series of large research projects and published high profile reports to raise awareness of the need to take action, and where this action needed to be focused. Targets to reduce HHFW were introduced into national voluntary agreements, to highlight the key role that retailers and other food businesses had to play, alongside national and local governments, community groups and others. The main key success factors were:

- A comprehensive evidence base that helped secure high profile media coverage, the interest of a wide range of partners and consumers themselves. This evidence base helped direct the development of effective resources and recommendations for partners.

- Working with a wide range of partners, who had the trust of consumers and who could reach different groups of the population. This included retailers and large brands, local authorities, community and other groups etc.
- Adopting a positive and helpful tone, and ensuring that messages and benefits were motivating to consumers (e.g. monthly/annual cost savings were much more appealing to most than 'hard' environmental messages) and advice was easy to implement (e.g. 'fruit in the fridge', simple rather than complex recipes).
- Taking a multi-channel and multi-pronged approach. For example, helping to dispel myths and concerns around freezing food was made much easier when done in parallel to changing 'official' advice and on-pack labelling.
- Supporting behavior change work with technical innovations that increased shelf-life, improved labelling, offered more appropriate pack sizes and new functionality that kept food fresh for longer.
- Addressing barriers 'head on' with new evidence and through engagement with influential stakeholders (e.g. the perception that packaging was 'bad' for fresh produce). One of the major challenges was trying to ensure 'joined up' communication with consumers and businesses on related issues such as food waste recycling, food safety and diet. Working closely with governments and regulators helped mitigate against this risk. Securing sufficient funding/resources from the public and private sector is also not easy, when large scale and difficult behavior change is needed. Research showing how concerned consumers are about food waste, and what they expect business and others to do to help them, has been helpful.

All these interventions have led to significant reductions in supply chain food waste at a UK level. Critical elements of success include having a strong evidence base upon which to set ambitious but realistic targets and to identify where businesses should target action, practical guidance, tools. There has been skepticism amongst some NGOs and others about the ability of voluntary approaches to deliver meaningful impact (vs regulation), and therefore having a sufficiently large signatory base covering a significant percentage of each sector was critical for credibility. The support of government was also key to success, for funding, credibility and to ensure a close link between policies and the agreement deliverables. Retailers and trade associations played a central role in helping to recruit and reach the widest possible number of suppliers and smaller businesses.

**FoodCycle** (2008 – ongoing) is a UK charity that combines surplus food, spare kitchen spaces and volunteers to create three-course meals for people at risk of food poverty and social isolation. FoodCycle operates from London, England, but has operations throughout the United Kingdom. At FoodCycle, success is providing a safe, welcoming space for vulnerable people to enjoy a tasty, community meal. Food waste is a vehicle that enables to achieve this

goal and to have a positive environmental impact. On the other hand, a key barrier is access to food waste in certain areas of the country. There are more charities looking to make use of surplus food and a more joined up approach is needed to ensure all those who need it, can access it.

Table 49. Number of actions reported for each stage of the food supply chain and action sub-type in United Kingdom

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution		1	1	2	2
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed				1	
Behavior change (BC)	Awareness/educational campaign				1	2
	Digital tool BC					2
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging		1			
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement		1	2	2	1
	Regulatory framework/policy					
	National FW prevention program	1	1	1	1	1
	Fiscal incentives					

### 4.36 Andorra

For **Andorra**, only one food waste prevention action was found. The **Comú d'Escaldes-Engordany** prepared a presentation for the citizens explaining what the composting process consists of. In this presentation it is explained explain what compost is, how it is produced, which are the different stages of this process, which are the admissible residues, and finally, some tips to ensure optimal fertilizer production. After having acquired the basic knowledge on the production of compost, it is presented how to make composters from recyclable materials, such as logs, olive metal drums and more, through a workshop at the citizens of the Comú [92].

Table 50. Number of actions reported for each stage of the food supply chain and action sub-type in Andorra

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					1
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

### 4.37 Switzerland

Around one third of all edible food is lost or wasted between the field and the plate in Switzerland as is the case for the EU in general. More specifically, food waste amounts to around 2.8 million tons per year in Switzerland (Beretta and Hellweg (2019). This corresponds to about 330 kg of avoidable food loss per person per year.

**Partage** is a food bank active in the Canton of Geneva since 2005. Partage collects and sorts unsold stock from Geneva's food stores and companies in order to distribute them free of charge to associations and social services, which assist and provide food for those in need in Geneva. Through its action, Partage fights against food waste and supports professional rehabilitation. No food waste reduction programme existed in the Canton of Geneva prior to the Foundation of Partage, therefore it has pioneered the food waste discussion in this region. Partage monitors and records all quantities of food collected and redistributed. Fundraising is always a challenge in this kind of projects but Partage has managed to reach its funding goals every year.

Partage has been growing since its start in 2005. In 2010 it redistributed 549 tons of food, amount that was almost doubled in 2017. From the evaluation of the program in 2017, it was estimated that 940 tons of food products were redistributed from which 90 tons were vegetables processed into soups, and the remaining 850 tons were donated as meals. Thus around 850,000 meals were donated. This corresponds to 12,375 people receiving donations weekly through 57 charities and social services. 37 people in professional reintegration and 600 volunteers were involved, rendering the cost of action 4 million €. Table 51 presents the economic and environmental benefits that derived from this action.

Table 51. Efficiency of Partage, Switzerland in terms of economic and environmental benefits

	Economic benefits (€)	Environmental savings	
		Climate Change (kg CO <sub>2</sub> eq)	Water Use (m <sup>3</sup> eq)
Economic value of the food diverted from waste / Environmental impacts linked to the production of food replaced by the donated food	6,800,000	3,309,160	6,675,911
Avoided cost of the waste treatment/ Avoided environmental impacts of the waste treatment operations	195,728	32,293	45,979

Table 52. Number of actions reported for each stage of the food supply chain and action sub-type in Switzerland

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution					1
	Gleaning					
	Digital tools R					
Food valorization	Value added processing					
	Animal feed					
Behavior change (BC)	Awareness/educational campaign					
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount					
	Imperfect produce sale					
	Certification					
	Public procurement					
	Digital tools SCE					
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					



- **Guidelines on food waste reduction and donations in the hospitality sector (2017)**

HOTREC, the umbrella Association of Hotels, Restaurants, Bars, Cafes and similar establishments in Europe, published in 2017 a set of guidelines for its members to help hospitality businesses prevent and reduce food waste. This brochure also contained joint recommendations with the European Food Banks Federation (FEBA) to help hospitality businesses willing to partner with local food banks on the donation of unused food. The brochure was developed considering that the hospitality sector is composed largely by micro-enterprises facing specific challenges (e.g. non standardized production methods and dishes, handling of small quantities of ingredients, difficulty to assess in advance expected occupancy of a restaurant, small operational margins making any business sensitive to administrative burdens). HOTREC therefore decided to help these businesses by setting concrete guidelines to implement in their daily operations to prevent and reduce food waste and to donate surplus food.

The main barriers/obstacle to overcome were linked to the composition of the sector and its heterogeneity: 90% of hospitality businesses are micro-enterprises, often operating on low profit margins and with limited resources available. They need simple solutions that do not imply costs or burdens.

Success factors of this actions were that hospitality businesses are welcoming guidance documents with a focus on simple tips and recommendations to be easily introduced in daily operations, and that micro-enterprises particularly welcome the link made with cost-savings due to the prevented food waste, as well as the possible marketing benefits towards clients.

The European Food Banks Federation (FEBA) is a European umbrella nonprofit organization and works in collaboration with 24 members and 4 projects in European countries. For more than 30 years, FEBA mission has consisted in representing its membership at European and international level, supporting and strengthening food banks in Europe by providing training, sharing best practice and knowledge, and developing partnerships, and fostering the creation of new food banks.

- **Every Meal Matters**

Organization: Food Drink Europe

Short summary: Guidelines on food donations, developed to help food and drink manufacturers and retailers to put in place internal processes to redistribute surplus food in order to maximize the resource efficiency benefits.

## 5 Review of existing programs at national level

### 5.1 Introduction

The Cypriot production of household waste per capita is among the highest in Europe. According to the Statistical Services of the Republic of Cyprus in 2017 the waste generation reached 636 kg per capita, placing Cyprus second after Denmark which generates 781 kg. Overall European Union averages to 486 kg per capita, a third of which (i.e. 88 million tons) is Food Waste.

The Cypriot **policy on waste management** is based mainly on waste hierarchy (prevention, reuse, recycling, recovery, disposal) and the correct environmental handling. The ultimate aim is to protect the environment and human health. This is achieved through the reduction/elimination of the negative effects of the generation and management of waste, the promotion of reuse, recycling and recovery and generally the environmentally sound management in order to reduce the disposal in landfills and to reduce the overall impact of the use of resources by improving the efficiency and effectiveness of their use.

In a report prepared by Frederick University for the Department of Environment of Cyprus entitled “Measurement, Recording and Preparation of a Report on Food Waste Levels at Various Stages of the Food Supply Chain”, the quantities of food waste were measured and recorded in all stages of the food supply chain, based on a methodology and format established by the European Environment Agency. Results on food waste generation in Cyprus for the year 2018 are presented in Table 53.

Table 53. Results of overall food waste production in Cyprus (year 2018)

Supply chain stage	Food waste (tons)	Per capita per year (kg per capita)
Primary Production	43,564	50
Processing	169,706	194
Retail and other food distribution	50,268	57
Restaurants and food services	27,145	31
Households	63,338	72
<b>SUM</b>	<b>354,021</b>	<b>404</b>

Clearly, the largest source of food and agro waste in Cyprus is generated in the stage of food processing, while households, retail, distribution and primary production are following in similar levels.

## 5.2 Ongoing and completed food waste prevention programs

**Zero Food Waste Cyprus**, launched in February 2018, is an initiative of young volunteers aimed at reducing food waste by collecting “waste food” from local markets and re-distributing it to anyone in need in Nicosia. It all started through the vision of one person to prevent food from being thrown away, which contributes to climate change as well as food inequality. Alexia Kalourkoti came up with the brilliant idea to meet the local vendors at the "OXI" food market and through some fruitful discussions, managed to get their support. They agreed that food waste "is an inefficient management of resources" and they were willing to donate to her, what would have otherwise been wasted. Thus, the initiative was born. In 2021, the initiative became Bi-Communal, realizing that climate change has no borders; they are now operational in North Cyprus, Kyrenia.

The main values of the project are:

- Zero Hunger: end hunger, achieve food security, improved nutrition and promote sustainable agriculture. They aim to reduce hunger by distributing food for free to anyone in need, while the spoiled food is composted.
- Circular Economy: re-use, reduce and recycle products.
- Sustainability.
- Equity at all levels, including gender, race and inter-generational.

Within **Zero Food Waste Cyprus**, specific initiatives take place in South and North Cyprus. More specifically, "**Saturday Aftermarket**" in Nicosia and "**Wasteless Wednesday's**" in Kyrenia [55] are implemented. Volunteers visit the local markets and collect food that would have otherwise been wasted. This food is then sorted and distributed to vulnerable groups of people contributing in this way to a circular economy. At the same time, their aim is to raise awareness about the issue of food waste and how it can be tackled. More specifically, the steps below are followed:

1. Volunteers arrive at the "OXI" market
2. Food Collection Begins, volunteers visit food vendors and collect the food that would have otherwise been wasted.
3. Food Gets Sorted in Boxes, preparing the food for re-distribution and data gathering of what has been collected.
4. Boxes are Transported to Distribution Centre
5. Beneficiaries are assigned a Queue Number, making sure Covid-19 precautions are carried out to ensure the safety of both volunteers and beneficiaries.
6. Distribution Begins
7. Cleaning of the Distribution Centre and donating the leftover food to partner organisations takes place.

8. Debrief and Post-Work Activities.

In Table 54 and Figure 1, the monthly amounts of food and vegetables saved by Zero Food Waste Cyprus program in 2021, whereas in Table 55 and Figure 2 the respective amounts for 2022 are presented. No data were available for January 2021, but it is worth mentioning that the total amount of food saved in 2021 reached up to almost 18 tons and in 2022 was even higher (21.6 tons). Significant deviations among the different months are noticed which cannot be attributed to a specific reason since a specific trend cannot be detected. Whichever the case, these results are very encouraging. The increase in the amount of food saved from 2021 to 2022 also had a major impact on the people that benefited from this action, as it can be shown in Figure 3 where an increase of almost 30% was observed.

Table 54. Food and Vegetables in kilograms saved by Zero Food Waste Cyprus program in 2021

Month	Saved Food and Vegetables (kg)
February 2021	579
March 2021	1729
April 2021	1564
May 2021	946
June 2021	1780
July 2021	2631
August 2021	763
September 2021	2469
October 2021	1886
November 2021	2946
December 2021	657
<b>Total</b>	<b>17950</b>

Figure 1. Monthly rescue of food and vegetables of the Zero Food Waste Cyprus project in 2021

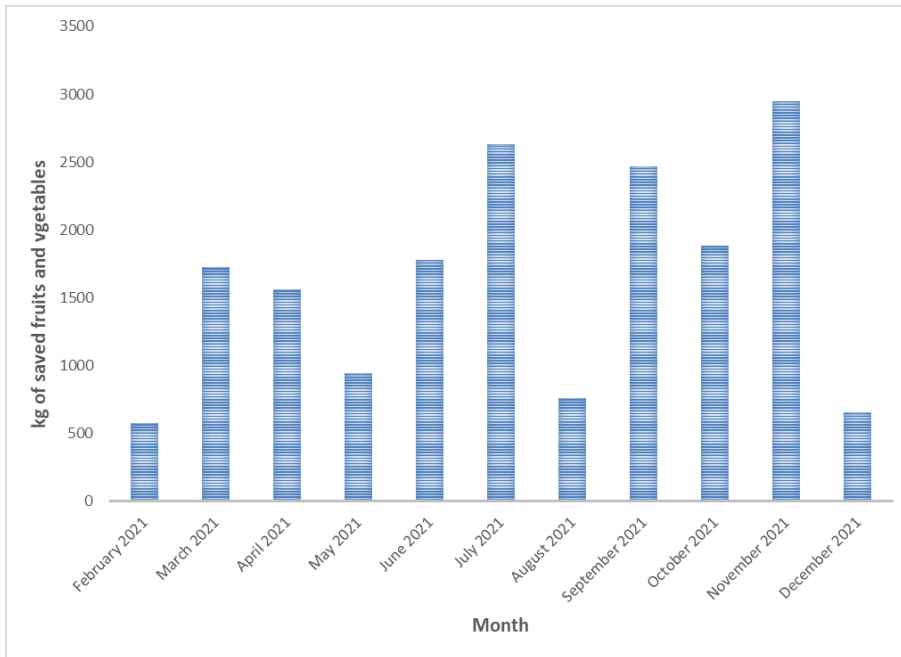


Table 55. Food and Vegetables in kilograms saved by Zero Food Waste Cyprus program in 2022

Month	Saved Food and Vegetables (kg)
January 2022	870
February 2022	1146
March 2022	1012
April 2022	1675
May 2022	1845
June 2022	1876
July 2022	3350
August 2022	1200
September 2022	575
October 2022	1770
November 2022	2257
December 2022	4028
<b>Total</b>	<b>21604</b>

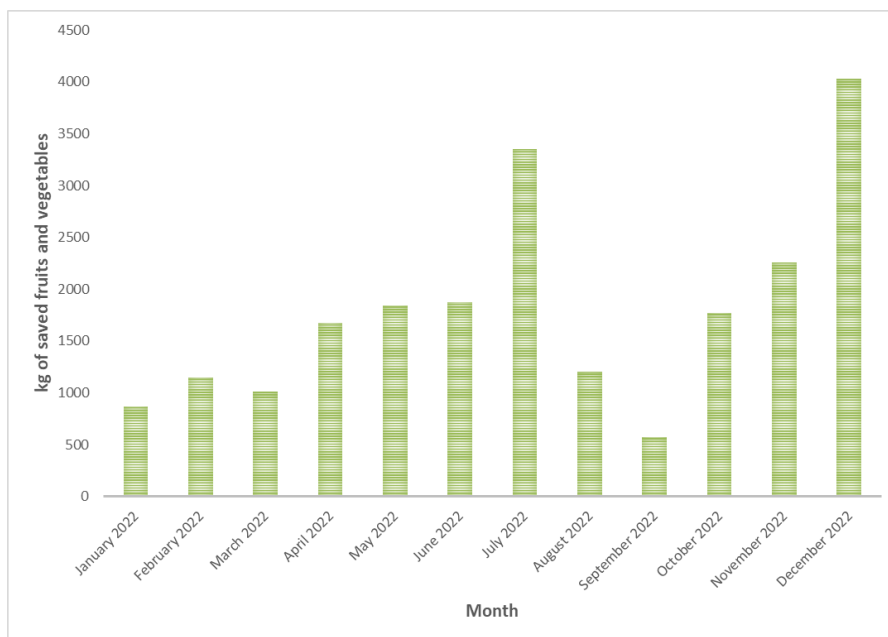


Figure 2. Monthly rescue of food and vegetables of the Zero Food Waste Cyprus project in 2022

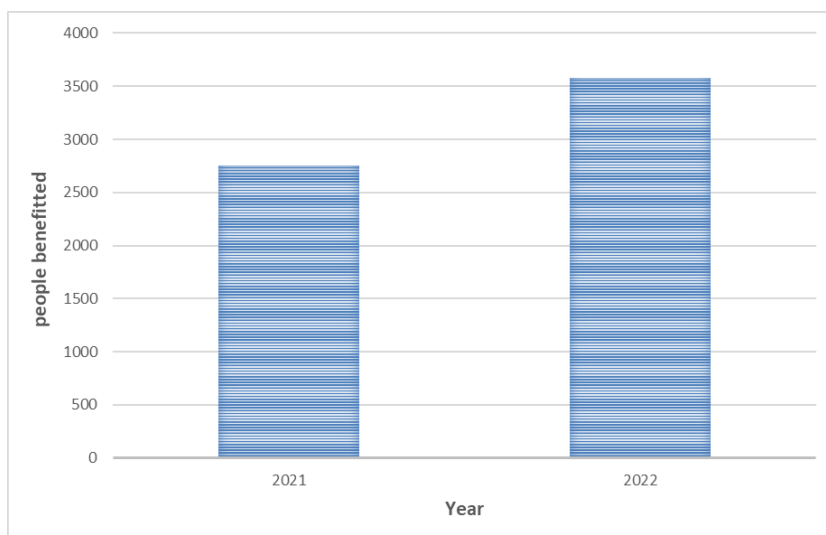


Figure 3. People benefitted from the Zero Food Waste Cyprus in 2021 and 2022

**AKTI** has launched the “**Sincerely Food, Cyprus**” [56], an eight-month long, bi-communal project which is EU-funded under ‘Global learning approach on food waste in non-formal education’ (Project No. CSO-LA/2017/388- 342). It aimed to utilise the engaging material developed by ‘Sincerely, Food’, adapt it to the Cypriot reality, disseminate it and raise awareness about food waste to as wide an audience as possible. The main project activities were:

- the Food for Peace Campaign, a bi-communal action that focused on culinary arts students at two universities aiming to develop a more considerate and environmental culture to be adopted by the future cooking professionals, cooks and chefs.
- presentations in schools to raise awareness

- door-to-door awareness raising in two communities
- a cooking competition focusing on reducing food waste during preparation
- guidelines such as a small information brochure and a notebook on measures to prevent food.

Since domestic workers are the ones managing the cooking activities and thus household food waste in many of the households in Cyprus, the informational material was translated in Filipino as well, the language of the majority of domestic workers in Cyprus [57].

The **WASP Tool** project (Development and Demonstration of a Waste Prevention Support Tool for Local Authorities, LIFE10 ENV/GR/622) was a LIFE+ program (lasted 2011 - 2014). The overall objective of the WASP Tool project was to investigate, demonstrate and optimize the waste prevention potential at the local authority level. More specifically, it attempted to transfer and adapt experience from successful waste prevention activities implemented across the EU to Greece and Cyprus. The project was developed and implemented three waste prevention strategies, one for each of the pilot areas participating in the project (two in Crete, Greece and the third in Cyprus) [58].

A web-based decision support tool (the WASP Tool) was developed to enable local authorities to select and implement the optimum waste prevention programs for their local circumstances. The tool takes into account both local data, such as population and waste production per inhabitant, as well as local authorities' preferences concerning the overall design of their waste management policies and strategic goals. It extracts characteristics and features of implemented waste prevention strategies, it models them, and it applies multi-criteria evaluation techniques in order to facilitate decision making. It interacts with users to determine the significance of each evaluation factor and evaluates waste prevention activities accordingly. The output of the system includes a ranking of the appropriate waste prevention activities, as well as estimated results for each activity, taking into account local demographics and waste parameters [59].

Approximately 11,000 households were directly involved in the pilot actions of the project by receiving compost bins, reusable shopping bags, reusable water bottles, and an information/awareness raising campaign on food waste prevention. Importantly, it should be noted that when the WASP Tool project started, there was no waste prevention strategy at national level, in either of the two participating countries.

**Quasimodo Ugly Fruits N' Veggies** (<https://quasimodo.com.cy/>) products are manufactured in Cyprus by Amalthia Trading Nicosia Ltd, one of the largest fruit and vegetable importers and suppliers in Cyprus. The company Amalthia Trading Nicosia Ltd., is active in the import of fresh fruits and vegetables, as well as in cooperation with local producers. More specifically,

the company supplies supermarkets, grocery stores in Cyprus as well as HORECA companies (hotels/restaurants/cafes). It also has a very neat space, the "Old Warehouse" in Pallouriotissa, where you can find fresh fruits and vegetables, as well as Quasimodo products.

The company Quasimodo was established in 2019, with the aim of limiting the food waste disposed of in landfills resulting from the activities of Amalthia Trading Nicosia Ltd. The effort for the years 2020, 2021 and 2022 is very important and promising because a significant part of the food waste is channeled to produce new products, jams, sauces and freshly cut vegetables. Furthermore, it is observed that for the years 2020 to 2022 only a percentage of below 10% of food waste is discarded, while in the years before 2019 all quantities were discarded. Quasimodo's philosophy is about respecting diversity and nature, while reducing the global problem of food waste, one jar at a time [60]. The company's efforts and vision for a more sustainable future have borne fruit by reducing the deposition and alternative management of waste, either as animal feed, or for biogas production, or for its use in processing.

**Rescuedbox** aims to reduce food waste and simultaneously promote a responsible local and sustainable consumption. The main objectives of this program are to:

- Eliminate waste by rescuing 500 tons of food waste by 2025.
- Support local farmers and local farmers' cooperatives that are certified and use approved biological pesticides as per the EU directives.
- Promote sustainability by using recyclable boxes and tape and by optimizing the delivery routes away from traffic further reducing the carbon footprint.
- Help those in need by donating 10% of the rescued boxes to charity every week in order to fight hunger in Cyprus whilst reducing waste.
- Raise awareness by creating strong partnerships with local organisations to spread the message of food waste in general and healthy eating habits to all households and schools in Cyprus.

Rescuedbox sources local, fresh and seasonal delicious fruits and veggies. Based on the produced surplus of the week, rescued boxes are prepared and delivered to consumers [61].

**Waste mapping guidance for hotels** in Cyprus is a guide primarily designed to meet the needs of hotel operators and other organisations in the Cypriot tourism industry. The guide identifies the sources, types and quantities of waste generated and investigates where and how waste is generated. It provides specific guidelines on the way to conduct a dedicated food waste mapping study (e.g. 4 bins - one for each area / type of food waste: spoilage, preparation, overproduced food and plate scrapings, and a simple set of weighing scales). The process helps prioritize areas where simple actions can be taken to minimize waste, save money and achieve sustainable waste management. It provides guidance to chefs, waiting



staff and bar staff, so as to think about how they buy raw ingredients, prepare food and avoid waste being created, as well as how waste produced by guests is disposed of. It is made clear that all staff including chefs, waiters and managers can, and should, get involved in helping to map food waste, and help to identify opportunities to reduce food waste. Following completion of the food waste audit the following must be identified:

- the meal time that produces the most waste;
- the area that produces the most waste;
- the types of food waste produced.

This information when coupled with the budgeted cost of meals provides an indication of which area and meal time to prioritise for further attention.

**FOODPrint** is an awareness raising campaign to prevent and manage food waste among consumers, the food and hospitality industry. The LIFE project aimed to bridge the gap between awareness and behavior of key stakeholders regarding the environmental problem of food waste in Cyprus. The main objectives of this project are to:

- Raise awareness on the scale of the food waste problem in the hospitality and food industries in Cyprus as well as among consumers
- Inform on sustainable solutions and practices to possibly prevent and reduce food waste through their application
- Train professionals and/or students of the food and hospitality industry to adopt more sustainable practices for food waste reduction and prevention
- Strengthen the collaboration between actors of the food supply chain and social actors for using supplementary food for 'social food donation initiatives'
- Support the government and local authorities (policy makers) to create enabling policy environments that stimulate food waste prevention and reduction [62].

The core measures of FOODPrint are:

- the development of a cooperation network for social food donations
- workshops and consultations with stakeholders (target groups are food service and hospitality sector companies, professionals, local authorities, non-governmental organizations and students)
- the development of project material, i.e. specific project material targeting the project's key audiences and, in particular, businesses and households/consumers to provide practical information and knowledge on food waste prevention
- an awareness campaign on food waste prevention and management among consumers, the food industry and the hospitality sector, from 2020 to 2023
- the introduction of the 'FoodPrint' award by the Employers and Industrialists Federation, promoting companies that actively work to reduce food waste and targeting those directly involved in the food sector, such as the hotel and restaurant sectors and food retail

- the development of a Collaboration Platform of LIFE FOODPrint that brings together food donors/companies with surplus food such as supermarkets, restaurants, caterings etc., receivers such as charities helping vulnerable groups and volunteers and conscious consumers.

Within FOODPrint, three quantitative surveys were conducted during the period October 2020 to January 2021. The main survey covered 554 people aged 18 and over, who are either responsible for household shopping or food preparation run in the period 21 – 23 October 2020. The geographical distribution of the sample was proportional to the actual distribution of the population. The data was not weighted during processing. The second, was a shorter online questionnaire via the Dias group websites with a larger sample (total 1828 participants, out of which 1104 with complete answers) and participation from other countries (Greece, UK, other) between 05/11 and 09/11/2020. A third online survey with a smaller sample (total 1432 participants, out of which 943 with complete answers) was performed during 13/1 – 18/1/21.

The main outcomes were:

- Buying more food than needed. Seven out of ten consumers tend to buy more than the required quantities of food. These habits may root back into concerns of security among the population.
- Food waste management. Most consumers throw away the food they consider unsuitable for consumption (72%). Three out of ten give this food to pets, while much fewer report that they compost it.
- Feelings when wasting Food. The main feeling of consumers when throwing food away, is a feeling of guilt (56%), secondly that of waste of money (46%) and thirdly of concerns for the environmental impact (30%). One out of ten is completely indifferent.
- Taking food leftovers from outings. In the whole sample, only 25% always take food leftovers from outings, 25% do it quite often, 20% do it sometimes and 30% do it rarely or never. The habit of taking food leftover from outings, is more common among those living in other EU countries and the United Kingdom than among those participated from Cyprus or Greece. Among the participants from Cyprus, 18% of them consider it very important to take with them food that is left over after eating out, but do not always do so.
- Percentage of food in household waste. Almost half of the participants underestimate the problem of food waste production in their household as they consider that their production is less than the average household.

The innovative "**Save Our Food**" program aimed to "rescue" food from various catering establishments and offer it to people. The program was coordinated by Dr. Stavros K. Parlalis,

through the Frederick Research Center in collaboration with the Municipality of Aglantzia, the Cyprus Youth Organization, the Nicosia Volunteer Corps and the organization "Boroume" (Greece). The online platform that was created by Frederick University's Mobile Device Laboratory (MDL), where both food donors and underprivileged people who wished to receive food were registered is an important breakthrough of the program. In addition, a mobile phone application has been developed, which enables the connection between food donors and beneficiaries, helping to reduce the waste of edible food.

Throughout the project for the one (1) year that food collection/distribution was running, 14,774 portions were collected from 12 local businesses, as detailed in Figure 4. After the end of the project, with the contribution of the Municipality of Aglantzia, the rescue of edible food continued, as shown in Figure 5. A total of 22,815 portions of food from six (6) businesses that regularly/daily donate food and some other businesses that occasionally contributed, from May 2021 until November 2022.



Figure 4. Infographic of the "Save our Food" project.

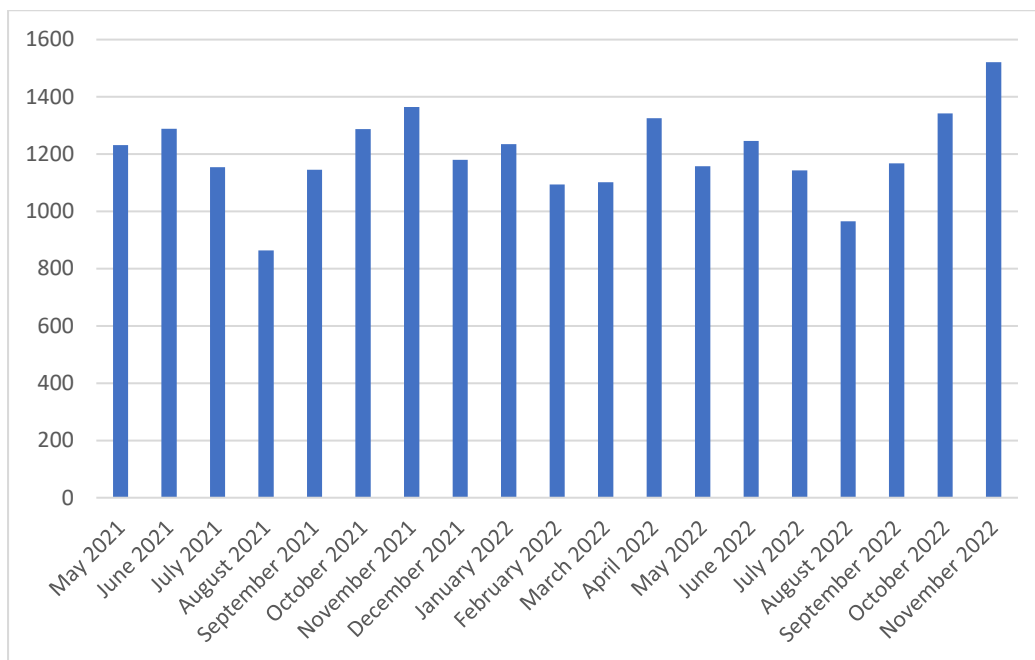


Figure 5. Monthly rescue of edible food.

### 5.3 Interviews

Representative actors in all stages of the food supply chain in Cyprus were selected. 14 people were interviewed by phone and 4 by in-person communication. Initially, interviews were asked to cite an action of waste prevention, valorization or reuse that takes place in their professional environment, then to describe in more detail the means to achieve their targets and last to classify the action in terms of the classification system adopted in this study. In many cases the interviewee asked for examples since the context of waste prevention was not always clear. A preliminary analysis of the interview responses is presented in Table 56. Ticks indicate that at least one interviewee mentioned that the particular action type took place in his/her workplace. Table 56 cannot provide evidence on how widely an action is being adopted nationally, how successful is in achieving its waste prevention goal, and what were the quantities of waste that it affected, although some answers contained quantitative information. It gives an overview of the current situation in Cyprus and particularly the important gaps that need to be covered. Ticks in parentheses indicate actions (the Pay as You Throw system) that they are well known, they are about to start, but they did not have a real impact yet.

Table 56. Actions reported for each stage of the food supply chain and action sub-type in Cyprus by a qualitative analysis of interviews

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution		?	?	?	
	Gleaning	?				
	Digital tools R					
Food valorization	Value added processing	?	?	?		
	Animal feed	?	?	?		?
Behavior change (BC)	Awareness/educational campaign				?	?
	Digital tool BC					
	School programs					
	Awards					
	Innovation of products - date marking					
Supply chain efficiency (SCE)	Process innovation					
	Innovation of products - packaging					
	Training & guidelines					
	Price discount		?			
	Imperfect produce sale		?			
	Certification					
	Public procurement					
	Digital tools SCE					



<b>Food waste prevention governance</b>	Voluntary agreement		?	?	?	?
	Regulatory framework/policy					
	National FW prevention program					(?)
	Fiscal incentives					(?)

The main findings and remarks that derived from the personal communications are summarized in the section below.

## **Interview Results**

### *Agricultural sector*

In the primary production sector, prevention can be considered as an accurate estimation of market needs and an adequate production planning that involves both farmers and food suppliers so as to avoid overproduction. However, no organized control or official regulatory systems of the kind and amounts of agricultural production flows have been recorded in Cyprus. Given that there can't be total elimination of food waste production, valorization or exploitation of agricultural products could be a viable option. Such activities were found to be common in Cyprus farming. Utilization, for example, of surplus agricultural products along with crop residues as feedstock in compost or soil conditioner production, use as animal feed or transfer to biogas production units were often mentioned by the farmers interviewed. Apart from surplus production, it is worth noting that small farming units generally operate in Cyprus. In mountainous areas where most old orchards, like apples, are situated, fruit picking and trading is often unprofitable and large amounts of annual produce of fruits remain on the trees.

An interviewee that runs of a citrus trees orchard, for example, emphasized his interest in the valorization of discarded fruits apart from tree prunings. He described that recently he has started to operate a small composting unit using prunings, fruits, tree roots and other residues as feedstocks.

### *Food processing*

Regarding food processing, a huge effort is made towards food waste reduction according to the interviews. Examples of valorisation routes adopted are the following problematic juices are used for biogas production; fruit peels are given to cattle as animal feed; products that have expired are given for biogas production; liquid waste from brewery (wheat washing), winery and distilleries is transported to stations for biological treatment; the husks of the barley as well as herbal aromas that enter the various distillates (from the brewery) are given as animal feed; the different type of solid waste produced during the winemaking is given for biogas production, production of compost or soil conditioner, animal feed or is given to specialized units for the production of the local drink zivania and the serum left over from milk production is given to the animals.

Furthermore, it was recorded that in olive mills, fruit pulp and olive skin result as a waste stream. This stream is sometimes used as animal feed or composted, mixed with thin prunings and leaves from the olive mill to produce a stable organic soil amendment with fertilization value.

According to bakeries' owners, the remaining breads are fried and crumbled and are either used in breading meats or given to butchers for the preparation of sausages and burgers. Additionally, some bakery food waste is given to the local nursing homes. Another common practice is to mix food waste together with leftovers from the bakery and to use it as animal feed for hens and pigs.

#### *Retail stores (supermarkets, street markets, fruit shops)*

Most supermarkets in Cyprus take actions before discarding food waste. For example, they sell soon-to-be-expired, old or slightly damaged products at a discount. Additionally, some supermarkets use forecasting applications in order to get alerts regarding soon-to-expire products and to properly manage them.

#### *HORECA sector*

The main conclusions arising from the phone interviews of people working in the restaurant/catering services sector are similar to those of the LIFE FoodPrint project. Valorization and reuse actions are more common than food waste prevention measures. Fats and oils are treated to produce biodiesel and food waste is given to anaerobic biogas stations. However, awareness for the need to take prevention measures is growing. Some hotels and restaurants are trying to remove the buffet service, which, in general, leads to greater amounts of waste and prefer meals "a la carte" or the "live cooking" system. Moreover, in many restaurants, the food that is not consumed by the customer is suggested to be given for take away. Moreover, appropriate storage logistic systems of raw materials are used in order to minimize food waste.

## **5.4 General outcomes**

In general, a rather limited public debate about important issue of food waste prevention was noted. Harmful habits that are related to increase food waste generation are still widely present, although probably diminishing. There are still many events offering buffet meals that are known to produce a high volume of plate waste. Taking a lot of food from a buffet or cooking food in greater quantities than those that can be consumed in a household are behaviors that are still widely present. Furthermore, the amount of food unnecessarily wasted is great due to the touristic development of the island.

On the other hand, most of the waste management actions recorded cannot be considered as real prevention measures, but intended rather to exploit, valorize or reuse materials. No waste prevention measures (production planning and estimation of market needs) has been operating in the primary production sector, and farmers complain that they have no assistance in doing so, as no official regulatory systems of amounts of agricultural produce was identified to restrict oversupply.



Retailers also play a significant role on that. If they work closely with farmers or encourage their intermediaries to collaborate with them, agricultural food waste could be significantly reduced. They could also more systematically share forecast data for specific food items to help farmers with their production plans and prevent overplanting. Retailers already apply some management actions that reduce significantly disposal of food. Some of them sell old or slightly damaged products at a discount, they donate surplus to organizations and they establish partnerships with animal producers for providing animal feed, and with anaerobic fermentation units for providing feedstock for biogas production. Animal feed and energy production in biogas stations were the most widely mentioned and apparently the most “successful” measures to reduce waste.

In Cyprus, **FOODPrint** is applied in a wider geographical area and has become popular. The dissemination actions of this project are so far quite successful and thus have attracted much attention (from businesses, professionals, students, local authorities, NGOs and civil society organisations, policy makers and general public). Furthermore, the FOODPrint platform has several members that are brought together and thus the communication between food donors and receivers has been facilitated. Quantified outcomes of FOODprint’s actions have not yet been made public, but it seems that they are quite encouraging. Hence, they may stand as a good starting point in an effort to broaden food waste and agro waste prevention actions.

Table 57. Number of actions reported for each stage of the food supply chain and action sub-type in Cyprus

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution				3	1
	Gleaning					
	Digital tools R				1	
Food valorization	Value added processing	2	2	2	2	2
	Animal feed	2	2	1	1	
Behavior change (BC)	Awareness/educational campaign				1	2
	Digital tool BC					1
	School programs					1
	Awards					
Supply chain efficiency (SCE)	Innovation of products - date marking					
	Process innovation	3	3		1	
	Innovation of products - packaging					
	Training & guidelines					1
	Price discount					
	Imperfect produce sale					
	Certification					
Public procurement				1		
Digital tools SCE						
Food waste prevention governance	Voluntary agreement					
	Regulatory framework/policy					
	National FW prevention program					
	Fiscal incentives					

## 6 Discussion

### 6.1 Concluding remarks

In total 209 actions were listed from all countries and continents studied. The majority of the reported actions were from Denmark (16), Italy (19) and Portugal (22). It is important to highlight that the distribution of actions across countries and typologies is not considered representative of the actual situation in Europe, due to the type of the survey (grey literature) and a potential bias in the group of entities. However, some worth mentioning outcomes have arisen from this research that could either provide ideas about programs that might be applied in Cyprus or help in avoiding mistakes that have already been made.

Each action was attributed one or more codes, based on the categorization that was analyzed in the introduction, and the full list of actions reported is presented in Table 55.

*Table 55. Total of actions reported for every country.*

Country	Reported actions
Australia	5
Belgium	7
Albania	2
Bosnia	4
Bulgaria	2
Croatia	10
Cyprus	4
Czech Republic	4
Denmark	16
Estonia	1
Finland	4
France	7
Germany	7
Greece	5
Hungary	7
Iceland	?
Ireland	5
Italy	19
Kosovo	-
Latvia	1
Lithuania	2
Luxembourg	2
Malta	5
Montenegro	2
Netherlands	10

North Macedonia	3
Norway	12
Poland	5
Portugal	22
Romania	6
Serbia	3
Slovakia	3
Slovenia	3
Spain	8
Sweden	6
England	5
Andorra	1
Switzerland	1
total:	209

Table 56 presents, for each action sub-type, the total of programs reported for each stage of the supply chain.

Table 56. Number of actions reported for each stage of the food supply chain and action sub-type in Europe.

Type	Sub-type	Supply chain stage				
		Primary production	Manufacturing	Distribution and retail	Food service	Households
Redistribution (R)	Surplus food redistribution	8	9	13	28	13
	Gleaning	6	0	0	0	0
	Digital tools R	0	0	1	2	0
Food valorization	Value added processing	0	0	1	3	1
	Animal feed	0	0	0	3	1
Behavior change (BC)	Awareness/educational campaign	3	2	6	23	57
	Digital tool BC	0	0	0	3	14
	School programs	0	0	0	0	12
	Awards	0	0	0	1	1
	Innovation of products - date marking	0	2	0	4	4
Supply chain efficiency (SCE)	Process innovation	0	1	0	8	5
	Innovation of products - packaging	1	2	3	3	3
	Training & guidelines	2	3	2	12	10
	Price discount	0	0	2	3	0
	Imperfect produce sale	0	0	0	1	0
	Certification	0	0	0	1	0
	Public procurement	0	0	0	6	0
	Digital tools SCE	1	1	2	8	1
Food waste prevention governance	Voluntary agreement	5	7	8	6	5
	Regulatory framework/policy	5	5	5	9	1
	National FW prevention program	5	6	7	6	6
	Fiscal incentives	2	1	2	4	0

The majority of actions reported are Behavior Change actions, reaching the number of 132. 91 of them are awareness/educational campaigns implemented mainly at a household and food service level. Then, 95 actions are reported as government implementations. However, their actual number is much smaller as every National program or legislation is usually referred to all the supply chain stages. Redistribution and Supply chain efficiency initiatives fluctuate around the same levels with 81 and 80 actions respectively. As for the Valorization actions, only 9 of them were reported, and this can be attributed in the urbanization and the intense transition from agriculture to industrial occupations, as food valorization refers to food originated from primary production.

Unfortunately, although several programs and initiatives have been launched throughout the world, the main barrier that is evident is that there exists lack of means of their assessment. Just a few (12) have been thoroughly evaluated. Some programs could not be assessed due to a lack of data, as the projects reported are still ongoing. Another case scenario is that the information reported described a research project, which for example could show the potential of a change in the production of animal feed that has not yet been put in practice by the industry. For this reason, there was no further analysis related to this type of actions in the sections above.

It is worth noting that there is a monitoring approach in the calculation of efficiency and effectiveness. This was hard to be identified in fields like Awareness/educational campaign, redistribution and gleaning as the people who benefit from it cannot be counted. In parallel, most actions did not set clear objectives or provide baseline values against which one could measure the actions' performance. Thus, some specific suggestions to improve the evaluation of the effectiveness and efficiency of some groups of actions are provided.

Actions belonging to BC are primarily focused on educating and raising awareness amongst the public on the issue of food waste. Although this should ideally lead to a reduction in the amount of food waste generated, the majority of the actions reported were focused on monitoring outcome objectives (e.g. an increase in the population understanding the difference between two date marks) rather than impact objectives (e.g. the reduction of the waste per meal generated by a restaurant). Whenever possible, priority should be given to the measurement of impact objectives, to enable a proper evaluation of the effectiveness of a food waste prevention action.

This analysis revealed important information gaps that hinder the systematic impact assessment of food waste prevention interventions. This is in agreement with what is reported by other studies in the literature [1, 2]. A key outcome of this research is that future programs should be designed and implemented ensuring the provision of the data required for their evaluation. Additionally, the database of actions collected could be expanded by

means of tailored surveys developed for each type of action, to optimize the data collection and lighten the burden of the respondents in completing the survey.

## 6.2 Potential replication of projects in Cyprus

Buon Fine Coop project (Italy) focuses on reducing food surpluses from Coop supermarkets and donating them to social voluntary associations which, in their turn donate them directly or use them to prepare meals to support people in need. Due to the fact that this project has already been implemented for three decades, interesting results have arisen in the redistribution sector. It is of high priority that the staff that is in charge of selecting, storing and preparing the food donations is trained properly. Moreover, there were a few notable barriers, namely, the limited capability of some voluntary associations to collect all the food available and the difficulties encountered by these associations in monitoring and reporting their activities, a fact that makes it harder for the cooperatives to report on the social impact of this initiative.

Some other Redistribution (R) results that derived from ACG's actions report about "best practices and initiatives to prevent and reduce food waste", include that, a key learning point of this activity was to make it as easy as possible firstly for the donor and secondly for the recipient charity to donate and receive food. In other words, the donations must take place at a local level to ensure that it will be easier for the donor to provide and for the recipient charity to collect. Donors are generally receptive to the idea of donating their food surplus. However, the food surplus does not always match the needs of the beneficiaries, both in terms of its geographical location and its nature. For these reasons, sometimes, donations have to be refused. To ensure that the receiving entities are aware of this challenge, it is necessary to continually invest in training programs.

"Espigoladors" is a Catalan, non-profit and social business that collects produce that would be left to rot in the fields and distributes it to food banks and social entities. A small part (5-10%) of the produce recovered is used to make jams, pâtés, sauces and creams. This action creates employment for people in social disadvantage and the profits are used to finance the rest of the project. The success factors of the project are the team consolidation through trust and empowerment, professionalization of the team and the practice, networking and establishment of key partnerships, social and environmental value added, adaptation to changes allows to take new opportunities. However, the initiative was launched from almost zero investment, so its speed depends on the injection of money.

As of the Behavior Change (BC) sector, "Christmas Surplus" (Denmark), "Too good for the bin!" (Germany), "Avanzi popolo" (Italy) and "Food support network" (Portugal) constitute some typical examples and also success stories. According to them, a review of the existing

means of communication used by this initiative is necessary. Firstly, it is important to focus on the information provided to consumers mainly on foodstuffs that are wasted the most, and to reach out to newly identified target groups. Secondly, this group of initiatives needs to be spread more on the younger generation since the elderly, in general, throws away less food. Moreover, it is important to collaborate with professional NGOs, who have access to approved data of citizens below the poverty line, when needed, in collaboration with municipalities and authorities, to ensure that the food surplus is only given to the citizens who are truly in need.

The success of these programs lies in their replicability and their applicability to affect different target groups. For example, "Christmas Surplus" initiative can be applied at any other Holiday where the supermarkets are closing for Holidays - and it can be replicated all over the EU and the world, so Cyprus could stand as a first replication case. The "Food support network" reached several members of society: a number of different entities, the city council, the red cross and the parish, that started collaborating towards a common goal; the school canteen staff members and the volunteers involved, that became more aware of the issue of food waste; and the families' beneficiaries of the program, that thanks to it could have one full meal a day.

As fighting food waste needs mostly a cultural revolution, the main barrier is the resistance to change; most private businesses don't know the fiscal benefits coming from the new national law against food waste and are worried that they will be considered responsible for potential food contamination that could occur after the donation; many charities are not properly organized to efficiently manage large quantities of food and relate with businesses; most people have to overcome a cultural barrier before considering food-sharing (that is giving and taking food from strangers) as a real and feasible option. Being conscious of these problems, the "Avanzi polo" association acts as an intermediary who understands that businesses and charities are not used to communicating and sometimes speak different languages, needing a "translator".

"Distribuição de refeições que sobram em refeitórios de uma escola e da CerciEspinho" refers to a daily collection of surplus meals from three schools in the city of Espinho, to serve them to people in need on the same day. DECO, a Portuguese consumer association organizes the Green Chef project, which invites schools to produce videos with culinary recipes made from food leftovers and/or culinary recipes with better food use, with the objective to sensitize young consumers to prevent food waste and the adoption of responsible consumer behavior. These initiatives could be easily implemented in small countries like Cyprus.



On the other hand, already implemented in Cyprus initiatives such as FOODPrint along with the respective platform may serve as a basis for a wider application of food waste and agro waste prevention measures.

## 7 References

1. <https://www.usda.gov/foodwaste/activities>
2. EPA (Nov. 2022), Regional Resources to Reduce and Divert Wasted Food Across the United States [online] Available at: <https://www.epa.gov/sustainable-management-food/regional-resources-reduce-and-divert-wasted-food-across-united-states#10>
3. JLI FAD Investing in rural people (Sep. 2020), *Fighting food waste in China: Local efforts, global effects* [online] Available at: <https://www.ifad.org/en/web/latest/-/blog/fighting-food-waste-in-china-local-efforts-global-effects>
4. Chomba (Jan. 2022), '3 Ways to Tackle Food Loss and Waste in Africa' ,*World Resources Institute* [online] Available at: <https://www.wri.org/insights/3-ways-reduce-food-loss-waste-africa>
5. WRAP (2022), *FLAWLESS South Africa* [online] Available at: <https://wrap.org.uk/taking-action/food-drink/initiatives/flawless-food-loss-and-waste-leveraging-economic-systems/flawless-south-africa>
6. FARMING FIRST (Apr. 2019), *Actions in Africa Preventing Food Loss and Waste* [online] Available at: <https://farmingfirst.org/2019/04/18874/>
7. <https://reliefweb.int/report/world/rockefeller-foundation-fao-supporting-africa-halve-food-loss>
8. <https://www.dcceew.gov.au/environment/protection/waste/food-waste>
9. UMWELTBUNDESAMT (2017), *Entwicklung des abfallvermeidungsprogramms* [online] Available at: <https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0614.pdf>
10. Action Program "Lebensmittel sind kostbar!" (Food is precious!), 2019
11. <https://www.toogoodtogo.com/>
12. FOODBANK (2022), *Food Waste Facts* [online] Available at: <https://www.foodbank.org.au/food-waste-facts-in-australia/?state=au>
13. United Against Waste (2022), *Avoid Food Waste & Save Costs* [online] Available at: <https://united-against-waste.at/>
14. European Week for Waste Reduction (2021), *Food Waste exchange of regional good practices* [online] Available at: <https://ewwr.eu/actions/food-waste-exchange-of-regional-good-practices/>
15. European Week for Waste Reduction (2021), *Zero Waste tipstricks* [online] Available at: <https://ewwr.eu/actions/zero-waste-tipstricks-voor-handelaars-enhorecazen-conseils-zero-dechet-pour-les-commerces-et-horeca/>

16. European Week for Waste Reduction (2021), *Campagne dinfluence sur le zero dechet* [online] Available at: <https://ewwr.eu/actions/campagne-dinfluence-sur-le-zero-dechet/>
17. Bulgaria waste prevention country profile 2021
18. Voedselverlies (2020), *Prevention of food losses in Flanders* [online] Available at: <https://www.voedselverlies.be/EN>
19. One Planet, handle with care (Jan. 2022), *Food Waste Reduction Roadmap 2020 Progress report* [online] Available at: <https://www.oneplanetnetwork.org/knowledge-centre/projects/food-waste-reduction-roadmap-2020-progress-report>
20. Plan for prevention and reduction of food waste generation of the republic of Croatia (2019 – 2022) [online] Available at: [https://food.ec.europa.eu/system/files/2020-05/fw\\_lib\\_fwp-strat\\_national-strategy\\_hrv\\_en.pdf](https://food.ec.europa.eu/system/files/2020-05/fw_lib_fwp-strat_national-strategy_hrv_en.pdf)
21. POTRAVINOVE BANKY (2022), *We fight against waste and hunger* [online] Available at: <https://www.potravinovebanky.cz/>
22. European Commition (2022), *Food Waste European Actions Report* [online] Available at: [https://food.ec.europa.eu/system/files/202202/fw\\_eu\\_actions\\_dm\\_20211130\\_report\\_1.pdf](https://food.ec.europa.eu/system/files/202202/fw_eu_actions_dm_20211130_report_1.pdf)
23. SAA SOYDA (2022), *Tips for reducing food waste* [online] Available at: [www.saasyoda.fi](http://www.saasyoda.fi)
24. 22Ministry of Agriculture and Food Sovereignty (Oct. 2018), *The national pact to combat food waste* [online] Available at: <https://www.ecologie.gouv.fr/gaspillage-alimentaire#:~:text=Le%20pacte%20national%20de%20lutte%20contre%20le%20gas pillage%20alimentaire,-Sign%C3%A9%20en%202013&text=Il%20fixe%20notamment%20l'objectif,an%20entre%202013%20et%202025>
25. ADEME (2022), *A presence throughout France* [online] Available at: <https://www.ademe.fr/lagence/notre-organisation/>
26. ADEME (2016), *FOOD LOSSES AND WASTE - INVENTORY AND*
27. *MANAGEMENT AT EACH STAGE IN THE FOOD CHAIN* [online] Available at: <https://librairie.ademe.fr/cadic/2220/food-losses-waste-inventory-management-2016-summary.pdf?modal=false>
28. Federal Ministry of Food and Agriculture (Jul. 2022), *National Strategy for Food Waste Reduction* [online] Available at: <https://www.bmel.de/EN/topics/food-and-nutrition/food-waste/national-strategy-for-food-waste-reduction.html>
29. European Week for Waste Reduction (2021), *Informationsstand zur abfallvermeidung und ressourcenschonung im klenow tor* [online] Available at: <https://ewwr.eu/actions/informationsstand-zur-abfallvermeidung-und-ressourcenschonung-im-klenow-tor/>
30. European Week for Waste Reduction (2021), *Organization earth compost games* [online] Available at: <https://ewwr.eu/actions/organization-earth-compost-games/>
31. Greece waste prevention country profile 2021
32. European Week for Waste Reduction (2021), *Low waste brunch* [online] Available at: <https://ewwr.eu/actions/low-waste-brunch/>

33. <https://www.boroume.gr/>
34. Circular Economy, the Action plan of Greece, Ministry of Environment and Energy [online] Available at: [https://ypen.gov.gr/wp-content/uploads/2021/12/SXEDIO-DRASHS-KO-FINAL .pdf](https://ypen.gov.gr/wp-content/uploads/2021/12/SXEDIO-DRASHS-KO-FINAL.pdf)
35. Boroume (2020), *Boroume saving food – saving lives* [online] Available at: <https://www.boroume.gr/en/news/news/alliance-for-the-reduction-of-food-waste/>
36. The American College of Greece (2022), *Best Practices and Initiatives to Prevent and Reduce Food Waste* [online] Available at: <https://www.acg.edu/news-events/news/national-alliance-for-the-reduction-of-food-waste-acg-featured-in-the-first-report-on-food-waste-prevention-and-reduction-best-practices/>
37. Maradek Nelkul (2022), *WITHOUT REMAINS - LET'S REDUCE THE AMOUNT OF FOOD WASTE TOGETHER!* [online] Available at: <http://maradeknelkul.hu>
38. WASTELESS (2018), *Life Food Waste Platform meeting 2018 conference* [online] Available at: <https://maradeknelkul.hu/en/policy-results/life-food-waste-platform-meeting-2018/>
39. Nebih Oktatas (2022), *NEBIH* [online] Available at: <http://nebihoktatas.hu/>
40. Assessment of foodwaste prevention waste
41. Interreg Central Europe (2017), *Situation of food waste in Italy* [online] Available at: <http://www.reducefoodwaste.eu/situation-on-food-waste-in-italy.html>
42. Zero Waste Europe (Nov. 2020), *Italy's law for donation and distribution of food and pharmaceuticals to limit food waste* [online] Available at: [https://zerowasteurope.eu/wp-content/uploads/2020/11/zwe\\_11\\_2020\\_factsheet\\_italy\\_en.pdf](https://zerowasteurope.eu/wp-content/uploads/2020/11/zwe_11_2020_factsheet_italy_en.pdf)
43. FUSIONS (Jun. 2016), *Italy – Country Report on national food waste policy* [online] Available at: [www.eufusions.org/phocadownload/countryreport/FUSIONS%20IT%20Country%20Report%2030.06.pdf](http://www.eufusions.org/phocadownload/countryreport/FUSIONS%20IT%20Country%20Report%2030.06.pdf)
44. Ministry of Environment, Land and Sea (2013) *National program for waste prevention* [online] Available at: [https://www.mite.gov.it/sites/default/files/archivio/normativa/dm\\_07\\_10\\_2013\\_programma.pdf](https://www.mite.gov.it/sites/default/files/archivio/normativa/dm_07_10_2013_programma.pdf)
45. Latvias waste prevention country profile 2021
46. <https://www.maistobankas.lt/>
47. [Antigaspi (2022), *The Food Waste in Luxemburg* [online] Available at: [www.antigaspi.lu](http://www.antigaspi.lu)
48. Maltas waste prevention country profile 2021
49. Montenegro's waste prevention country profile 2021
50. <https://zerowastemontenegro.me/>
51. <https://samentegenvoedselverspilling.nl/>
52. AMCHAM North Macedonia (2018), *Site Siti – Redistribution of Food Surplus* [online] Available at: <https://amcham.mk/events/site-siti-info-session/>
53. Macedonia's waste prevention country profile 2021

54. <https://www.matvett.no/uploads/documents/CutFoodWaste2020-in-Norway-food-waste-in-the-food-service-industry-2017-2020.pdf>
55. <https://doga.no/aktiviteter/dogas-priser/doga-merket-design-arkitektur/vinnere-av-doga-merket/kunsten-a-ikke-kaste-mat/#:~:text=Med%20boka%20Kunsten%20%C3%A5%20IKKE,utgitt%20i%20august%20samme%20%C3%A5r.>
56. Nofima (Mar 2022), *Shelf life and food safety* [online] Available at: <https://nofima.com/research/processing-and-food-safety/shelf-life-and-food-safety/>
57. Poland waste prevention country profile 2021
58. PRO (2022), *The PROM Project* [online] Available at: [www.projektprom.pl](http://www.projektprom.pl)
59. Banky Zywnosci (2018), *Save food that others dream of* [online] Available at: <http://www.wspieraj.bankizywnosci.pl/>
60. [https://www.cncda.gov.pt/images/Estrategia/ENCDA\\_Atualizao-Out2018\\_EN.pdf](https://www.cncda.gov.pt/images/Estrategia/ENCDA_Atualizao-Out2018_EN.pdf)
61. <https://re-food.org/en/home/>
62. <https://www.acrplus.org/en/es/2013-06-11-10-57-57/noticias-de-nuestros-miembros/628-lipor-dose-certa-project-reduces-30-of-food-waste-in-restaurants>
63. <https://www.carrefour.com/en/csr/commitment/combating-food-waste>
64. <https://www.alimenterre.org/le-festival-alimenterre-0>
65. [https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n\\_proj\\_id=5236](https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n_proj_id=5236)
66. <https://www.flaw4life.com/en>
67. <https://frutafeia.pt/>
68. <https://goodafter.com/pt/>
69. <https://cityloops.eu/news?c=search&uid=CH9jMhKj>
70. <https://transforma-te.pt/>
71. <https://dariacordar.org/>
72. <https://www.restolho.or>
73. <https://www.greenchef.com/>
74. <https://cms-lawnow.com/en/ealerts/2017/05/romanian-regulations-on-diminishing-food-waste>
75. BIZ (Oct. 2021), Kaufland Romania launches the first integrated anti-food waste campaign [online] Available at: <https://www.revistabiz.ro/kaufland-romania-lanseaza-prima-campanie-integrata-anti-risipa-alimentara/>
76. THE RECURSIVE stories share stories (Nov. 2021), *Romanian bonapp.eco launches mobile app to combat food waste* [online] Available at: <https://therecursive.com/romanian-bonapp-eco-launches-mobile-app-to-combat-food-waste/>
77. Romania's waste prevention country profile 2021
78. Serbia's waste prevention country profile 2021
79. OECD Environment Policy (Dec. 2017), Making the Slovak Republic a more resource efficient economy [online] Available at:

- <https://www.oecd.org/environment/waste/Policy-Paper-Making-the-Slovak-Republic-a-more-resource-efficient-economy.pdf>
80. Slovak Republic waste prevention country profile 2021
81. <https://reducefoodprint.org/eatc/about.html>
82. Slovenia's waste prevention country profile 2021
83. [https://circulareconomy.europa.eu/platform/sites/default/files/espana\\_circular\\_2030\\_executive\\_summary\\_en.pdf](https://circulareconomy.europa.eu/platform/sites/default/files/espana_circular_2030_executive_summary_en.pdf)
84. [https://food.ec.europa.eu/system/files/2016-12/fw\\_eu-platform\\_20161129\\_pres-eu-food-donation-guidelines.pdf](https://food.ec.europa.eu/system/files/2016-12/fw_eu-platform_20161129_pres-eu-food-donation-guidelines.pdf)
85. <https://www.alimentacionsindesperdicio.com/>
86. <https://espigoladors.cat/en/about-us/>
87. Sweden's waste prevention country profile 2021
88. <https://wrap.org.uk/taking-action/food-drink/initiatives/courtauld-commitment>
89. WRAP (Sept. 2010), *Evaluation of Courtauld Food Waste Target – Phase 1* [online] Available at: <https://wrap.org.uk/resources/report/evaluation-courtauld-food-waste-target-phase-1>
90. WRAP (Nov. 2013), *Evaluation of Courtauld Food Waste Target – Phase 2* [online] Available at: <https://wrap.org.uk/resources/report/evaluation-courtauld-food-waste-target-phase-2>
91. WRAP (Jan. 2017), *The Courtauld Commitment 3: Delivering Action on Waste (final report)* [online] Available at: <https://wrap.org.uk/resources/report/courtauld-commitment-3-delivering-action-waste-final-report>
92. European Week for Waste Reduction (2021), *Compostem pel medi ambient* [online] Available at: <https://ewwr.eu/actions/compostem-pel-medi-ambient/>
93. Zero Food Waste Cyprus (2022), *Kyrenia "Wasteless Wednesday's"* [online] Available at: <https://zfwcy.org/north-cyprus-projects/>
94. AKTH (2017), *Sincerely food Cyprus* [online] Available at: <http://www.akti.org.cy/portfolio/sincerely-food-cyprus/>
95. AKTH (2022), *Events calendar* [online] Available at: <https://www.akti.org.cy/events/>
96. European Commission (2011), *Development and demonstration of a waste prevention support tool for local authorities* [online] Available at: [https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n\\_proj\\_id=3992](https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n_proj_id=3992)
97. Lassaridi K. (2013), 'Waste prevention in the context of Local Waste Action Plans: prospects and constraints', Harokopio University, Department of Geography [online] Available at: [http://uest.ntua.gr/tinos2015/proceedings/pdfs/Lasaridi\\_et\\_al.pdf](http://uest.ntua.gr/tinos2015/proceedings/pdfs/Lasaridi_et_al.pdf)
98. Quasimodo (2022), *Ungly Fruits and veggies just got a makeover* [online] Available at: <https://quasimodo.com.cy/#>
99. Rescuedbox (2022), *RESCUEDBOX* [online] Available at: <https://rescuedbox.com/>
100. Foodprint (Mar. 2021), *Awareness – Raising campaign to prevent and manage food waste among consumers, the food and hospitality industries* [online] Available at: <https://www.foodprintcy.eu/wp-content/uploads/Baseline-brief-report.pdf>

101. Foodprint (2022), *Save food – Waste less* [online] Available at: <https://foodprintcy.eu/collaboration-platform/>