wasteless

Waste Quantification Solutions to Limit Environmental Stress

Lead Partner: SDU
Month: M8 – August 2023

D1.1 - White book for FLW reduction, measurement, and monitoring practices

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Executive Summary

Food loss and waste (FLW) represent the inefficiencies in food supply chian considering the profound of economic, environmental, and social impacts they have caused. Given the pressing need to address FLW issues, a harmonized framework to measure and monitor FLW could enhance understanding this problem. However, FLW measurement and monitoring actions across Europe are currently inconsistent and incompatible, posing challenges in tackling FLW.

WASTELESS project aims to develop and test a mix of innovative tools and methodologies for FLW measurement and monitoring. As the entry-point, Work Package (WP) 1 is going to provide a baseline framework for the implementation of measuring and monitoring. The current Deliverable (D) 1.1 (D1.1), "White book for FLW reduction measurement, and monitoring practices", was developed based on the first task of WP 1 to be submitted at Month (M) 8, M8 – August 2023. Specifically, this deliverable aims to cover the current policies and legislation with impact on FLW reduction, FLW measurement and monitoring practices across the European Member States (MSs) and Food Supply Chain (FSC) sectors, as well as the business strategies for FLW reduction, measurement, and monitoring practices for both national and FSC levels. To achieve these objectives, several online surveys were carried out in order to collect relevant information.

At the national level, three independent surveys were assigned among WP 1 consortium, namely: i) agencies identification survey, ii) FLW measurement and monitoring practices mapping survey, and iii) FLW legislations mapping survey. Of note, agencies refer to the entities engaged in measuring and monitoring FLW, and/or relevant legislation actions. The FLW measurement and monitoring practices refer to the process of measuring, monitoring, or estimating the level of FLW generated. Moreover, in order to give evidence-based recommendations, this report include only those practices that directly measured or monitored FLW. FLW legislation actions refer to those actions that aim to guide or govern certain activities concerning FLW.

At the FSC level, one survey focusing on FLW-related business strategies and measurement & monitoring of the private sector was designed and distributed among partners for answers. Narrative reports for each partner country were conducted to further depict the supply chain level situations. The survey answers were analysed to identify valid FLW measurement and monitoring practices and legislation actions and to build the inventory. The inventory was then followed by a

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SWOT analysis among partners, focusing on the harmonization of FLW measurement and monitoring.

Regarding the survey's results, at the national level, it was identified 68 practices, among them 40 practices had FLW measurement and monitoring conducted, 12 practices focused on FLW recycling and using optimization, while 16 practices worked on FLW reduction, redistribution, and donation. Among those practices targeting measurement, this report found that FLW definitions from FUSIONS and FAO were the two main definitional frameworks. Around one-third of the measurement practices had the data collected for the whole food supply chain. For the remaining practices, the household was registered as the main context to measure FLW. Particularly, 77% of the total measurement and monitoring practices included all the food commodities in the data collection. Regarding the legislation actions, it was identified 96 items. Furthermore, the types of legislative actions exhibited variations among them, with regulation, policy, and law ranking as the top three categories. Regarding the implications for FLW, the predominant legislative focus encompassed FLW reduction, FLW management, and FLW generation.

At the food supply chain level, regarding FLW management, one of the main aspects to be considered is ensuring food security. No matter whether it is being used in donations, animal feeding, or recycled in other production systems, it must be edible. Hence, the food labels like "best before" should be given more attention. As the MS legislation could maximize EU efforts to address FLW issues, institutional and private initiatives should be integrated.

From the SWOT analysis, focused to develop a harmonized framework on the FLW measurement and monitoring practices, it was unveiled multiple strengths: the availability of data collection methods, sufficient practices benefits, wide practice coverage, etc. In the meantime, inconsistent and incompatible data collection methods, unbalanced coverage of FSC sectors and stakeholders, as well as limited information sharing and low stakeholder engagement have emerged as weaknesses in the current practices. These aspects should be given special attention.

The development of the harmonized framework could take advantage of the opportunities such as high levels of governance awareness, existing data collection methods, sufficient funds, and innovative technologies. However, attention should also be directed towards potential governance issues, inefficient management and monitoring of practices, ethical impacts, and low levels of public engagement and collaboration.

As for the legislative actions, the current legislation should be fully explored, given its robust foundation with extensive coverage and limited economic impacts, especially those regulations adapted to local contexts.

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Implementation challenges, legislative gaps, disparities across countries and regions, and harmonization issues were identified as weaknesses. On the other hand, opportunities include promoting cooperation among sectors and stakeholders, implementing ambitious governance measures, increasing public awareness, facilitating dissemination and knowledge sharing among stakeholders and institutions, updating legislation and technology, and more. To better address the threats, attention should be focused attention should be focused on potential conflicts with existing legislative actions, limited acceptance among stakeholders, ineffective communication strategies, limited stakeholder engagement, as well as inadequate monitoring procedures.

This D1.1 - "White book for FLW reduction measurement, and monitoring practices", serves as a preparatory guide for the forthcoming stages of the of the WASTELESS project. It aims to determine the most appropriate direction for studying effective and efficient FLW measurement and reduction methods, with the ultimate goal to promote sustainability throughout the FSC, from Farm to Fork.

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List of Acronyms

Abbreviation / acronym	Description
D	Deliverable
EC	European Commission
EU	European Union
FSC	Food Supply Chain
FLW	Food Loss and Waste
FW	Food Waste
M	Month
MSs	Member States
SWOT	Strengths, Weaknesses, Opportunities, and Threats
WASTELESS	Waste Quantification Solutions to Limit Environmental Stress
WP	Work Package

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1. Background

Over the last years, Food Loss and Waste (FLW) management have gained extensive momentum among industries, associations, governments, and consumers (FAO, 2019). One-third of food produced for human consumption is lost or wasted globally (FAO, 2011).

Among them, around 14% of world's food is lost annually between harvest and retail market (FAO, 2019), while 17% of food is wasted in the subsequent sectors (UNEP, 2021). To address this issue, the United Nations' Sustainable Development Goal 12.3 aims to reduce FLW throughout the supply chain stages, as well as the amount of global Food Waste (FW) in both retail and consumer levels by 50% (UN, 2015). In 2020, the European Union (EU) generated around 127 kg of FLW *per* inhabitant, with household FW accounting for more than half of total amount[1]. The EU is committed to tackling FLW in alignment with United Nations Sustainable Development Goals. The FLW reduction is recognized as a significant lever for promoting food systems transition, while ensuring food security and driving sustainable development (EU, 2019, 2020). In addition, the EU is resolute in tackling FW issues, targeting a 10% reduction in processing and manufacturing stages, and a combined 30% reduction (*per* capita) at the retail and consumption stages (EUROPEAN COMMISSION, 2023).

To achieve these FLW reduction goals, it is essential to have a solid understanding of the problem. Questions regarding the amount of food being discarded and its distribution across FSC sectors remain to be answered. The Farm to Fork Strategy emphasizes that FLW prevention goals cannot be achieved without innovative FLW measurement and monitoring methods (EU, 2020). Also, the Integration of FLW prevention into EU policies was recognized as an ambitious step toward the food supply chain transition and contributes to achieving a circular economy (EU, 2019).

The implementation of strong FLW strategies and initiatives requires a detailed data collection approach through a variety of sources (Chauhan et al., 2021; Fabi et al., 2021; Xue et al., 2017). Effective solutions to address FLW will certainly benefit from a harmonized measurement and monitoring framework, which will, in turn, contribute to the informed development of legislation. The implementation of a harmonized framework is expected to enhance the development of strategies aimed at addressing FLW, thereby promoting sustainability throughout the FSC.

[1] Food waste: 127 kg per inhabitant in the EU in 2020. https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220925-2

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The European Commission (EC) issued a common methodology and minimum quality requirements for measuring Food Waste (FW) (EUROPEAN COMMISSION, 2019). However, FLW measurement approaches integrated into both national strategies and private business strategies vary across European Member States (MSs) (FUSIONS, 2014, 2016). There is a pressing need for a harmonized framework on FLW measurement and monitoring across countries, sectors, and stakeholder groups.

Addressing FLW issues aligns with the EC's ambitious commitments to promote food system transition, evidenced by continued funding of related projects in the past decade. However, across Europe, FLW measuring and monitoring still suffers from inconsistent methodologies. By reviewing the previous EU-funded projects (e.g., REFRESH project "Resource Efficient Food and dRink for the Entire Supply cHain" and FUSIONS "project Food Use for Social Innovation by Optimising Waste Prevention Strategies"), as well as relevant activities carried out by multiple national and international agencies (e.g., World Resource Institute, FAO, etc), this report found very few studies to understand the drawbacks and challenges of the implementation of the existing framework. And among these projects, there is limited attention on engaging food actors in the FLW measuring and monitoring in different food sectors for both at regional and national levels (REFRESH, 2019, 2020; FUSIONS 2014, 2016).

Under this context, WASTELESS[2] project was designed to develop and test a mix of innovative tools and methodologies for FLW measurement and monitoring. Specifically, the primary goal of WP1 is to establish a baseline framework for effectively implementing measurement and monitoring processes. To complete the task 1.1 on SoA of current FLW policies and strategies, this report conducted a series of surveys to map current FLW measurement and monitoring practices, as well as legislative actions that might impact FLW.

2. Methodology

This study carried out several of online questionnaire surveys to complete task 1.1 (SoA of current FLW policies, measurement & monitoring at national level). The surveys conduction process is described in this chapter.

Task 1.1 has been divided into two subtasks, and the survey conduction was organized into two phases concentrating on the national and FSC levels, respectively. At the national level, three independent surveys were conducted: agencies

[2] WASTELESS - Waste Quantification Solutions to Limit Environmental Stress. https://wastelesseu.com/

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identification survey, FLW measurement and monitoring practices mapping survey, and FLW legislations mapping survey.

At the FSC level, one online survey focusing on FLW-related business strategies and measurement & monitoring of the private sector was conducted. In addition, narrative reports with a specific focus on project partner countries were conducted to provide further depiction of the supply chain level situations.

All those surveys presented in this deliverable, D.1.1, were drafted and distributed by Google Forms[3]. The following sections present more detailed descriptions of national and food supply chain level surveys.

2.1 National level mapping

At national level the three surveys were conducted with the specific objectives of identifying responsible agencies, understanding, and reviewing the current FLW measurement and monitoring practices, and mapping legislation actions that impact FLW.

To clarify, agencies refer to those entities that are involved, directly or indirectly, in measuring and monitoring FLW, and/or in developing and implementing relevant policies. FLW measurement and monitoring practices refer to the process of measuring, monitoring, or estimating the level of FLW generated. FLW legislation actions refer to those actions that aim to guide or govern certain activities concerning FLW. Survey questionnaires are attached in the appendix. The **Figure 1** presents the general framework of the national surveys, and each survey comprises a series of questions that are outlined as following:

- The agencies identification survey was designed to understand the agency profiles (name, country, and type) and their actions concerning FLW. Contact information for further communications was included as well;
- The FLW measurement practices mapping survey aimed to disclose relevant practices with their profiles (title, country, responsible agency, time scale, geographic scope), applied FLW definition, applied data collection approaches (data originality, FLW measurement method, target food commodity);
- The legislation mapping aimed to understand relevant legislative actions with their general profiles (title, country, responsible agency, time scale, geographic scope, type, area) as well as implications regarding FLW.

[3] Google Forms. https://www.google.com/forms/about/

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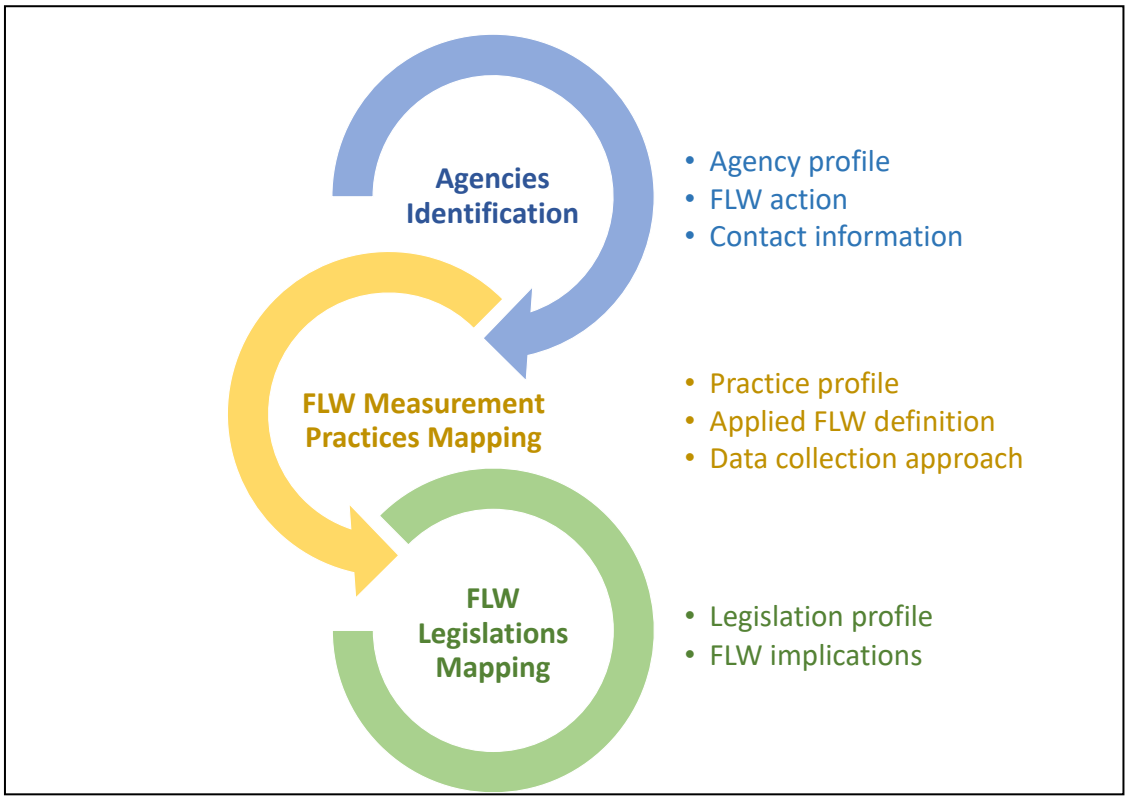

Figure 1. National surveys framework

The Work Package (WP) 1, WP1, lead partner designed the initial templates of three surveys (agencies identification, FLW measurement and monitoring practices mapping, FLW legislations mapping). Then, a round of survey test and review was conducted among WP 1 partners, and their comments and feedback were integrated into the final survey forms. Three independent surveys were assigned to the WP 1 partners to provide answers.

To better identify and extract relevant data from the survey responses, particular to identify useful FLW measurement and monitoring practices and legislative actions, this report adheres to the following criteria.

For the FLW measurement and monitoring practices, this report tagged as relevant practices which deal with the quantification or estimation of FLW amounts or levels, using any measuring methods. Given that this deliverable is intended to serve as an evidence-based inventory to identify recommendations for the FLW measurement and monitoring framework harmonization, only practices that directly measured and monitored the level of FLW were included. For those practices that conducted estimation exclusively with secondary data or literature data were excluded from the report due to the lack of comprehensive data and might be bias. In addition, this report identified practices that did not measure FLW, but might be related to FLW

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reduction, recycling, and redistribution. Those practices were presented in the Appendix to offer additional value to this report.

To categorize all the practices into different groups, this report defines the following practice clusters:

- **FLW measure and monitoring**: Practices focusing on measuring, quantifying, or monitoring the level of FLW generated.
- **FLW recycling and using optimization**: Practices focusing on techniques, strategies, activities that recycle, valorize, or make use of those food products that would be lost or wasted.
- **FLW reduction/redistribution/donation**: Practices focusing on FLW reduction and prevention activities, or surplus food redistribution and donation.

For the FLW legislation actions, this report included all these materials classified as regulation, directive, decision, and COM documents following the FUSIONS review (FUSIONS, 2015), as well as parliament resolutions, policies, laws, communications, and decrees. To ensure a wide coverage, this report included practical actions like initiatives, strategies, and government action plans, as well as industrial guidelines like agency orders, industrial agreements, and recommendations. Those practical actions and industrial guidelines were included as they could provide evidence-based insights to inform legislation development.

To further categorize all the legislation actions, this study analysis their enforcement levels as the following:

- Level high. Legislation actions that are legally binding are categorized in the high enforcement group. In this study, regulations, policies, and laws that with strict obligations fall into this group.
- Level middle. Legislation actions that are conditional legally binding are categorized as having middle enforcement. They are legal actions, but only mandatory to certain food supply chain actors, or under certain conditions. In this study, Communications, Directives, Decisions, Decree, Initiative, Recommendation belong to the middle-level group.
- Level low. Legislative actions that are not legally binding are categorized in the low enforcement group. In this study, legislation actions such as International Commitment, Agency Order, Industrial Agreement and Policy Paper, which are not issued by government agencies, and they are not legally mandatory to any entities and actors belong to the low-level group.

To further quantify the degree of enforcement of legislation actions across European countries, this study gives grades to different level legislation actions, namely 3 to

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high-level actions, 2 to middle-level actions, and 1 to low-level actions. Then an average level score is calculated by Equation (1).

$$AL_i = \frac{3 \times NumH_i + 2 \times NumM_i + 1 \times NumL_i}{Num_i} \quad (1)$$

AL_i stands for the average level for the legislative actions in country i. $NumH_i$, $NumM_i$, $NumL_i$, and Num_i stands for the number of high-level legislation actions, the number of middle-level legislation actions, the number of low-level legislation actions, and the total number of all the legislation actions, respectively.

2.2 Food Supply Chain level mapping

At the FSC level, one online survey was designed by subtask 1.1.2 leader partner and assigned among subtask partners. The survey conducted at the FSC level was designed to ascertain optimal approaches for measuring, monitoring, and reporting FLW within various FSCs. This encompassed input from primary production stakeholders, the food processing industry, retailers, and food services, all aimed at identifying best practices. To further contribute to the understanding of relevant situations at FSC level, for each subtask 1.1.2 partner country, a national narrative analysis was conducted.

Specific indicators that were integrated into the FSC level survey to understand relevant strategies and practices are presented below:

1) Type of organization answering the survey
2) Type of systems for measuring FLW used by the organization
3) Monitoring tools used
4) Reporting tools used
5) Estimated volume of FLW in each own production
6) Changing perceived after using measurement, monitoring and reporting tools
7) Annual average costs of FLW handling/disposal
8) Annual average cost of FLW management
9) Man/days dedicated to FLW management
10) Strategies implemented by respondents
11) Any communication actions of FLW management/reduction
12) Any national/EU projects participated by respondents about FLW management

To enrich the FSC level survey, subtask 1.1.2 partners carried out a qualitative study focusing on their own countries, namely Czech Republic, Denmark, Hungary, Spain,

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Slovenia, Austria, Greece, Turkey, and Italy. These qualitative studies employed narrative analysis and were executed through the development of concise country reports. Specifically, given the unique context of each country, these country reports aimed to describe the local practical strategies and actions among private sectors, drawing an overview of EU situation, as data come from EU-27 Members – except for Turkey, which participated as Associated entity of WASTELESS EU Project. The focus priorities of these country reports were within the food processing, retailer, and food service sectors.

2.3 SWOT analysis

SWOT analysis is strategic analysis tool to evaluate the strengths, weaknesses, opportunities, and threats associated with specific resources (Benzaghta et al., 2021; Gürel, 2017). This report runs a SWOT analysis targeting the existing FLW measurement and monitoring practices, as well as the existing legislative actions impacting FLW. Specifically, this SWOT analysis wants to better identify areas for improvement, potential strategies for enhancing, and inform decision-making and policy development to effectively address FLW issues, while humanize the FLW measurement and monitoring across Europe. Tailoring to this analysis objective and focusing on the identified FLW measurement and monitoring practices and legislation actions, this study builds a SWOT analysis framework with the following definitions:

- Strengths: attributes and characteristics that give advantages to be leveraged and inform for harmonized FLW measurement and monitoring framework building.
- Weaknesses: existing challenges, barriers, and limitations that might hinder the development of the harmonized framework.
- Opportunities: positive factors that could exploit to forester the FLW measurement and monitoring framework harmonization.
- Threats: potential risks and elements that might jeopardize the harmonization process.

The SWOT analysis was carried out among WP 1 partners based on the inventory of identified FLW measurement and monitoring practices and legislation actions. Then SWOT analysis outcomes in bullet points from partners were gathered in bullet points for strengths, weaknesses, opportunities, and threats.

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3. Results

3.1 FLW measurement and monitoring practices mapping

3.1.1 Practices inventory and profiling at the national level

An inventory of 68 practices has been identified at the national level, among them a total of 40 practices which had FLW measurement and monitoring conducted were included in the Cluster 1. For the remaining practices, based on their characterization and objectives, were clustered into other clusters subsequently. The **Table 1** presents the inventory of Cluster 1 practices with their original countries and applied FLW definitions. The information of Cluster 2 and Cluster 3 practices are provided in the Appendix II.

This study examines the definitions regarding FLW applied in each practice. Findings revealed that definitions FAO (2019) and FUSION (2014) were prevalent across the practices (shows in **Table 1** and Appendix II). In addition, several practices employed relevant definitions that were adjusted to their specific context or aligned with EU regulations. Those definitions besides FAO (2019) and FUSION (2014) were descried in **Table 2**.

Table 1. Inventory of food loss and waste measurement and monitoring practices and their food loss and waste definitions

Table legend for the FLW Action Type: WS, Whole stage. PP, Primary production, HS, Handling and storage, PM, Processing and manufacturing, DL, Distribution and logistics, RW, Retail and wholesale, FS, Food services, HH, Households

Practice number	Measurement practice title	Target FSC stages	FLW definition
1	Municipal Food Waste Measurement	WS	NA
2	Central Register for Waste Plants and Waste Balance	WS	FAO (2019)
3	FUSION (Food Use for Social Innovation by Optimising Waste Prevention Strategies)	WS	FUSIONS (2014)
4	Research and collection of Austrian food industry FLW data	WS	FAO (2019)
5	Household Budget Survey	HH	FUSIONS (2014)
6	Ministry of Agriculture and Forestry's Food Waste Survey	HH	FAO (2019)
7	Smart Scale System	RW, FS	FUSIONS (2014)

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8	no name actually	PM, DL	NA
9	Household food waste measurement	HH	FUSIONS (2014)
10	The generation of food waste and food loss in the Estonian food supply chain – Household stage.	HH	FUSIONS (2014)
11	The generation of food waste and food loss in the Estonian food supply chain – retail and wholesale stages	RW	FAO (2019)
12	The generation of food waste and food loss in the Estonian food supply chain - SEI household survey	HH	FAO (2019)
13	The generation of food waste and food loss in the Estonian food supply chain – whole food supply chain	WS	FAO (2019)
14	Digital weighing	PP, HS, PM, DL	FAO (2019)
15	Meals department Skövde municipality	FS	FAO (2019)
16	Origins of Food waste in the food chain	FS, HH	FUSIONS (2014)
17	Waste composition analysis	HH	Others
18	collection green waste and composition analysis for food waste	HH	Others
19	Self-reported Food waste frequency questionnaire on a weekly average	HH	Others
20	Self-reported food waste questionnaire & food waste diary	HH	NA
21	food loss, mass flow analysis based on survey (industries) and in-depth process investigation of some food processing sectors	PM	Others
22	self-reported amount of food waste	HH	Others
23	Food waste from primary production, processing and manufacturing sector 2018	PP, PM	EU regulation
24	Generation and Treatment of Municipal Solid Waste	WS	FUSIONS (2014)
25	Quantification of food waste in an insular island state for all stages of the food supply chain	WS	FUSIONS (2014)
26	Food Waste in Spain Report	RW, FS, HH	FAO (2019)
27	Food Waste Behaviour among Romanian Consumers: A Cluster Analysis	HH	FUSIONS (2014)
28	Data collection from waste generators	WS	EU

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	through an information system		regulation
29	National Waste and Resource Management Plan (PNGDR) measurement valuation	WS	EU regulation
30	Amount and composition of food waste in Luxembourg	WS	EU regulation
31	Food waste prevention plan essential elements for supermarkets with a sales area >= 400 m2	RW	EU regulation
32	CIRCTER SPIN-OFF Luxembourg Case Study (ESPON)	WS	FUSIONS (2014)
33	WASTESTIMATOR	FS, HH	Others
34	The statistical survey on food waste - households	HH	FUSIONS (2014)
35	The statistical survey on food waste - business entities	PP, PM, DL, RW, FS	FUSIONS (2014)
36	FEED THE HUNGRY THE POTENTIAL OF SURPLUS FOOD RECOVERY	WS	Others
37	Factsheet on food waste by consumers 2013	WS	FUSIONS (2014)
38	Supplementary memorandum Food waste in Dutch households in 2016	PM, HH	FUSIONS (2014)
39	Analyzing household food waste in the Maltese islands	HH	FUSIONS (2014)
40	"The Italy case" Report by Waste Watcher International	HH	FUSIONS (2014)

Table 2. Descriptions of FLW definitions besides FAO (2019) and FUSION (2014).

Practice number	FLW definition description
17	Food waste was defined as still edible meat and fish and other foodstuffs or parts thereof originally suitable for consumption.
18	Meat/fish (still edible, avoidable FW) and other food (still edible, avoidable FW) were considered as avoidable food waste, and grub waste as unavoidable food waste, not considered as food waste.
19	All avoidable and possibly avoidable food waste.
20	All organic materials (edible and non-edible, such as banana peels and bones) that are removed from the food value chain and not used for their intended purpose (providing food) are recorded as losses. This includes food for animal feeding. This definition is consistent with that of Beretta et al. (2013) and that of Richter and Bokelmann (2016).

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22	Following the avoidable food waste (WRAP, 2009), this practice defined food waste as all foods in a household that are discarded in a waste or bio-waste bin, composted, or fed to animals.
23	Following EU regulation: Delegated Decision (EU) 2019/1597.
28, 29, 30, 31	EU regulation: "food waste": all foodstuffs within the meaning of Article 2 of Regulation (EC) No. 178/2002 established the general principles and general requirements of food law, establishing the European Food Safety Authority and laying down procedures relating to the safety of foodstuffs which have become waste.
33	Food waste: Total food waste and kitchen biowaste (Parts of food that were originally inedible: potato peelings, fruit peels and stems, bones, roes, fish skin, coffee grounds with filter paper, tea bags).
36	Surplus food is defined as edible food products that for various reasons are not purchased or consumed by customers or people for whom they were produced, processed, distributed, served or purchased. At this point, “food waste” is defined based on the contexts in which it is generated, namely, it is the part of surplus food that is not recovered for human consumption (social perspective), for feeding animals (zootechnical perspective), or for the production of goods or energy (environmental perspective).

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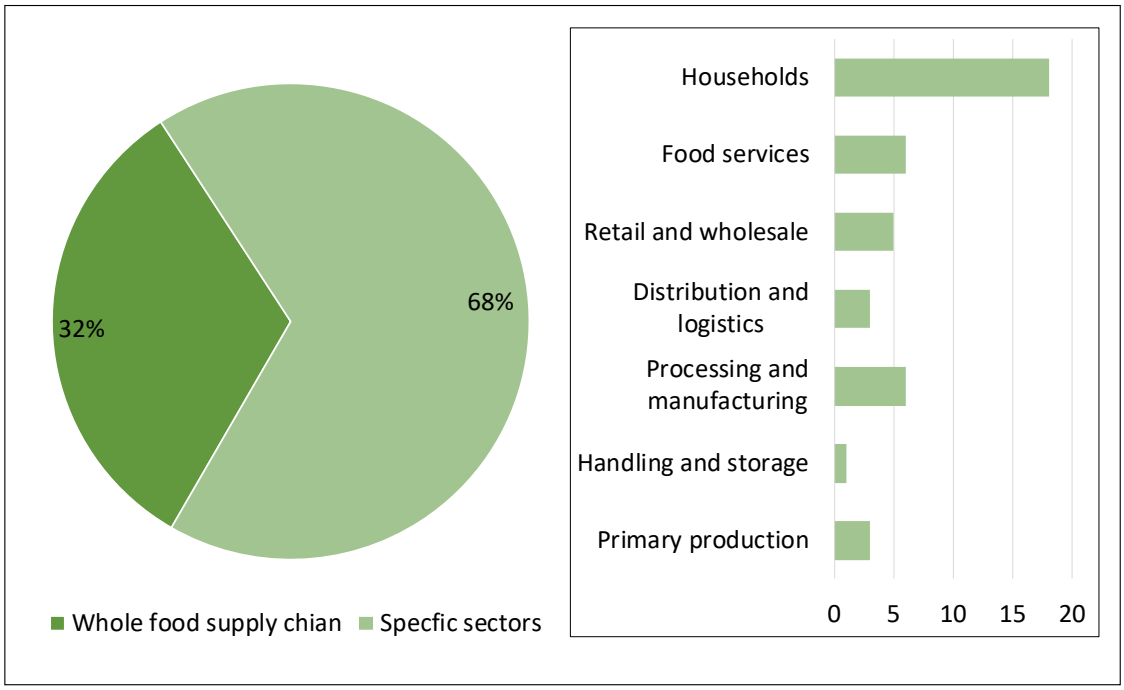

Figure 2. Distribution of target food supply chain sectors for Cluster 1 practices

This study reviewed those 40 FLW measurement and monitoring practices with further understanding on their implementation and data collection methodologies.

The findings revealed almost one-third (13 out of 40) of the FLW measurement and monitoring practices were designed to encompass the whole FSC. For the remaining practices that did not cover the entire supply chain, household and foodservice sectors were emerged as the top two contexts in which these FLW measurement and monitoring practices were implemented (**Figure 2**).

The geographic coverage of these practices was predominantly national wide, with 31 practices out of 40 practices conducted at this level. In addition, regional practices accounted for 5 registrations, while 3 practices were conducted at the municipal level, and one study is case study (**Figure 3**). Regarding food commodities that have been measured in those practices, more than three quarters (77%) of practices cover all food commodities without differentiating by type during measurement. Within the practices that focused on specific food categories, fruit and vegetables emerged as the top two types that were quantified for loss and waste (**Figure 4**). The **Table 3** provides the specific data collection methods as well as the data originality for each FLW measurement and monitoring practice.

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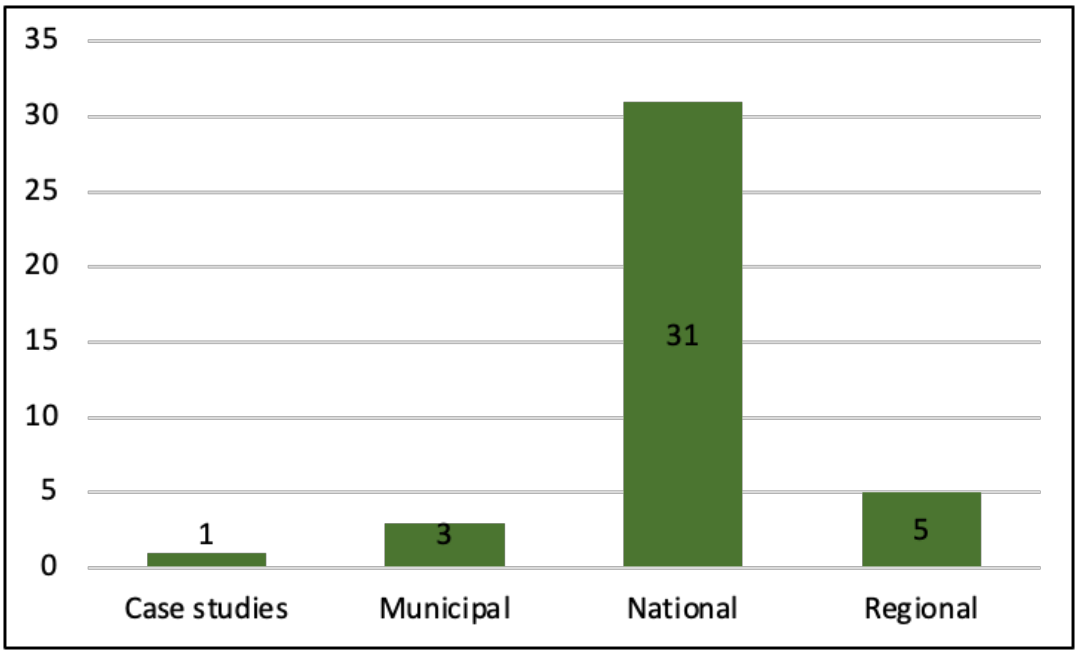

Figure 3. Distribution of practices geograp hic scope for Cluster 1 actions.

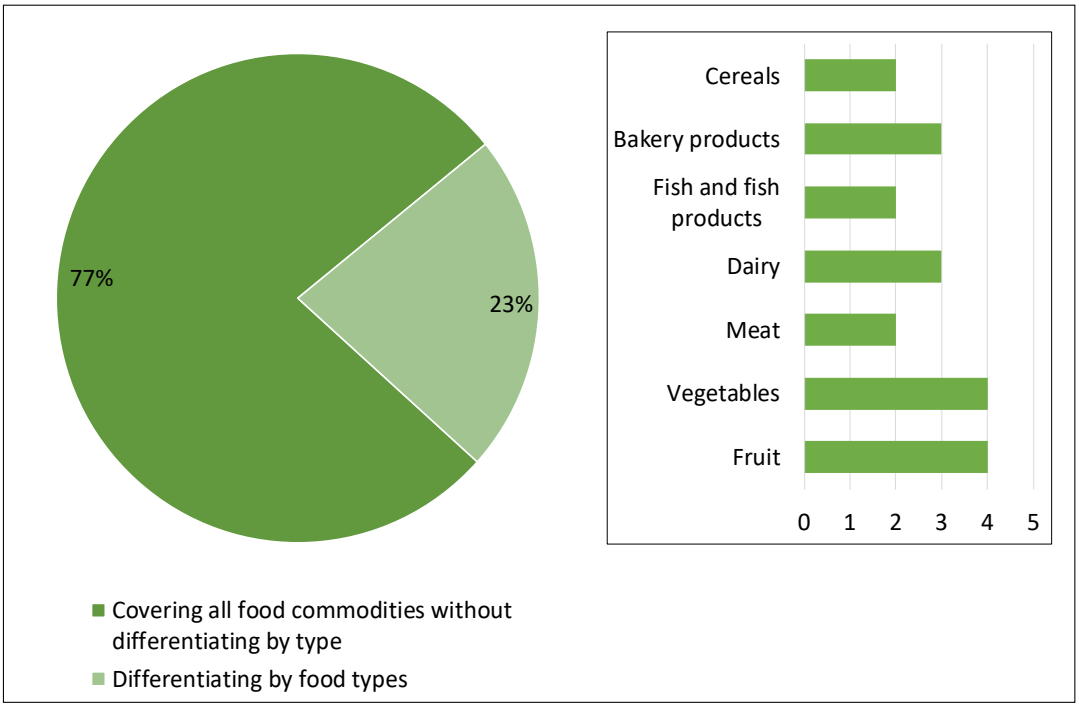

Figure 4. Distribution of target food commodities for Cluster 1 actions.

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Table 3. Food loss and waste measurement and monitoring practices data collection methods.

Practice number	Data originality	FLW measurement method
1	Primary data	Digital weighing
2	Primary data, Secondary data	Mass balance, Food balance, Literature data
3	Primary data, Secondary data, Literature data	Mass balance, Surveys and interviews, Modelling, Food balance, Proxy data, Literature data
4	Primary data, Secondary data	Mass balance, Surveys and interviews, Food balance, Literature data
5	Primary data	Surveys and interviews
6	Primary data	Surveys and interviews
7	Primary data	Digital weighing
8	Primary data	Diaries, Mass balance, the data is entered into the company's management system
9	Primary data	Diaries
10	Primary data	Diaries
11	Primary data	Diaries
12	Primary data	Digital weighing, Diaries, Surveys and interviews
13	Primary data, Secondary data	Digital weighing, Mass balance, Surveys and interviews
14	Primary data	Digital weighing
15	Primary data	Digital weighing
16	Primary data	Surveys and interviews
17	Primary data	Waste composition analysis in waste bags from households
18	Primary data	Waste composition analysis
19	Primary data	Diaries, Food waste frequency questionnaire

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20	Primary data	Diaries, self-reported food waste frequency questionnaire
21	Primary data	Mass balance
22	Primary data	Surveys and interviews
23	Primary data, Secondary data	Surveys and interviews, Food balance, Proxy data
24	Primary data	Digital weighing
25	Primary data, Secondary data, Literature data	Mass balance, Surveys and interviews, Literature data
26	Primary data	Mass balance, Modelling, Literature data, Diaries by smartphone
27	Primary data	Surveys and interviews
28	Primary data, Secondary data	Food waste composition analysis
29	Primary data, Secondary data	To be implemented
30	Primary data, Secondary data	Surveys and interviews
31	Primary data, Secondary data	It depends on supermarket methodology
32	Primary data	Amount of material consumed per inhabitant, while the latter measures the amount of material consumed to produce a unit of economic output
33	Primary data	Digital weighing, Surveys and interviews, Household food waste: weighed and recorded in "Waste Manager application"
34	Primary data	Digital weighing, Diaries
35	Primary data	Surveys and interviews
36	Primary data	Food balance, Transportation document (in Italy - DDT)
37	Primary data	Waste Composition analysis

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38	Primary data	Surveys and interviews, Food balance, Proxy data, Literature data
39	Primary data	Surveys and interviews
40	Primary data	Surveys and interviews

3.1.2. FSC level FLW measurement and monitoring practice analysis

From the analysis of the reports issued by Denmark, Czech Republic, Spain, Greece, Italy, Austria, Slovenia, Hungary, and Turkey, the practices applied depended on the specific sector/actor of the supply chain (such as, harvest control for farmers, dissimilarities restrictions for companies/food industry, storing techniques in households), and usually the solutions and possible strategies to be implemented can be replicated from nation to nation.

Collecting data usually occurs through surveys, distributed among companies and stakeholders involved in the FSC. In some virtuous cases, the data are collected through online platforms, such as the EU Platform on Food Losses and Food Waste – established in 2016: this kind of tool not only pursues a mapping of current losses and waste, but it also creates a box where to share *best practices*. In other countries, such as Czech Republic or Spain, Governments issued Directive or Regulations to spread which goals are expected and how to reach them, giving again to surveys or interactive tools the task of collecting inputs. In other nations, like Italy, the Governments both monitor the flow with the help of private Observatories or Universities – which elaborate surveys or app to keep track of FLW. For countries as Greece, which reports a lack of data in this matter, the strategies and tools like those abovementioned can be inspiring to effectively face the problem.

Based on data gathered with WASTELESS Survey, the measurement of FW is set in different ways according to the sector, tools and the nature of waste. Some answers highlight the scope for improvement, especially where manual tools are used, instead of digital programs (e.g., SAP), apps or electronic instruments (such as, calibration weighing instruments for waste), data collected inside and outside form factory in storage area which name is evaluation warehouse, and then recorded in SAP. When it comes to monitoring, tools used are major tracking ones, SAP, intranet, and internal software programmes. After these two phases, reporting should be generated in order to keep track of progress, while having the chance to comparing performance year after year, and thus understanding if steps undertaken are valuable; again, here we find SAP and statistical analysis, based on data manually entered, traceability system, and internal IT. Part of the respondents also noted that

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after the implementation of FLW measurement, monitoring and reporting, their amount of volumes of FW and losses have decreased, as showed in the **Figure 5**.

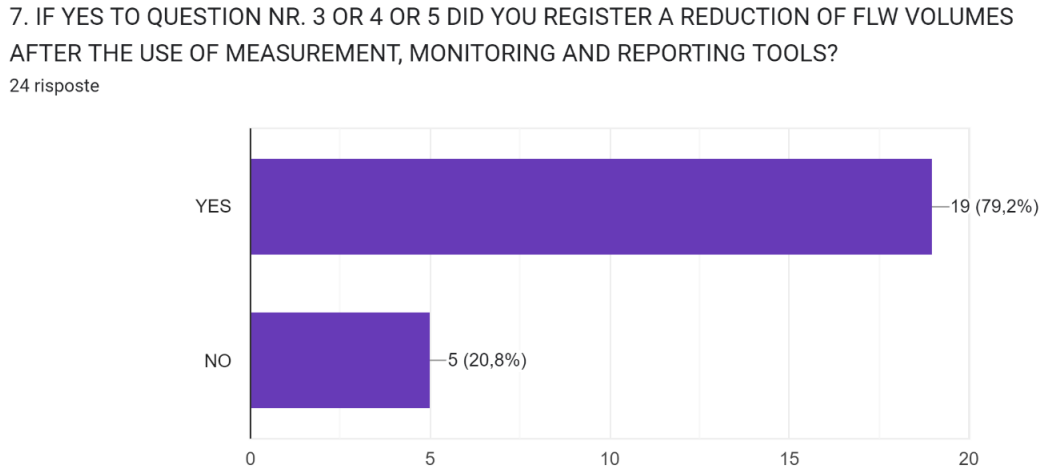

Figure 5. FSC survey respondents' sentiments after FLW measurement, monitoring and reporting implementation.

Another important finding on surplus management arises from the survey: how FLW are treated and reused within the production process (**Figure 6**). A "green" and sustainable data revealed that the highest percentage of FLW are transferred or sold to processing companies to produce renewable energy or animal feed (23%), and 15% of FLW are used within the same production process, where FLW originated. Good examples are from everywhere Europe: in Turkey, for instance, an international brewing company uses by-products and FW from yeast and malt as animal feed and fertiliser by recovery using drying and biogas facilities; in addition, another Turkish food company sends its fruit waste and by-products to an energy electricity production company; in Italy, by-products of citrus are used to create natural fabrics or natural pectin (this second aspect originated from a EU project "Life Citrus"). Even though these two aspects are quite positive and significant, it is worthy to pay attention to 21% of FLW that are simply disposed as waste: further investigation on this aspect should be carried out to effectively understand to what kind of residual waste it is referred to and how to valorise it. Another aspect to be investigated is related to the figure on donations to charitable organizations or NGOs: according to respondents of the questionnaire, only 10% of food is donated to the needy; again, this data should be further explored to evaluate why the percentage is so low: are legislations too restrictive, and do they ease this donation process or represent a barrier? Is the network of companies (farms or industries) well connected with national Food Banks or volunteering bodies which recover food and

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sorting it to the needy? Technology and digital improvements can play also here an important role in improving this data: nowadays, there are many Apps connected with the network of local companies and retailers which offer a certain amount of products (near to expiring date or produced over the last 24 hours, but still edible) at a lower price, in order to avoid that surplus is wasted. The most famous example is "TooGoodToGo": its mission is to inspire and empower everyone to fight FW together and for this reason its network is active worldwide: from Italy, to Poland, from Switzerland to United States, from Austria to Canada. In Czech Republic, there is also a national mobile App facing FW reduction in restaurants: Nesnězeno helps to order with just a click remaining food in restaurants in Prague, which clients need to pick at lower price (approximately 200 portions are sold daily).

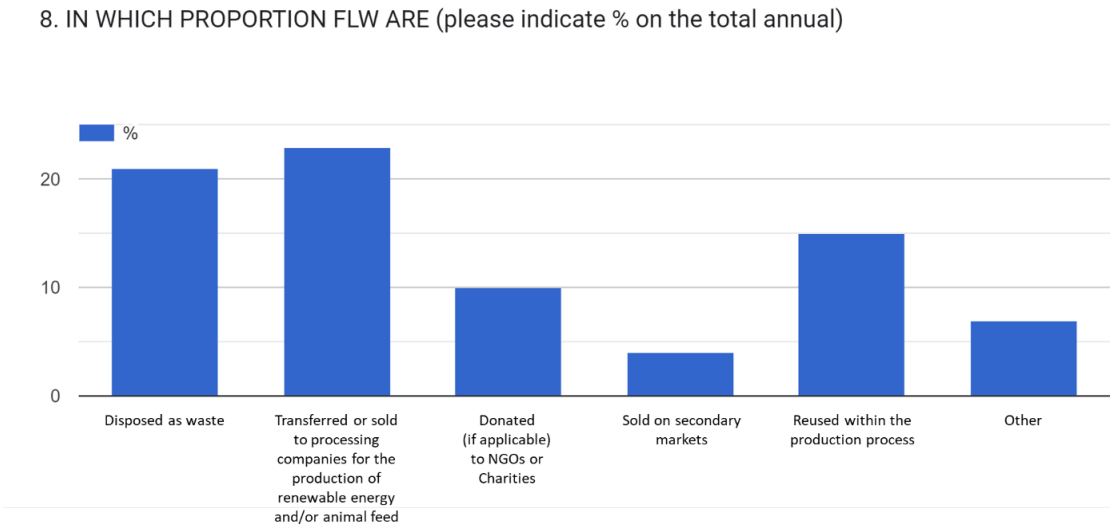

Figure 6. Distribution of FLW management across FSC.

From left, disposed as waste; transferred or sold to processing companies to produce renewable energy and/or animal feed; donated to NGOs and Charity; sold on second market; reused within production; other.

To conclude about FLW management, one of the main aspects to take into consideration is ensuring food safety of food: in order to donate it, to be used for animal feed or even to implement in other production systems, the main aspect to guarantee is the integrity of food/ingredients, that is to say that it must be edible, and thus manipulation or handling must be performed in the safest way possible. Finally, during the last years, many initiatives have been carried out, including political dialogue, to evaluate whether eating a specific food after "expiring date" is good for human health: also, for this aspect, "best before" or "best preferably before" should be more studied to finding level of understanding and utilization of date marking by food operators.

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As FLW also comprehends not only environmental aspects, but also an economic one, keeping track of FLW, knowing how much it costs, it could really help a company to better manage its resources. As shown in the **Figure 7**, most respondents ignore the costs of FLW handling and disposal. This condition results in a loss of income and revenue for the company, which can be better optimized.

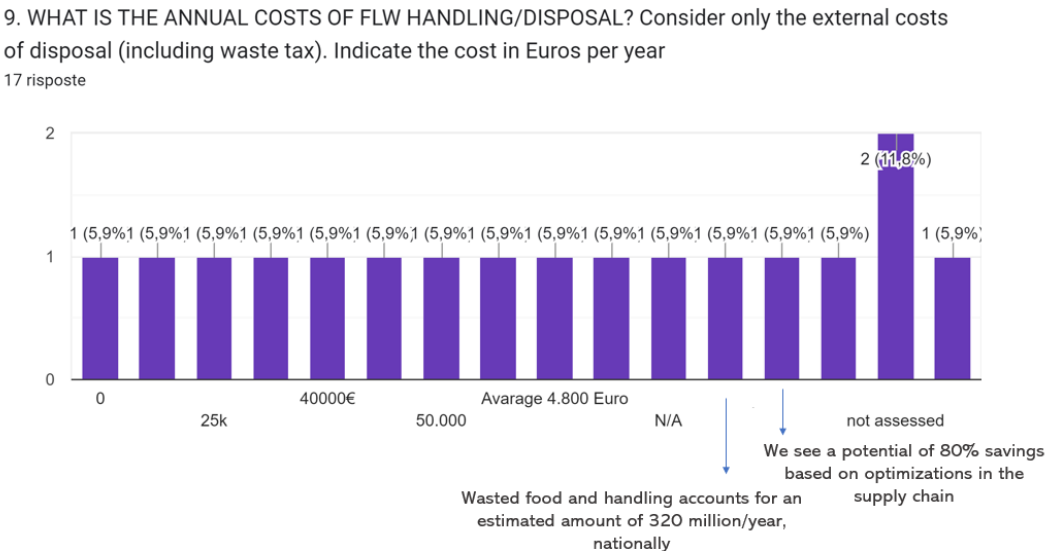

Figure 7. FSC survey - outlook of annual costs of FLW handling/disposal.

3.2 Legislation actions mapping

3.2.1 Legislation actions mapping

The mapping of FLW legislation has identified a total of 96 actions. All these actions were reviewed to uncover the profiles and understand their implications related to FLW. Results showed that the legislation inventory encompassed 14 types of legislation, with regulation, policy, and law registered as the top three legislation types (**Figure 8**).

The findings indicated that reduction, management, and generation were emerged as the top three implications associated with FLW, along with measurement and monitoring, use optimization, food donation, and data reporting (**Figure 9**).

As showedshown in **Figure 8**, there are nine countries that scored 3 for the average legislation action enforcement level, namely, Cyprus, France, Malta, Poland, Romania, Slovenia, Sweden, Switzerland, Turkey. It means all the recorded

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legislation actions recorded under these countries are legally enforced. A total of eight countries scored between 2 and 3. Those countries are: Spain, Latvia, Portugal, Lithuania, Austria, Estonia, Luxembourg, Slovakia. It means that among these countries, FLW are included into the national legislation framework not just in a high enforcement level, but also in some middle-level or low-level actions. It means for all these countries, there is a rather diverse legislation framework to tackle FLW. A total of seven countries scored no more than 2, they are Croatia, Finland, Ireland, Italy, Netherlands, Germany, Norway. For all these countries, FLW legislation actions are not fully mandatory to all the FSC actors under all the conditions. **Figure 9** shows that across Europe, high-level legislation actions concerning FLW are prevalent, particularly in southeastern central Europe. A more diversified FLW legislation framework is witnessed in northern, western, and southern Europe, as in these three areas middle and low-level legislation actions take a rather lager share compared to the figures of central and southeastern Europe.

For a comprehensive overview of all the identified legislative actions, the **Table 4** provided a general profile for each of them.

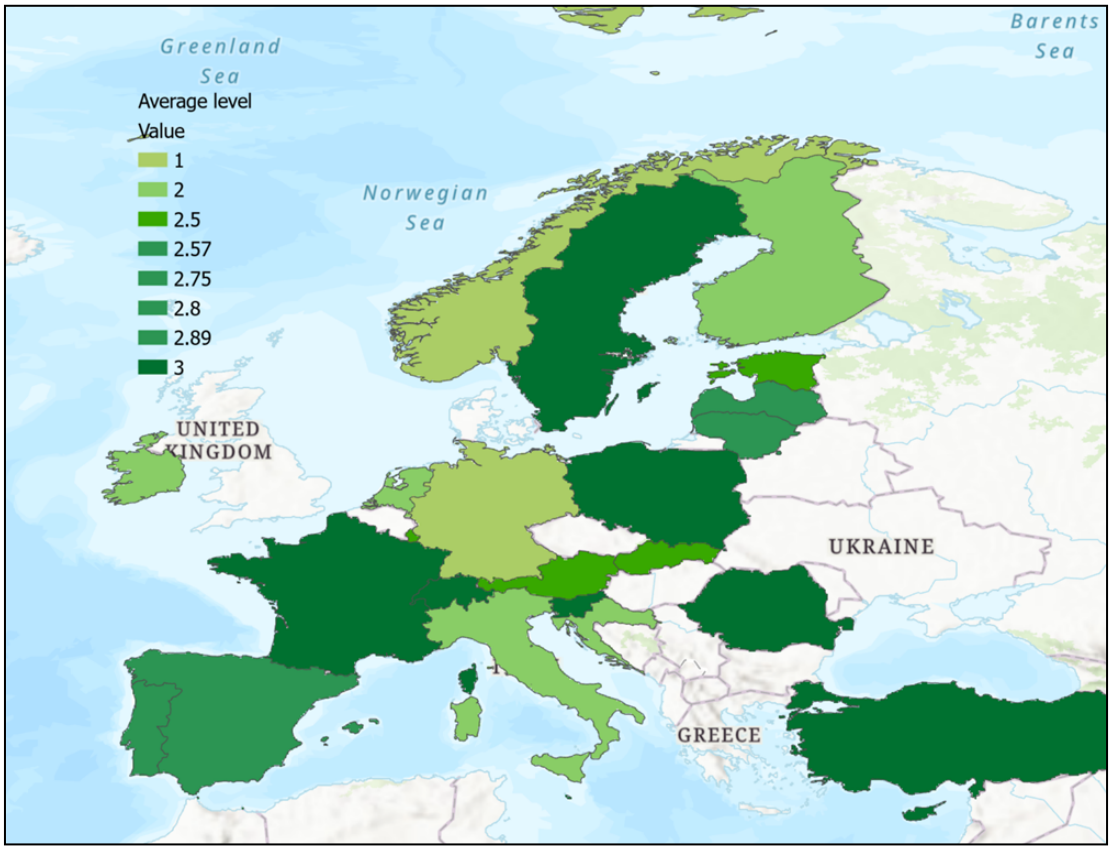

Figure 8. Legislation actions average enforcement level for each country.

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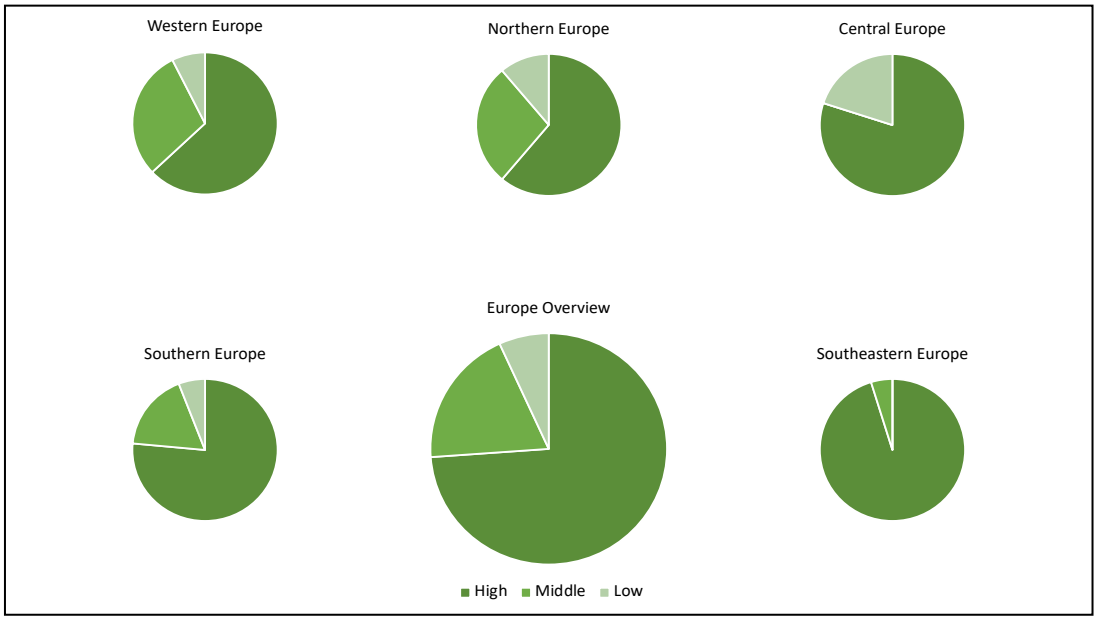

Figure 9. Distribution of different levels of legislation actions across Europe and in different regions.

Figure legend:

High level. Legislation actions that are legally binding are categorized in the high enforcement group. In this study, regulations, policies, and laws that with strict obligations fall into this group.

Middle level. Legislation actions that are conditional legally binding are categorized as having middle enforcement. They are legal actions, but only mandatory to certain food supply chain actors, or under certain conditions. In this study, Communications, Directives, Decisions, Decree, Initiative, Recommendation belong to the middle-level group.

Low level. Legislative actions that are not legally binding are categorized in the low enforcement group. In this study, legislation actions such as International Commitment, Agency Order, Industrial Agreement and Policy Paper, which are not issued by government agencies, and they are not legally mandatory to any entities and actors belong to the low-level group.

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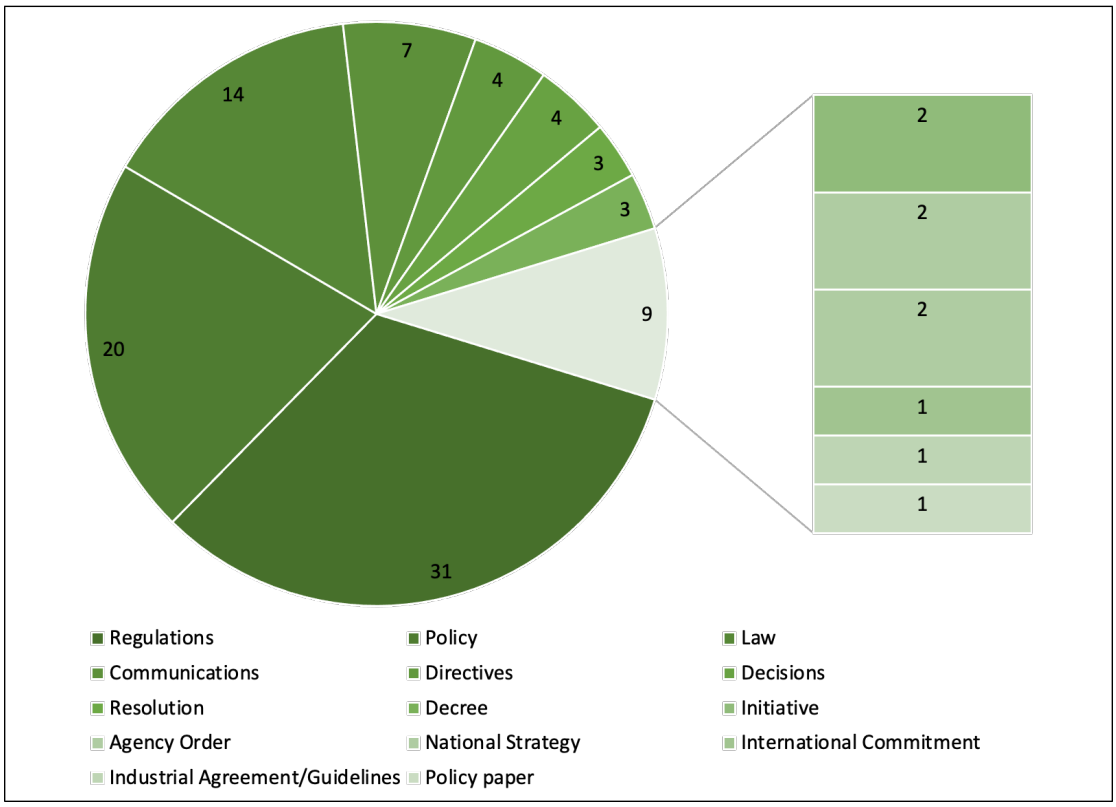

Figure 10. Distribution of legislation types.

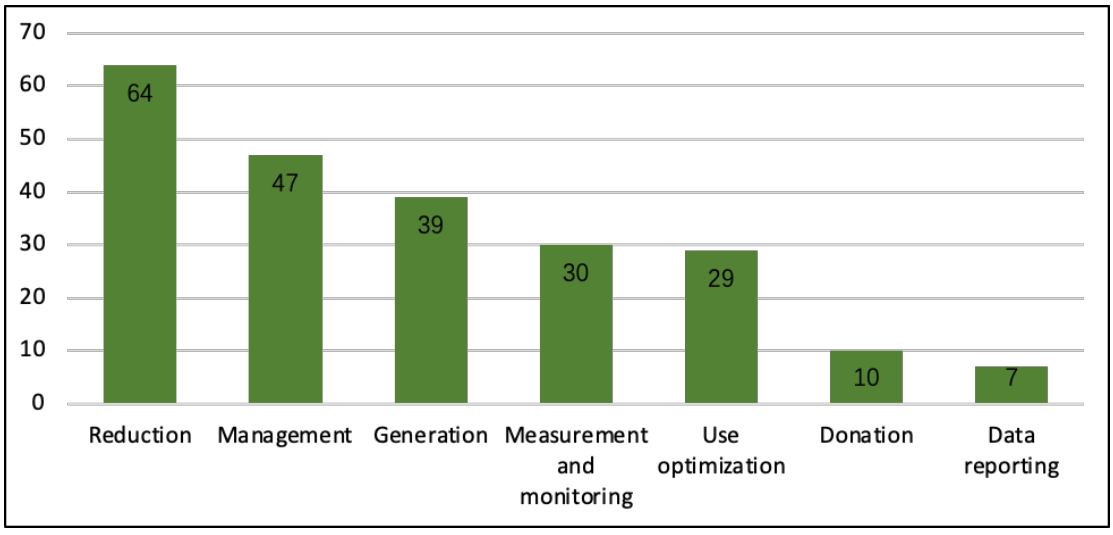

Figure 11. Distribution of legislation implications on food loss and waste.

Table 4. Inventory of FLW legislations and their impactions on FLW

Table legend for the FLW Action Type: GE, Generations. MM, Measurement and monitoring. MA, Management. RE, Reduction. UO, Use optimization. DR, Data reporting. DN, Donation.

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#	Legislation title	Country	Policy type	FLW implications
1	"Bundes-Abfallwirtschaftsplan"/ Federal Waste Management Plan	Austria	Regulations	MA, RE
2	Action Programme: Foods are precious	Austria	Communications	GE, MM, MA, RE, UO
3	Strategies for the prevention of food waste	Austria	National Strategy	GE, MM, MA, RE
4	Food Waste Legislation and Action in Austria	Austria	Communications	GE, MM, MA, RE
5	Milan Food Policy - Integrated Action on Food Losses and Waste Management	Italy	International Commitment	RE, DI
6	Action Plan for Food Waste Prevention	Estonia	Policy	MA
7	Food Rescue Action Plan	Estonia	Directives	MM, MA, RE
8	"Måltidspolicy"	Sweden	Policy	GE, MM, MA, RE, UO
9	Value Added Tax Law and Law on Amendments to Decree Law No. 178 with Certain Laws	Turkey	Law	RE
10	Turkey's National Strategy Document and Action Plan on the Prevention, Reduction and Management of Food Loss and Waste	Turkey	Policy	GE, MA, RE, UO
11	Compost Regulation	Turkey	Regulations	MA, UO
12	Regulation on the Procedures and Principles to be Followed in Determining the Tariffs of Wastewater Infrastructure and Domestic Solid Waste Disposal Facilities	Turkey	Regulations	RE

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13	Regulation on Mechanical Separation, Drying and Biomechanization Plants and Fermented Product Management	Turkey	Regulations	MA, UO
14	Turkish Food Codex Regulation on Food Labelling and Consumer Information	Turkey	Regulations	RE
15	Regulation on Standard Practices to be Followed in Wholesale and Retail Trade of Vegetables and Fruits	Turkey	Regulations	RE
16	The Environmental Law	TÜrkiye	Law	MA
17	Veterinary Services, Phytosanitary, Food and Feed Law	Türkiye	Law	RE
18	Agricultural Products Licensed Warehousing Law	Türkiye	Law	MA, RE, UO
19	Law on the Regulation of Trade in Vegetables and Fruits and Other Goods with Sufficient Depth of Supply and Demand	Türkiye	Law	MA, RE, UO
20	Waste Management Regulation	Türkiye	Regulations	GE, MA, RE, UO
21	Zero Waste Regulation	Türkiye	Regulations	GE, MM, MA, RE, UO
22	Regulation on Regular Landfilling of Wastes	Türkiye	Regulations	MM, MA
23	Strategy to reduce food loss and food waste in the food supply chain “Respect food, respect the planet”	Slovenia	Policy	RE
24	Agriculture Act (Zkme-1, Official Gezette of the Republic of Slovenia; Articles 89a and 89b)	Slovenia	Regulations	RE

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25	Swiss action plan against FLW 06.04.2022 – Postulat 18.3829 Chevalley (2022 – 2025)	Switzerland	Policy	MM, MA, RE, UO
26	Federal constitution, Art. 104a Food security, SR 101	Switzerland	Regulations	GE, MA, RE
27	Environmental protection law SR 814.01 (Chapter 4: Waste)	Switzerland	Regulations	MA
28	Waste regulation Art. 11 Abs. 1, SR 814.600, Avoidance of waste	Switzerland	Regulations	RE, AG
29	Waste regulation (Art. 11, Abs. 2, SR 814.600), Avoidance of waste	Switzerland	Regulations	GE, RE
30	Waste regulation Art. 6 SR 814.600, Reporting & environmental protection law art. 46 abs. 1 and abs. 2, Obiligation to provide information	Switzerland	Regulations	MM, MA, RE
31	Swiss action plan against FLW 06.04.2022 - Postulat 18.3829 Chevalley (2022 - 2025)	Switzerland	Policy	MM
32	"Estratégia de combate ao desperdício alimentar"	Portugal	Resolution	GE, MM, MA, RE, UO
33	Directive 2008/98/EC	European Parliament And Council	Directives	GE, MM, RE, DR
34	Commission Decision 2000/532/EC	European Commission	Decisions	MM, DR
35	Regulation (EC) No 2150/2002 on waste statistics	European Commission	Regulations	GE, MA, MM, DR
36	Regulation (EU) No. 849/2010 on amending Regulation (EC) No. 2150/2002 on waste statistics.	European Commission	Regulations	GE, MM, MA, DR

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37	Delegated Decision (EU) 2019/1597 - a common methodology and minimum quality requirements for the uniform measurement of levels of food waste	European Commission	Decisions	MM
38	Implementing Decision (EU) 2019/2000 - a format for reporting of data on food waste and for submission of the quality check report in accordance with Directive 2008/98/EC	European Parliament And Council	Decisions	MM, DR
39	Law 7/22, of April 8, on waste and contaminated soil for a circular economy (Ley 7/22, de 8 de abril, de residuos y suelos contaminados para una economía circular)	Spain	Law	RE
40	Food Loss and Waste Prevention law	Spain	Law	GE, UO
41	The industry agreement on reducing food waste: Main report 2020	Norway	Industrial Agreement/Guide line	MM, RE
42	National Strategy and Action Plan to Combat Food Waste	Portugal	Policy	MA
43	National survey of Food Waste in Portugal	Portugal	Directives	GE, MM
44	Regulatory framework on the donation of food items for social solidarity purposes and FLW action measure	Portugal	Regulations	DN
45	Commission Regulation (EC) No 782/2005 on setting out the format for the transmission of results on waste statistics	European Commission	Regulations	MM, DR

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46	Commission Regulation (EC) No. 1445/2005 on defining the proper quality evaluation criteria and the contents of the quality reports for waste statistics for the purposes of Regulation (EC) No. 2150/2002	European Commission	Regulations	MM, DR
47	Waste Law of 2011 (L.185(I)/2011)	Cyprus	Law	GE, MA, RE, UO
48	2015-2021 Municipal Waste Management Strategy	Cyprus	Policy	GE, MA, RE, UO
49	Ministry of Agriculture Rural Development and the Environment' s Strategic Planning 2015-2017	Cyprus	Policy	GE, MM, MA, RE, UO
50	Waste Management Law	Latvia	Law	GE, MA, RE, UO
51	Cabinet of Ministers Regulations No. 788 in 2016	Latvia	Regulations	MA
52	National waste management plan (2021-2028)	Latvia	Directives	GE, MM, MA, RE, UO
53	Republic of Latvia Cabinet Regulation No. 514/ Requirements for the Food Distribution after Expiry of the Date of Minimum Durability	Latvia	Regulations	RE
54	Cabinet Regulation No. 145 of 17 March 2020/Requirements for Retail Establishments that Deliver Poultry Eggs or Donate Food of Animal Origin	Latvia	Regulations	RE, DN
55	"Más alimento, menos desperdicio"	Spain	Communications	RE
56	"Aquí no se tira nada"	Spain	Policy	RE

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57	"La alimentación no tiene desperdicio"	Spain	Regulations	RE, UO
58	New Common Agricultural Policy (PAC)	Spain	Regulations	GE
59	Spanish Circular Economy Strategy - EEEC	Spain	Policy	GE, RE
60	Agenda to Reduce Food Waste 2022-2027	Spain	Regulations	GE
61	Food Loss and Waste Prevention Law	Spain	Regulations	GE, RE
62	The Romanian Law 217/2016 (amended in 2018)	Romania	Resolution	GE, MA, RE, UO
63	WASTE MANAGEMENT LAW OF THE REPUBLIC OF LITHUANIA	Lithuania	Regulations	GE, RE
64	STATE PLAN FOR WASTE PREVENTION AND MANAGEMENT 2021-2027	Lithuania	Resolution	GE, MA, RE
65	National energy and climate action plan 2021-2030	Lithuania	Policy	GE, MA, RE
66	Food Law	Lithuania	Regulations	RE
67	APPROVAL OF THE DESCRIPTION OF THE PROCEDURE FOR THE USE OF NON-ANIMAL FOOD FOR FEEDING ANIMALS	Lithuania	Agency order	MA, RE, UO
68	Buffet recommendations	Lithuania	Recommendation	RE, UO
69	Lithuanian Bioeconomy Strategy (draft)	Lithuania	Policy	MA, UO
70	Food Waste Disposers - An integral part of the EU's future waste management strategy	Luxembourg	Communications	MA, RE
71	Law of 21 March 2012 on waste management (amended by Law of June 9, 2022)	Luxembourg	Regulations	GE, MA, RE, UO

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72	National Waste and Resource Management Plan (PNGDR)	Luxembourg	Policy	GE, MM, MA, RE, UO
73	NULL OFFALL LËTZEBUERG': THE WASTE PREVENTION STRATEGY	Luxembourg	Initiative	MA, RE
74	Eco Box (part of Clever Lessen initiative)	Luxembourg	Initiative	RE
75	Managing waste	Luxembourg	Policy	MA, UO
76	Circular Economy Strategy Luxembourg	Luxembourg	Policy	MA, RE
77	Redistribution/donation of foodstuffs for human nutrition	Luxembourg	Communications	MA, RE, UO
78	A plan for prevention of food waste	Slovakia	Policy	GE, MM, MA, RE
79	Policy Paper -Making the Slovak Republic a more resource efficient economy	Slovakia	Policy Paper	GE, RE
80	Decree of the Ministry of the Agriculture and Forestry & 16088/5, 19.1.2013 Evira Instructions	Finland	Decree	MA
81	Strategy of the Environmental Policy of the Slovak Republic until 2030	Slovakia	Policy	GE, MA, RE, UO
82	Evira Instructions 16035/1 – Under Decree 1367/2011 Decree of the Ministry of Agriculture and Forestry on the food hygiene of the notified food premises	Finland	Decree	DN
83	Waste prevention programme of the Slovak Republic for the years 2019-2025	Slovakia	Policy	GE, MM, MA, RE, UO

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84	Decision on adoption of the plan for prevention and reduction of food waste generation of the republic of Croatia 2019 – 2022	Croatia	Decisions	GE, MM, RE, DN
85	United Against Food Waste	Netherlands	Communications	RE
86	Long Term Waste Management Plan 2021 – 2030	Malta	Policy	GE, MM, MA, RE, UO
87	Waste prevention country profile	The Netherlands	Communications	MM, RE
88	Law 166/2016 - Disposizioni concernenti la donazione e la distribuzione di prodotti alimentari e farmaceutici a fini di solidarietà sociale e per la limitazione degli sprechi	Italy	Law	DN
89	Decree no. 9084 of August 28, 2014 "National provisions regarding the approval and control of fruit and vegetable producer organisations and their associations, operational funds and programs"	Italy	Decree	DN
90	LOI n° 2016-138 du 11 février 2016 relative à la lutte contre le gaspillage alimentaire (relating to the fight against food waste)	France	Law	DN
91	Ordonnance n° 2019-1069 du 21 octobre 2019 relative à la lutte contre le gaspillage alimentaire (relating to the fight against food waste)	France	Law	DN

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92	LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire (relating to the fight against waste and the circular economy)	France	Law	DN
93	S.I. No. 190/2015 - Waste Management (Food Waste) (Amendment) Regulations 2015.	Ireland	Regulations	GE
94	EPA Food Loss and Waste Measurement Protocol FOR THE FOOD AND DRINK MANUFACTURING SECTOR	Ireland	Industrial Agreement/Guidelines	GE, MM, RE
95	National Strategy for Food Waste Reduction	Germany	National Strategy	RE
96	Act on Counteracting Food Waste	Poland	Law	DN

3.2.2. FSC related legislation analysis

At the EU level, the realm of legislation concerning FW is intricately connected. Beyond the focused regulations addressing FLW, other initiatives have been implemented to drive this endeavor, including the EU Green Deal, EU Farm to Fork Strategy, and EU Circular Economy Action Plan. Each of these plans or strategies provides recommendations and guidelines not only for businesses, with specific goals to attain, but also for consumers, offering practical advice on how to proactively participate in FW prevention, even within households. EU waste legislation already requires MSs to implement national FW prevention programmes and to reduce FW at each stage of the supply chain, while monitoring and reporting on FW levels. This interaction of policies should urge MSs to take actions and strengthen collaboration among actors among the same value chain and other stakeholders, such as NGOs, private agencies, universities, Food Banks, and Charity organisations.

Considering countries which are partner of WASTELESS and contributed with National Reports, all nations have to abide by EU legislation and many of them have internal directives to follow.

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Italy seems to be the first implementing legislation back in 1999, with **Law 133 of 13/05/1999**[4], mainly focused on **VAT exemption for products donated to ONLUS**. It was anticipated by a Legislative Decree on December 4, 1997 (No. 460)[5] which was the reference standard governing donations of food and non-food goods to NPOs. In addition, Italy approved **Law No. 155/2003 "Good Samaritan Law"**[6], promoted by the non-profit Food Bank Foundation, to encourage donations of ready-to-eat and unconsumed food, including in mass catering that would otherwise be thrown away. Passing through the **Zero Waste Chart** (2011)[7] for municipalities, **Italian National Program about waste** (2013)[8], the real turning point is **Law 166/2016 on Food Donation**[9]**,** the so-called Law Against Waste or Gadda Law, by the name of the Member of Italian Parliament who promoted it: the law is based on the incentives and enhancement of good practices, the ability to create lasting relationships among stakeholders that consider each other's needs and capacity; it also sets the limit of € for the value of the goods sold from 5.000€ to 15.000€, easing the process of notification to Italian Income Agency for donations.

Denmark is another virtuous nation: in addition to EU regulations, since 2009 it has been facing FLW also internally, with specific directives concerning all kind of waste management, and FLW were included as all FSC sectors were targeted (**Bekendtgørelse om affald Nr. 1473**)[10].

Slovenia represents a good example of implementation national policies to face this issue; in fact, the Ministry of Agriculture, Forestry and Food prepares the strategy for preventing and reducing food loss and waste; in addition, the Ministry of the Environment, Climate and Energy is responsible for drafting legislation on waste, including food waste, within its remit. Moreover, on 29 September 2020, the following bodies signed together a Declaration for Cooperation to Reduce Food Loos and Waste [11], also organizing awareness raising campaigns: the Ministry of Agriculture, Forestry and Food, the Chamber of Agriculture and Forestry, the Cooperative Union of Slovenia, the Chamber of Commerce and Industry of Slovenia - Chamber of Agricultural and Food Enterprises, the Chamber of Crafts and Enterprises, the Chamber of Commerce and Industry, the Chamber of Tourism and Catering and the Consumers' Union.

4 "Il portale della legge": https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:1999-05-13;133
5 "La Gazzetta Ufficiale": https://www.gazzettaufficiale.it/eli/id/1998/01/02/097G0489/sg
6 "La Gazzetta Ufficiale": https://www.gazzettaufficiale.it/eli/id/2003/07/01/003G0174/sg
7 "Zero Waste: from action to law". https://www.sprecozero.it/rassegna-stampa-due/spreco-zero-da-movimento-a-legge/
8 Italian Ministry of Environment: https://www.mase.gov.it/pagina/spreco-alimentare
9 "La Gazzetta Ufficiale", https://www.gazzettaufficiale.it/eli/id/2016/08/30/16G00179/sg
10 https://www.retsinformation.dk/eli/lta/2010/1473
11 European Commission portal: https://ec.europa.eu/food/safety/food_waste/eu-food-loss-waste-prevention-hub/eu-member-state-page/show/SI

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Austria as part of European Union is bound to EU Regulations and Directives, thus Austrian Laws are an extension of the EU Waste Framework Directive. On national level, On national level, Austria is subjected to the **Waste Management Law 2002** (**Abfallwirtschaftsgesetz** AWG 2002[12]). This law is based on precautionary and preventative principles and establishes qualitative criteria for waste management. It also introduces the waste hierarchy, which takes both the ecological impact and economic aspects of waste into account. Furthermore, the regulation on waste disposal sites (Deponieverordnung 2008[13]) is in effect, which obliges disposal sites to avoid any negative impact on surface and ground water, soil, air, and the global environment, including greenhouse gas emissions, along with any impacts on human health. On a subnational level, Austrian provinces are regulated according to their local government's laws, which have to abide by the rules set out by national law.

Czech Republic has also implemented national regulatory systems with potential and direct implications on food waste generation: **Decree No. 299/2003 Coll[14]**. on measures for prevention and control of diseases and diseases transmissible from animals to humans; **Law No. 110/1997[15]** on food and tobacco products and Decree No. 113/2005 Coll[16]. regulating the labelling of foodstuff; **Government Regulation 352/2014 Coll**.[17], on Waste Management Plan of the Czech Republic for the period 2015-2024. This latter is the most strategic one as it includes "waste prevention programs" to minimize waste, while managing collecting recyclable portions and dispose only if delivery/donation is not possible. Last but not least, Czech Republic also implemented **Law No. 180/2016 Coll. amending the Bill No. 110/1997 on foodstuffs and tobacco products[18]**, which contains hygiene rules and safety for production, storage of food and meals; it also introduces obligation of donating food to charitable organizations for stores of over 400 square meters. It applies only to foods that do not meet certain legislative requirements (e.g. foodstuffs that are mislabeled or deformed). Donated food must be safe and not harmful.

To conclude, national laws maximize EU efforts to control and reduce FLW. Thus, Institutional and private initiatives must be encouraged to boost MSs commitment to tackle common and urgent issue like FLW in the FSC.

12 Source: https://www.bmk.gv.at/themen/klima_umwelt/abfall/recht/awg.html
13 Source: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20005653
14 Source: https://en.svscr.cz/wp-content/files/animal-welfare/ib0704a.pdf
15 Source: https://www.tobaccocontrollaws.org/laws/act-no-110-1997-czech-republic
16 Source: https://www.szpi.gov.cz/en/article/information-for-importers.aspx
17 Source: https://ec.europa.eu/environment/pdf/waste/studies/deliverables/CDW_Czech%20Republic_Factsheet_Final.pdf
18 Source: https://www.global-regulation.com/translation/czech-republic/6092886/change-the-law-on-foodstuffs-and-tobacco-products-and-other-acts.html

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4. Discussion and Conclusion

4.1 Unlocking potential: FLW measurement and legislation SWOT analysis

This report conducted a SWOT analysis to evaluate the strengths, weaknesses, opportunities, and threats associated with the existing FLW measurement and monitoring practices, as well as the existing legislative actions governing FLW. Based on the survey results as well as given the objective of improving FLW measurement and monitoring process, this analysis wants to identify areas for enhancement, thereby informing decision-making and policy development with valuable insights.

Regarding the current FLW measurement and monitoring practices, **Figure 10** summaries the identified strengths, weaknesses, opportunities, and threats respectively. Within **Appendix IX, Table 5** through **Table 8** provide comprehensive elaborations on each SWOT dimension. Additionally, **Figure 11**, coupled with **Table 9** through **Table 12** in the same appendix, showcases visual representations of the indicators pertaining to legislative actions.

Figure 12. FLW measurement and monitoring SWOT analysis.

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In exploring the strengths, the current FLW measurement and monitoring practices shows competencies as several MSs (i.e., Denmark, Spain, etc) already implemented their own national FLW measurement and monitoring practices, draw the FLW landscape under a whole nation context. The FLW measurement and monitoring practices show plenty of benefits, to both society and individual, could be leveraged and emphasized for during practices implementation to enhance acceptance among stakeholders. The current practices show competencies with the wide geographic and food commodity coverage, despite the focus might be varied by practices. Furthermore, notable data collection methods are in place, including the FUSIONS methodology and the common methodology outlined in Decision (EU) 2019/1597. However, there remains weaknesses to be addressed. First, a harmonized framework for EU is still absence. In the meantime, inconsistent and weak data collection methods, not well-defined food categories, unbalanced FSC sector/stakeholder coverage, limited information sharing/dissemination among institutions and stakeholders, as well as less stakeholder engagement may challenge the development of a harmonized framework, along with financial issues, low public engagement, etc.

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Figure 13. FLW legislation actions SWOT analysis.

As for the Opportunity, the performance of practices is benefited from high governing awareness, for instance clear national goals in tracking FLW issues could boost the harmonized framework development. The available of sufficient findings for FLW research and strategies implementation, innovative technologies could be better exploited as well. External threats like governance issues, inefficient management and monitoring of practices, the overlook of ethical impacts and low public engagement/cooperation should be better addressed to promote the framework development.

To better enrich the practices framework building with legislation support, the analysis encloses that currently there is a strong legislative base to be taken advantage of, for example Decision 2000/532/EC on the waste categorization. These legislations cover a wide range of stakeholders and countries. More and more legislation actions are implemented tailoring to the local contexts. However, there still exist weakness like implementation challenges (i.e., misalignment between management and prevention policies). Legislation gaps like no food categorization, no standardized framework on FLW measurement and monitoring should be better filled out. The current legislations were found disparities in development across counties/regions, attention should be given to low development countries and FSC

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sectors. Harmonization issues like tailoring the legislation to a universal context should be better addressed. As for opportunity, effects could be given to the promotion of cooperation among sectors and actors, integrating with governing actions like specific FLW reduction goals. Public awareness is witnessed increasing, dissemination and knowledge sharing were available among stakeholders and institutions. The ongoing legislation evolution and technology updating will enrich the FLW legislation development as well. To better address the threats, attentions should be given to potential conflicts with existing legislative actions, less acceptance among stakeholders, ineffective communications, limited stakeholder engagement as well as poor monitoring.

4.2 FLW measurement and monitoring good practices identification

Measuring and monitoring FLW across the food supply chain (FSC) is a complex task, as remaining numerous obstacles and challenges to be addressed for a comprehensive performance.

Despite the debate on FLW definition is still going on, this report witnesses that among all those FLW measurement and monitoring practices, definitional frameworks proposed by FAO (FAO, 2019) and FUSIONS were frequently applied. However, it's still worthy to be noted that these two definitional frameworks diverge. The FAO definition distinguishes between "food loss" and food waste according to where it occurs, while FUSIONS definition refers to them collectively under the general term "food waste". Several practices employ their own definitions, like practice 19 takes all the avoidable and possibly avoidable food waste into consideration to perform the household measurement. The avoidable and possibly avoidable food waste were defined by WRAP (WRAP, 2013) with a primary focus on domestic FW. FW generated at any other FSCs apart from household needs a more tailored definition. Several practices (Practice23, 28-31) adjust their FLW definitions aligning with relevant EU regulations, like Decision (EU) 2019/1597 and Regulation (EC) No. 178/2002, despite the primary legislative focus of the latter is on food safety rather food waste.

Different practices applied varying methods to collect FLW data, this may cause data inconsistent and then challenges the data comparison in both horizontal and vertical manner. Besides around one-third of all the practices that focus on the whole supply chain, household attracts the most attention. At the household stage, surveys and interviews applied widely to collect data. Surveys and interviews allow the data collection that aims to cover large sample size and, in the meantime, use a rather cost-effective research approach. Online survey used by Waste Watcher

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International (practice 40) recorded a total of 8,000 questionnaires in less than two weeks (Iori et al., 2022). However, questionnaire tends to let the respondent estimate their FW levels according to cooking or food managing experience, no accurate physical weight data is available. Combing the surveys and questionnaires with digital weighing (Practice 12 and 33) is recommended to collect accurate data. Practice 37 provides a good example of using digital weighing methods to collect household FW data. Aiming to reduce FLW by degerming the household FW hotspots, this practice carried out a FW composition analysis distinguished between residual waste and organic waste. Physical measurements of FW were applied in both residual waste and organic waste. To measure FLW generated at the consumption stage (including household and foodservice sectors), WASTESTIMATOR (Practice 33) combined digital weighing and surveys and interviews together (Silvennoinen et al., 2019). Schools, day-care centres, and restaurants participated in WASTESTIMATOR to provide data for the foodservice sector. FW generated at home were weighed and recorded in "Waste Manager application", which provides a clear overview for the participants to access FW status presented by figures.

The FLW measurement and monitoring at the primary production, processing and manufacturing sectors could be complex tasks. The scale of entities such as factories, workshops, stores, etc., the types of food products, sales models, etc. are all different here. How to harmonize the measurement and collect representative data is challenging. Practice 23 provides a good example. The practice is based on data collection from available sources, including interviews and surveys (Miljøstyrelsen, 2021). This practice is primarily based on the development of key figures that are either linked to produced volumes or turnover in specific industries. At the primary production, the established key figures for FLW are primarily based on statements from experts and individual companies. At the processing and manufacturing sector where the quality of FLW data is rather low, a combination of interviews, questionnaires, coefficients (key figures), company reports and statistics (production, where possible, and otherwise turnover) were used in the data collection.

4.3 Conclusion

The EU and MSs began long ago to address the urgent issue of FLW, and there remains much to be done to keep on improving current performance. The presented work offers inventories of current FLW measurement and monitoring practices, relevant legislation actions that have implications on them, as well as an overview on the engaged agencies. Overviews on the current measurement and legislation

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framework are built based on the inventories and then inform the barriers, challenges, and recommendations identifications.

At the national level, results show that FLW measurement practices were widely applied across EU Member States, this report identified 68 practices while 40 of them conducted FLW measurement and monitoring. Most practices applied existing definitions on FLW, like FAO (2019) and FUSIONS (2014), while the rest defined the tailored definitions based on the target situation or following EU legislations. The practice geographic coverage, targeting food commodities, and targeting food supply chain sectors varied across practices. Around one third of FLW measurement and monitoring practices conducted data collection for the whole FSC. And for the remaining practices, household, food services, retail and wholesale, and processing and manufacturing stages were drawn mostly attention, while handling and storage was given the least efforts in terms of practice number. Most of the practices were conducted under the whole country context while several of them were implemented in a regional or municipal context. This report identified 96 legislation actions. Legislation action types varied among them, while regulation, policy, and law registered as the top three legislation types. Most of the legislation actions have implications on FLW reduction, FLW management, and FLW generation.

At the FSC level, working together at the EU level on this issue can benefit companies and the whole supply chain. Addressing FLW can help reducing hunger, generating TAX deductions for donors, minimizing costs for companies, reducing garbage disposal costs and landfill operations, increasing donations to Food Banks and Charity organizations. On the other hand, procedures must ensure highest standard of safety (proper handling and cooling/logistics operations); moreover, it would be worthy to raise awareness about safeness of food near to “expiring date”.

Food supply chain has always been very keen on sharing and finding new best practices to innovate, including from the perspective of FW prevention and reduction. Many areas need to be further investigated when it comes to FLW in the food supply chain. Here after some examples which can be put on the table of single nations, in a view of common engagement at EU level:

1. Reduction of waste due to cosmetic dissimilarities;
2. Reduction of FW due to unclear interpretation of label claims (e.g., "preferably");
3. Reduction of waste due to non-recovery of products close to expiration;
4. Recovery of defective products or those for which disposal is necessary/convenient, through their destination to specialized entities that can convey them to the needy (i.e., Food Banks).

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In conclusion, establishing a clear baseline at the EU level and implementing same practices in MSs legislation is the best way to effectively address FW in FSC, sharing best practices and valuable insights from most virtuous countries.

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6. Appendix

Appendix I. Inventory of agencies involved in FLW actions.

Table 5. Inventory of agencies involved in FLW actions.

Table legend for the FLW Action Type:
DN, Donation; FD, Funding entities; MA, Management; MM, Measurement and monitoring; P&L, Policies and legislations; PC, Policy Consultation; PR, Prevention; RE, Reduction; SN, Stakeholder networking.

#	Agency name	FLW Action Type	Country/ region	Agency Type	Agency Website
1	Régal Normandie	P&L	France	Nonprofit organization	https://www.regal-normandie.fr/
2	The International Food Waste Coalition (IFWC)	M&M, P&L	Belgium	Nonprofit organization	https://internationalfoodwastecoalition.org/intro-to-ifwc/
3	Food loss and waste Monitoring & Evaluation Unit	M&M, P&L	Egypt	Government department	http://www.flwmeu-aeri.sci.eg/index.aspx?lang=en
4	UNEP (United Nations Environment Programme)	M&M, P&L	Kenya	Non-governmental organization	https://www.unep.org/
5	Lapro Stockerau	M&M, P&L	Austria	Private company	www.lapro-stockerau.at
6	Gabinete de Planeamento, Políticas e Administração Geral	P&L	Portugal	Government department	https://www.cncda.gov.pt/
7	INE	M&M	Portugal	Statistical departments	https://www.ine.pt

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8	OVAM - The Public Waste Agency of Flanders	P&L	Belgium	Government department	https://ovam-english.vlaanderen.be/our-organization
9	Ministry of Environment	P&L	Estonia	Government department	www.envir.ee
10	Republic of Turkey Ministry of Agriculture and Forestry Directorate General for European Union and Foreign Relations	M&M, P&L	Turkey	Government department	https://www.tarimorman.gov.tr/ABDGM/
11	Turkish Statistical Institute	M&M	Turkey	Government department	https://www.tuik.gov.tr
12	Virtua	M&M	Turkey	Private company	https://virtua.com.tr
13	Gıda Kurtarma Derneği	P&L	Turkey	Non-governmental organization	https://gktd.org
14	FOOD BANK (INSTITUTION AGAINST HUNGER)	PR, PC	Greece	Non-governmental organization	info@foodbank.gr
15	FOOD SAVING ALLIANCE GREECE	PR, PC	Greece	Non-governmental organization	https://foodsavingalliancegreece.gr/
16	Bundesministerium für Ernährung und Landwirtschaft (BMEL), Unit 211	P&L	Germany	Government department	www.bmel.de
17	Johann Heinrich von Thünen-Institut, Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei, Institut für Marktanalyse	M&M	Germany	Research institution	www.thuenen.de

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18	GfK SE	M&M	Germany	Private company	www.gfk.com
19	Collaborating Centre on Sustainable Consumption and Production gGmbH	M&M	Germany	Nonprofit organization	www.cscp.org
20	FAZLA	M&M	Turkey	Non-governmental organization	https://fazla.com
21	Ministry of Social Affairs	P&L	Estonia	Government department	www.sm.ee
22	Institute of National Welfare	M&M, P&L	Estonia	Research institution	www.tai.ee
23	Republic of Estonia Environment Agency	M&M	Estonia	Environmental agency	https://keskkonnaagentuur.ee/en
24	Statistics Estonia	M&M	Estonia	Statistical departments	https://www.stat.ee/en
25	Estonian Food Industry Association	SN, DN	Estonia	Non-governmental organization	https://www.toiduliit.ee/
26	Estonian Food Bank	DN	Estonia	Charity foundation	https://www.toidupank.ee
27	The Estonian Chamber of Agriculture and Commerce	SN, DN	Estonia	Nonprofit organization	www.epkk.ee
28	Estonian Hotel and Restaurant Association	SN	Estonia	Nonprofit organization	https://ehrl.ee/
29	The Estonian Retailers' Association	P&L	Estonia	Nonprofit organization	https://kaupmeesteliit.ee/

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30	Estonian Association for Environmental Management	P&L, SN	Estonia	Nonprofit organization	https://ekja.ee
31	Environmental Investment Centre	FD	Estonia	Government department	https://www.kik.ee/en
32	CEC-Commission for environmental cooperation	M&M, P&L	Canada	Environmental agency	http://www.cec.org/flwm/about/
33	Ministry for the Environment, Energy and Climate Change / Waste Management Directorate	M&M, P&L	Greece	Government department	https://ypen.gov.gr/diacheirisi-apovliton/geniki-grammateia-syntonismou-di/
34	ARA (Salvage Recycling Austria)	M&M, MA	Austria	Private company	www.ara.at/en
35	Federal Ministry of Climate Action and Environment	P&L	Austria	Government department	www.bmk.gv.at/en.html
36	BOKU Institute of Waste Management and Circularity	M&M	Austria	University	https://boku.ac.at/en/wau/abf
37	Federation of the Food and Drink Industries of the Czech Republic	M&M, P&L	Czech Republic	Nonprofit organization	www.foodnet.cz
38	Ekodomov, z.s.	M&M, P&L	Czech Republic	Private company	https://kompostuj.cz/kontakt/
39	Biogastro Ltd	M&M,RE	Hungary	Private company	www.biogastro.hu
40	Ministry of Agriculture, Forestry and Food	P&L	Slovenia	Government department	https://www.gov.si/en/state-authorities/ministries/ministry-of-agriculture-forestry-and-food/

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41	Ministry of the Environment, Climate and Energy	M&M, P&L	Slovenia	Environmental agency	https://www.gov.si/en/state-authorities/ministries/ministry-of-the-environment-climate-and-energy/
42	Statistical Office of the Republic of Slovenia (SURS)	M&M	Slovenia	Statistical departments	https://www.stat.si/
43	National Institute of Chemistry	M&M	Slovenia	Research institution	www.ki.si
44	Biotehnical Faculty, University of Ljubljana	M&M	Slovenia	University	https://www.bf.uni-lj.si
45	Chamber of Commerce and Industry of Slovenia	M&M	Slovenia	Non-governmental organization	https://eng.gzs.si
46	Slovene Consumers' Association	M&M	Slovenia	Non-governmental organization	https://www.zps.si
47	DIH Agrifood	M&M	Slovenia	Private company	https://www.f6s.com/dihagrifood/about
48	Danish Environmental Protection Agency	M&M	Denmark	Environmental agency	mst.dk
49	Hungast Group	M&M	Hungary	Private company	https://www.hungast.hu/
50	The meal department of Skövde municiality	M&M	Sweden	Government department	www.skovde.se

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51	Federal Council, Federal Office for the Environment FOEN	M&M, P&L	Switzerland	Government department	https://www.bafu.admin.ch/bafu/en/home/topics/waste/guide-to-waste-a-z/biodegradable-waste/types-of-waste/lebensmittelabfaelle.html
52	Federal Office for the Environment	M&M	Switzerland	Government department	https://www.bafu.admin.ch/bafu/en/home.html
53	National Food Chain Safety Office	M&M, P&L	Hungary	Government department	https://portal.nebih.gov.hu/
54	Ministry for the ecological transition and the demographic challenge (Ministerio para la transición ecológica y el reto demográfico)	M&M, P&L	Spain	Government department	https://www.miteco.gob.es/es/
55	National Institute of statistics (Instituto nacional de Estadística)	M&M	Spain	Statistical departments	https://www.ine.es/
56	Ministry of agriculture, fishing and nutrition (Ministerio de Agricultura, Pesca y Alimentación)	P&L	Spain	Government department	https://www.mapa.gob.es/es/
57	National Commission for Combating Food Waste (CNCDA)	M&M, P&L	Portugal	Government department	cncda.gov.pt
58	Stockholm Environment Institute Tallinn	M&M	Estonia	Research institution	www.sei.org
59	Estonian University of Life Sciences	M&M	Estonia	University	www.emu.ee

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60	Ministry of Rural Affairs	P&L	Estonia	Government department	www.agri.ee
61	KAMARERE	MA	Spain	Private company	www.kamarere.com
62	Ministry of Agriculture Rural Development and the Environment	P&L	Cyprus	Government department	https://moa.gov.cy/ministry/mission/?lang=en
63	Statistical Services of the Republic of Cyprus	M&M	Cyprus	Statistical departments	https://www.cystat.gov.cy/en/
64	The Parliament of the Republic of Latvia	P&L	Latvia	Government department	https://www.saeima.lv/en/about-saeima/the-parliament-of-latvia
65	The Ministry of Environmental Protection and Regional Development	P&L	Latvia	Government department	https://www.varam.gov.lv/en
66	The Ministry of Agriculture Republic of Latvia	P&L	Latvia	Government department	https://www.zm.gov.lv/en
67	KAMARERE	MA	Spain	Private company	https://www.kamarere.com/
68	OREKA	M&M, MA	Spain	Private company	https://www.somosoreka.com/
69	NARIA	M&M, P&L, MA	Spain	Private company	https://naria.digital/
70	BUREAU VERITAS	M&M	Spain	Private company	https://www.bureauveritas.es/
71	BANC DELS ALIMENTS	M&M, P&L	Spain	Nonprofit organization	https://www.bancdelsaliments.org/es/despilfarro-alimentario/

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72	AESAN (Spanish Agency of food safety and nutrition)	M&M	Spain	Government department	https://www.aesan.gob.es/AECOSAN/web/para_el_consumidor/ampliacion/desperdicios.htm
73	Ministry of Agriculture, Fisheries and Food	P&L	Spain	Government department	https://www.mapa.gob.es/es/ministerio/funciones-estructura/organigrama/Ministro-MAPA.aspx
74	Ministry of Consumer Affairs	P&L	Spain	Government department	https://www.consumo.gob.es/
75	Enraíza Derechos	M&M	Spain	Private company	https://enraizaderechos.org/
76	Romanian Parliament	P&L	Romania	Government department	https://legislatie.just.ro/Public/DetaliiDocumentAfis/203111
77	Ministry of Agriculture and Rural Development (MADR)	P&L	Romania	Government department	https://www.madr.ro/en/food-industry.html
78	National Research and Development Institute for Food Bioresources – IBA Bucharest	M&M, P&L	Romania	Research institution	https://bioresurse.ro/en/pages/despre-iba
79	Institute for Research in Circular Economy and Environment "Ernest Lupan" (IRCEM)	M&M, P&L	Romania	Research institution	https://ircem.ro/despre-noi/echipa/
80	BANCO ALIMENTARE	M&M, P&L	Italy	Nonprofit organization	https://www.bancoalimentare.it/it
81	Lithuanian Environmental Protection Agency (EPA)	M&M	Lithuania	Environmental agency	https://aaa.lrv.lt/lt/

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82	Department of Environmental Protection under the Ministry of Environment	M&M	Lithuania	Environmental agency	https://aad.lrv.lt/
83	Ministry of Environment of the Republic of Lithuania	M&M, P&L	Lithuania	Government department	https://am.lrv.lt
84	The Ministry of Agriculture of the Republic of Lithuania	M&M, P&L	Lithuania	Government department	https://zum.lrv.lt/en/
85	State Food and Veterinary Service	MA	Lithuania	Government department	https://vmvt.lt/?language=en
86	Ministry of Agriculture, Viticulture and Rural Development	P&L	Luxembourg	Government department	https://ma.gouvernement.lu/en.html (ministry)
87	Environment Agency (AEV)	M&M, P&L	Luxembourg	Environmental agency	https://aev.gouvernement.lu/en.html
88	Maisto bankas (Food Bank)	RD, PR	Lithuania	Nonprofit organization	https://www.maistobankas.lt
89	Nordic Council of Ministers Office in Lithuania	PR	Lithuania	Forum of cooperation for the governments	https://www.norden.lt/en
90	Lithuanian Consumer Institute	P&L	Lithuania	Non-governmental and nonprofit organization	https://www.vartotojai.lt/en/home-english/
91	Ministry for the Environment, Climate and Sustainable Development	M&M, P&L	Luxembourg	Government department	https://environnement.public.lu/fr.html

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92	CECED – European Committee of Manufacturers of Domestic Appliances ((now APPLIA - Home Appliance Europe)	P&L	Luxembourg	EU Committee	https://www.ceced.org/; https://www.applia-europe.eu/
93	Foodsharing Luxembourg	PR	Luxembourg	Nonprofit organization	https://www.foodsharing.lu/
94	Ministry for Consumer Protection	M&M	Luxembourg	Government department	https://mpc.gouvernement.lu/en.html
95	National Institute for the Development of Continuing Vocational Training (INFPC)	NA	Luxembourg	Government department	https://www.infpc.lu/accueil/en
96	Municipal Office of the City of Luxembourg	M&M	Luxembourg	Government department	https://www.vdl.lu/en
97	Ministry of Agriculture and Rural Development of the Slovak Republic	M&M, P&L	Slovakia	Government department	https://www.mpsr.sk/en/
98	Ministry of Environment of Slovak Republic	P&L	Slovakia	Government department	https://www.minzp.sk/en/about-us/
99	National Agriculture and Food Centre - Food Research Institute	M&M	Slovakia	Research institution	https://www.vup.sk/en/?mainID=1&navID=45
100	Ministry of the Agriculture and Forestry	M&M, P&L	Finland	Government department	https://mmm.fi/en/ministry
101	Natural Resources Institute Finland (Luke)	M&M	Finland	Research institution	https://www.luke.fi/en

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102	Ministry of Environment and Energy	M&M	Croatia	Government department	NA
103	Ministry of Agriculture	P&L	Croatia	Government department	https://poljoprivreda.gov.hr/
104	Ministry of Economy and Sustainable Development	M&M	Croatia	Government department	https://mingor.gov.hr/
105	Ministry of Agriculture, Nature and Food Quality	P&L	Netherlands	Government department	https://www.government.nl/ministries/ministry-of-agriculture-nature-and-food-quality
106	Ministry of Infrastructure and Water Management	P&L	Netherlands	Government department	https://www.government.nl/ministries/ministry-of-infrastructure-and-water-management
107	Netherlands Enterprise Agency (RVO)	FD, SN	Netherlands	Government department	https://english.rvo.nl/
108	Wageningen University & Research	Research	Netherlands	Research institution	https://www.wur.nl/en.htm
109	Netherlands Food and Consumer Product Safety Authority (NVWA)	P&L	Netherlands	Government department	https://english.nvwa.nl/
110	Statistics Netherlands	M&M	Netherlands	Statistical departments	https://www.cbs.nl/en-gb
111	Taskforce Circular Economy in Food	SN	Netherlands	Stakeholder alliance	https://www.wur.nl/en/show/Taskforce-Circular-Economy-in-Food.htm
112	Alliantie Verduurzaming Voedsel	SN	Netherlands	Stakeholder alliance	https://verduurzamingvoedsel.nl/
113	Afvalzorg	M&M, MA	Netherlands	Private company	https://www.afvalzorg.com/

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114	Renewi	M&M, MA	Netherlands	Private company	www.renewiplc.com
115	SUEZ Nederland	M&M, MA	Netherlands	Private company	https://www.suez.com/en
116	HVC	M&M, MA	Netherlands	Private company	https://www.hvcgroep.nl/
117	Remondis	M&M, MA	Netherlands	Private company	https://www.remondis.nl/en/remondis-in-the-netherlands/
118	Ministry for the Environment, Climate Change and Planning	P&L	Malta	Government department	www.gov.mt
119	Ministry for Agriculture, Fisheries, Food and Animal Rights	P&L	Malta	Government department	https://agriculture.gov.mt/
120	Malta Competition and Consumer Affairs Authority	P&L	Malta	Government department	https://www.mccaa.org.mt/
121	Environment and Resources Authority	M&M	Malta	Environmental agency	https://era.org.mt/
122	Malta Food Bank Foundation	NA	Malta	Nonprofit organization	https://www.foodbanklifeline.com/
123	WasteServ Malta Ltd	M&M, MA	Malta	Government department	https://www.wsm.com.mt/
124	University of Malta	Research	Malta	University	https://www.um.edu.mt/healthsciences/food-sciences/
125	The Malta Chamber	P&L, SN	Malta	Non-governmental organization	https://www.maltachamber.org.mt/

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126	Friends of the Earth Malta	RE	Malta	Non-governmental organization	https://foemalta.org/
127	Greenhouse Malta (GH)	RE	Malta	Non-governmental organization	https://maltacvs.org/voluntary/greenhouse-malta-2/
128	GreenPak Cooperative Society	M&M	Malta	Private company	https://www.greenpak.com.mt/
129	Environmental Recycling Services	M&M	Malta	Private company	https://www.gesmalta.com/
130	EcoHive	M&M	Malta	Private company	https://www.ecohive.com.mt/

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Appendix II. Inventory of FLW practices besides measurement and monitoring

Table 6. Inventory of FLW practices besides measurement and monitoring

#	Measurement practice title	Country	FLW definition
FLW recycling and using optimization practices			
41	Brewer's mash	Czech Republic	FAO (2019)
42	KARAMOLEGOS AE	Greece	NA
43	WRAPUP	Slovenia	FAO (2019)
44	BARLI	Slovenia	FAO (2019)
45	PINJA	Slovenia	FAO (2019)
46	CORNUT	Slovenia	FAO (2019)
47	NEWDLES	Slovenia	FAO (2019)
48	PROCESSING OF ANIMAL BY-PRODUCTS	Greece	FAO (2019)
49	a bag made of waste LUŠT tomato stalks	Slovenia	FUSIONS (2014)
50	USING NON-COMPLIEND APPLES FOR ANIMALS FEED	Slovenia	FAO (2019)
51	OnMyWhey	Slovenia	FAO (2019)
52	dried tomatoes, dried tomatoes in pumpkin oil, dried tomatoes covered in chocolate	Slovenia	FAO (2019)
FLW reduction, redistribution, and donation practices			
53	Buffet catering	Hungary	FAO (2019)
54	FoodPrint Public Opinion Online Surveys	Cyprus	NA
55	FoodPrint Public Opinion - Project	Cyprus	FAO (2019)
56	Semana de la reducción del desperdicio 2018	Spain	FAO (2019)
57	Gratix	Spain	FAO (2019)
58	TALKUAL	Spain	FAO (2019)
59	ReAprovecha Cantabria	Spain	FAO (2019)
60	BARUXKA	Spain	FUSIONS (2014)
61	PANDURU	Spain	FAO (2019)
62	KOMEFY	Spain	FAO (2019)
63	RED DE RECUPERACIÓN DE ALIMENTOS DE RIVAS	Spain	FAO (2019)
64	WINNOW	International	FAO (2019)

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65	Let's not waste food	Lithuania	NA
66	ILRES Survey - Secteur agricole et alimentation: vision des consommateurs et des producteurs	Luxembourg	NA
67	Control and reduce food waste in catering	Luxembourg	EU regulation
68	Food waste, the value of the food in the chain	Netherlands	FUSIONS (2014)

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Appendix III Practices Description

Practice title. Municipal Food Waste Measurement

Description. To prepare the National Inventory Report for submission under the "United Nations Framework Convention on Climate Change" the food waste ratio in municipal solid waste was calculated by weight.

Practice title. Central Register for Waste Plants and Waste Balance

Description. Electronic Data Management System for waste plants and waste balance.

Practice title. FUSION (Food Use for Social Innovation by Optimising Waste Prevention Strategies)

Description. The FUSION project paved the way for Directive (EU) 2018/851, which is mandating the gathering of data on food waste in accordance with a standardised methodology.

Practice title. Research and collection of Austrian food industry FLW data

Description. Holistic data generation and research of the whole Austrian Food industry FLW emergence.

Practice title. Household Budget Survey

Description. Annual household surveys are conducted in Turkey to determine the socio-economic status and consumption habits of people living in the country. In 2022, a questionnaire set examining people's awareness of FLW was included in the surveys. This questionnaire set includes questions about the frequency and most common reason for FLW at home, which food commodities are wasted in their homes, and which practices they implement to reduce FLW at the household level.

Practice title. Ministry of Agriculture and Foresty's Food Waste Survey

Description. This measurement method is based on a research-based approach that includes questionnaires to measure food waste at the household level. Conducted as part of the ""Save your Food"" project supported by FAO, this research aims to measure people's food waste behaviour. The questions examine the frequency and most common reason for food waste at home, which food commodities are wasted in their homes and why, and which practices they implement to reduce food waste at the household level.

Practice title. Smart Scale System

Description. This method is based on using a smart scale developed for the HoReCa industry to determine food waste. The extent of food waste is measured by weighing it with a smart scale and automatically generating analytics and reports based on the data for each specific food commodity recorded by the system. Using this system makes it easy to track and manage food waste.

Practice title. This practice has no title

Description. Monitoring, measurement, documentation, production control, control monitoring.

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Practice title. Household food waste measurement

Description. Regular measurement of food waste with the same methodology, at the same period of the year is a good way to monitor trends in the amount of food waste in the households. The food waste measurement methodology of Maradék nélkül (FUSIONS methodology adapted to national context) is designed to serve as an intervention action as such, because by recording all the individual waste items in the logbook, after the study period the households get an actual picture about what goes to their bins. The studies have shown that between 2016 and 2021 the amount of per capita avoidable household food waste decreased by 24%. It is a great achievement supporting UN SDG 12.3, and alleviating the social, economic, and environmental burden exerted by food waste. The results have been published in scientific papers and have been used in the public awareness raising campaigns of the programme.

Practice title. The generation of food waste and food loss in the Estonian food supply chain.

Description. Food waste measurement at households.

Practice title. The generation of food waste and food loss in the Estonian food supply chain.

Description. Conducted as a part of SEI survey, a research-based approach that includes questionnaires to measure food waste and loss in the whole food supply chain. A special survey was targeted to retailers (main food stores in Estonia).

Practice title. The generation of food waste and food loss in the Estonian food supply chain (SEI survey)

Description. A research-based approach that includes questionnaire, diary template and kitchen scale to measure food waste in households.

Practice title. The generation of food waste and food loss in the Estonian food supply chain. (SEI survey)

Description. A research-based approach that included study of FLW in the whole Estonian food supply chain, including catering institutions, food trade companies, food industry and primary production. The previous answers provided (households, retail and wholesale) form a part of the same survey. The survey analysis is based on the data collected in the detailed survey in 2020 and the national Waste Reporting System (WDMS) data for 2019.

Practice title. Digital weighing

Description. Compliance with Greek wastewater legislation and recycling packaging materials.

Practice title. Meals department Skövde municipality

Description. Skövde municipality is responsible for serving sustainable, good and nutritious public meals to children, students and the elderly. Every day, food waste is measured and followed up in statistics centrally.

Practice title. Origins of Food waste in the food chain

Description. Food waste includes all raw or processed foods and residues of these foods that are lost before, during or after food preparation and consumption, including food discarded during production.

Practice title. Waste composition analysis

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Description. Measuring waste composition among 33 communes in Switzerland (3 language regions German, French and Italian) - the contents of 500 kg waste bags from the 33 selected communes were sorted and divided into 18 different waste categories - the specific amount of waste generated was calculated in kilograms of waste per inhabitant per year [kg/E*a] was calculated.

Practice title. Collection green waste and composition analysis for food waste

Description. Measuring green waste composition among 6 Swiss German speaking communes.

Practice title. Self-reported Food waste frequency questionnaire on a weekly average

Description. For each of, how much they wasted on a weekly average, reasons for the wastage and how they disposed of the waste - For each category, the amount of food waste had to be indicated by the number of servings, defined according to the standards of the Swiss Nutrition Society (e.g., 100 g of bread and bakery products) (SNS, 2015).

Practice title. Self-reported food waste questionnaire & food waste diary

Description. Food waste frequency questionnaire: participants were asked to estimate the frequencies and quantities of food waste they produced on average using 23 different food products from six food categories. Participants reported the frequency of disposal and the average amount of waste produced for each category. Food waste diary: during 3 weeks, Participants recorded the kind of food items they disposed of, the amounts they disposed of, the primary reason for their disposal, and the disposal method/Food that was discarded away from home (e.g., at the workplace or at a restaurant) was considered irrelevant for the present study.

Practice title. Food loss, mass flow analysis based on survey (industries) and in depth process investigation of some food processing sectors

Description. Input flow, output flow, loss flow in organic quantity including wastewater among 27 processing sectors/The general procedure comprises four steps, starting with the concept development. For this purpose, a process analysis is created for a problem and described in terms of system boundaries, processes, and material flows. The result is a described process flow. The second step is data collection. The food flows are recorded and quantified in absolute kilograms and in kilograms of dry matter (via balance sheet). Step three involved the completion of the system. For this purpose, mass flows not directly quantifiable on quantifiable mass flows were determined using information from employees and internal operating documents.

Practice title. Self-reported amount of food waste

Description. Investigated the frequency scale and amount scale for the 11 food categories.

Practice title. Food waste from primary production, processing, and manufacturing sector 2018

Description. The primary objective of this report is to establish a baseline (2018) for food waste from primary production and the processing and manufacturing sector that fulfils the requirements of the Commission Delegated Act on a common methodology for measuring food waste. The baseline inventory is based on data collection from available sources, including interviews and surveys. The method is primarily based on the development of key figures that are either linked to produced volumes or turnover in specific industries. For

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primary production, the established key figures for food waste are primarily based on statements from experts (primarily consultants from the Danish Agriculture & Food Council/trade organisations) and individual companies. For the processing and manufacturing sector, the quality of data on food waste is very poor. Here, a combination of interviews, questionnaires, coefficients (key figures), company reports and statistics (production, where possible, and otherwise turnover) were used in the data collection.

Practice title. Generation and Treatment of Municipal Solid Waste

Description. Waste collection including household waste as well as waste originating from commerce, trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). Municipal waste is collected from door-to-door through traditional collection (mixed household waste) and fractions collected separately for recovery operations (mainly for recycling purposes, through door-to-door collection and/or through voluntary deposits).

Practice title. Quantification of food waste in an insular island state for all stages of the food supply chain

Description. This is a scientific paper to present the process of quantifying food waste at all stages of the food supply chain in an island Member State of the Euro- pean Commission, the Republic of Cyprus. Specifically, the study of quantifying the food waste at all the stages of the food supply chain was implemented by following the Commission Delegated Decision (EU) 2019/1597 concerning the common methodology and minimum quality requirements for the uniform measurement of food waste levels (European Union, 2019). Mass balances, questionnaires, and interviews were mainly used for the quantification of each waste.

Practice title. Food Waste in Spain Report

Description. Compilation of information about FOOD WASTE IN SPAIN in 2021.

Practice title. Food Waste Behavior among Romanian Consumers: A Cluster Analysis

Description. The main purpose of the study was to evaluate the Romanian consumers perceptions, attitudes, and beliefs on food waste. Thus, despite the limitation of the questionnaire instrument, the authors considered this to be a suitable approach in the first stage of the evaluation of household food waste in Romania. The second stage of the research will be represented by a quantitative estimation of household food waste by using diaries and waste composition analysis.

Practice title. Data collection from waste generators through an information system

Description. EPA carried out preliminary food waste measurement activities on a voluntary basis according to the EU methodology, utilizing available data from 2018. Reporting of data on food waste and food waste prevention was made according to Commission Implementing Decision (EU) 2019/2000. Every two years, the Lithuanian Statistical Department carries out surveys on food losses in the primary production stage.

Practice title. National Waste and Resource Management Plan (PNGDR) measurement valuation

Description. Monitor the evolution of food waste and the influence of various measures by analyzing the quantity of food waste every three years. Knowledge of the composition of food waste is essential to assess the impact of the various management measures implemented and to exploit prevention potential. A study of the quantities of food waste

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produced will be carried out every three years. To obtain a more comprehensive overview of the total quantity of food waste, studies will be carried out including food waste from the food industry, agriculture, horticulture, and the agricultural trade. The cooperation and assistance of the Ministry of Agriculture, Viticulture and Consumer Protection will be required for the collection of this data.

Practice title. Amount and composition of food waste in Luxembourg

Description. The amount and composition of food waste in Luxembourg were estimated based on data from various waste statistics, on the results of a survey (https://gouvernement.lu/dam-assets/images/actualites/2020/09-septembre/22-aev-etude/Studie2.pdf) of selected companies in the distribution and food processing chain, results of the 2018/2019 analysis of mixed municipal waste (https://environnement.public.lu/content/dam/environnement/actualites/2020/03/restabfallanalyse/20191203-Reschtoffallanalyse-2018-2019.pdf) , and a range of secondary and tertiary data. The Environmental Agency carries out compositional analyses of household waste on a regular basis, also measuring the ratio of food waste. https://environnement.public.lu/fr/offall-ressourcen/types-de-dechets/Biodechets/Gaspillage_alimentaire/Etudes_et_resultats.html for all the studies

Practice title. Food waste prevention plan essential elements for supermarkets with a sales area >= 400 m^2

Description. To prevent and limit the production of food waste, supermarkets >= 400 m^2 must draw up, implement and keep up to date a food waste prevention plan (Article 12(4) of the amended law of March 21, 2012 on waste management), to be published on a publicly accessible website.

The essential elements are:

- Quantity of food waste (avoidable and non-avoidable)
- Percentage of total surface area used for food sales
- Quantities of foodstuffs transmitted for human consumption, animal feed, or processing into non-food products
- Estimated amount of food waste disposed of by residual waste collection
- Estimated quantity of food waste evacuated by bio-waste collection
- Description of the methodology and measures taken to reduce food waste

Practice title. Control and reduce food waste in catering

Description. Training courses for FBOs private companies, which can book food waste prevention trainings.

Practice title. CIRCTER SPIN-OFF Luxembourg Case Study (ESPON)

Description. ESPON, an EU-funded interregional programme of European Territorial Cooperation hosting here in Luxembourg, has supported evidence-based policymaking since 2002 by providing European policymakers at all levels with pan-European, comparable, systematic, and reliable territorial evidence. Through its territorial evidence, ESPON can support policymakers in all stages of the policymaking process.

It reports data on food waste in Luxembourg, identified in the context of CIRCTER project, which also produced a novel waste indicator related to food waste, which is one of the priority areas identified by the EC.

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Practice title. WASTESTIMATOR

Description. WASTESTIMATOR aimed to develop a national food waste monitoring system focusing on household and food services sectors food waste estimation. This project explored potential ways to monitor food waste in the given sectors and tried to make it possible for the compassion with previous food waste measurement research. Continuous food waste monitoring could be conducted by the calculation formulae developed by WASTESTIMATOR.

Practice title. The statistical survey on food waste - households

Description. After random selection (two-dimensional stratification: region size and household number) of Croatian households, this research conducted the food waste measurement basing on face-to-face and online surveys. Before food waste measurement, one respondent from each household answered FLW related questions, including food waste management. Food waste measurement was based on direct weighing using digital scale. Waste food for animal feeding was excluded from this research.

Practice title. The statistical survey on food waste – Business entities

Description. After sample selection (stratified according to the statistical region, the type of OPG at the two-digit level, and the economic size class of the OPG) of Croatian business entities, this research conducted the food waste measurement basing on postal survey/on-line surveys and telephone annexation. Questions related to knowledge of terminology and handling of food in the business sector (e.g., donation and "former food") were answered by respondents as well.

Practice title. FEED THE HUNGRY THE POTENTIAL OF SURPLUS FOOD RECOVERY

Description.Fondazione Banco Alimentare measures food loss and waste within its warehouses and structures, through warehouse accounting implemented through the use of SAP management software and the necessary documentation (such as transport documents). We don't directly measure waste but the amount of food we recover from companies.

Practice title. Factsheet on food waste by consumers 2013

Description. In 2013, the Ministry of Economic Affairs commissioned Wageningen University and Research Centre (WUR) to study food waste in the Netherlands throughout the whole production chain, resulting in the Monitor Voedselverspilling (Food Waste Monitor). The conclusion was that the amount of food waste in the Netherlands in 2009 was between 83 and 151 kilograms per capita and in total amounted to 1.4-2.5 million tones.

Practice title. Supplementary memorandum Food waste in Dutch households in 2016

Description.In 2016, CREM Waste Management conducted a composition analysis of solid household waste from 130 households in 13 municipalities. Kantar Public conducted the consumer survey ‘Voedselverspilling in Nederland op basis van zelfrapportage’ [‘Food waste in the Netherlands based on self-assessment’] among 763 respondents. In addition, Kantar Public, commissioned by the dairy industry and the Dutch Food Industry Federation [Federatie Nederlandse Levensmiddelen Industrie, FNLI], performed an estimation survey on the waste of liquids among 1,105 respondents via an app.

Practice title. Analysing household food waste in the Maltese islands

Description. In this study, 212 survey responses were obtained from households in the Maltese Islands. The primary data collected was mainly analysed using IBM-SPSS, a

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predictive analytics software. Results showed that the most common volume of household food waste disposed of per week is less than half of one 2L container. Leftovers, fresh vegetables/ unused vegetables/ rotting vegetables and bread are the most commonly wasted foods.

Practice title. "The Italy case" Report by Waste Watcher International

Description. Waste Watcher International Observatory on Food and Sustainability (WWIO) aims to provide the community with tools for understanding the social and behavioral dynamics and lifestyles that generate and determine household waste: an Observatory capable of generating common and shared knowledge, to guide prevention policies and actions of food waste by public and private actors.

Description of FLW recycling and using optimization practices

Practice title. Brewer's mash

Description. Brewer's mash contains a large amount of fibre and other important substances, so it can be used other than as animal feed, which is still the predominant method. We considered that the carcasses would be given to animals, but after analysing the samples, we concluded that it would be an eternal shame. Thanks to the university's utility model, the company makes flour from ground crumbs that is gluten-free and contains a large amount of fibre. The result is cookies and wine bars.

Practice title. KARAMOLEGOS AE

Description. Inappropriate products are available at the company NUEVO for recycling. Recycling of paper and plastic.

Practice title. WRAPUP

Description. WRAPUP tortillas are made with ingredients that are considered a by-product of the food industry. These are pumpkin oil press cake and brewer’s spent grain.

Practice title. BARLI

Description. Barli is a fermented cereal bar covered with fruit and dark chocolate. The ingredient that makes Barli stand out is the spent barley – a by-product of the beer brewing industry – which makes the product environmentally friendly and sustainable to produce.

Practice title. PINJA

Description. PINJA transformed the traditional buttermilk into a modern guise in three varieties suitable for any time of day. The by-product of raw butter production is enriched with various fruit preparations and carefully selected vitamins and minerals. It is complemented with crunchy muesli and therefore the overall product offers the consumer a healthy snack. Recyclable and compostable packaging is also used for the product.

Practice title. CORNUT

Description. CORNUT is a fine bakery product that uses ingredients, which food industry normally throws away, such as grape pomace and butter milk. The biscuits are made for everyone who would like to enjoy something sweet but also healthy.

Practice title. NEWDLES

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Description. Newdles is durum wheat pasta with spent barley grain that was used in beer production, and simply thrown away. Another benefit of the pasta is also higher fibre content compared to ordinary pasta.

Practice title. PROCESSING OF ANIMAL BY-PRODUCTS

Description. Products of animal origin or other products obtained from animals and not intended for human consumption were processed and circulated.

Practice title. A bag made of waste LUŠT tomato stalks

Description. The bag, made from the stems of LUŠT tomato plants, represents an innovative reuse of waste material. The company has established a circular economy cycle as it re-integrates the produced biomass, which usually ends up as agricultural waste in a composting plant, into the value-added cycle. The packaging for tomatoes has a beautiful appearance, is able to actively absorb and emit moisture, which prolongs the storage time of the fruit in a natural way and is comparatively well resistant to tearing. After use, the consumer can recycle it in a home composter, or dispose of it in wastepaper packaging.

Practice title. USING NON-COMPLIEND APPLES FOR ANIMALS FEED

Description. APPLES THAT ARE UNFIT FOR CONSUMER ARE SEPARATED AND GIVEN FOR ANIMAL FEEDING

Practice title. OnMyWhey

Description. OnMyWhey® is a unique whey based probiotic fruit dairy product enriched with millet which makes healthy snacking easy. It is made from locally sourced, organic ingredients of premium quality.

Practice title. Dried tomatoes, dried tomatoes in pumpkin oil, dried tomatoes covered in chocolate

Description. Dried tomatoes in various forms are examples of additions to meals or as an independent dish.

Description of FLW reduction, redistribution, and donation practices

Practice title. Buffet catering

Description. Within the framework of a pilot program, we are investigating the extent to which the amount of food waste brought back by consumers is reduced. During public catering, 20% of food waste is generated. The reason for this can be traced back to the very short mealtime, the limitations of the nutrition and health regulation, and the lack of choice. Our experience shows that if consumers can choose food in quantity and quality, and education is also associated with the program, the amount of food waste returned by consumers is reduced to 5%.

Practice title. FoodPrint Public Opinion Surveys-Cyprus

Description. It 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. The questions aimed to measure deviations between claims of importance of taking food leftover from outings and the real behaviours.

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Practice title. FoodPrint-Public Opinion Survey – Cyprus

Description. This project aims to raise awareness to prevent and manage food waste among consumers, the food and hospitality industries. As a part of this project a survey was conducted to measure the consumer behaviour and awareness for food waste management. The 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 questions were related to the reasons for buying more food than needed, food waste generation reasons and food waste management strategies at household levels.

Practice title. Semana de la reducción del desperdicio 2018

Description. To raise awareness among the Spanish population, as well as the food sector, educational centres, gastronomy professionals, journalists, and bloggers, about the importance of making the most of food.

Practice title. Gratix

Description. App gives a second life to products you don't need. With GRATIX you can share food you that might get wasted.

Practice title. TALKUAL

Description. They sell fruits and vegetables fruits that do not meet the aesthetic requirements.

Practice title. ReAprovecha Cantabria

Description. Initiative to discover how much does the population re-cylce food to avoid food waste. To araise awareness.

Practice title. BARUXKA

Description. To recover unharvested products in the fields.

Practice title. PANDURU

Description. Revaluation of bread in Asturias. They make pastries with the surplus bread from different places.

Practice title. KOMEFY

Description. Promotion of initiatives focused on Storage, Preservation and Preparation of food.

Practice title. RED DE RECUPERACIÓN DE ALIMENTOS DE RIVAS

Description. They fight against food waste and help disadvantaged families in the municipality.

Practice title. WINNOW

Description. Run more productive, profitable and sustainable kitchens by cutting food waste in half. Solutions for every kitchen, designed for enterprise. They have an analytic platform to drive better decision making.

Practice title. Let's not waste food

Description. The project aims to strengthen understanding of the way young consumers interac with food and discover strategies to decrease avoidable household food waste

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amount in the region. This will be achieved by researching possible methodologies, identifying and testing selected methods as well as creating and communicating guidelines for relevant stakeholders on household food waste reduction.

Practice title. ILRES Survey - Secteur agricole et alimentation: vision des consommateurs et des producteurs

Description. As part of the implementation of a national food policy, the Ministry of Agriculture, Viticulture and Rural Development and the Ministry of Consumer Protection commissioned a study from the ILRES polling institute. The aim of the study was to find out about consumers' habits and concerns regarding their food. It revealed that 9 out of 10 residents are interested in food-related issues. The issues of greatest concern to consumers are food waste, healthy eating, and the availability of regional products.

Practice title. Food waste, the value of the food in the chain

Description. In 2010 the Ministry of Agriculture has initiated a project to develop an education implementation plan “Food waste, the value of the food in the chain”, which aimed to bring the food waste problem into attention:

- in professional and academic education (in colleagues, universities and vocational and private educational institutions)
- in general education (primary and secondary) for food waste.

The project is carried out in cooperation with Education Groups Wellant college, INHolland Delft, Wageningen UR.

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Appendix IV Legislation actions description

Legislation with implications on FLW measurement and monitoring

EU legislations

Title. Directive 2008/98/EC

Description. Directive 2008/98/EC 1 specifically requires Member States to take measures to encourage waste prevention. The implementation of food waste prevention measures shall be monitored and verified by measuring food waste through a methodology established by a delegated act (Delegated Decision (EU) 2019/1597). Directive specifies how Member States report data as well.

Title. Commission Decision 2000/532/EC

Description. Decision provides a list of wastes; FLW are integrated inside. The wastes included in the list are specifically defined by means of the six-digit code for each individual waste and the corresponding four-digit and two-digit codes for the respective chapters.

Title. Regulation (EC) No. 2150/2002 on waste statistics

Description. Regulation establishes a framework to produce Community statistics, by the Member States and the Commission, on waste generation, recovery and disposal (waste), based on a specific prefixed nomenclature.

Title. Regulation (EU) No. 849/2010 on amending Regulation (EC) No. 2150/2002 on waste statistics.

Description. Regulation improves framework (established by Regulation (EC) No. 2150/2002) to produce Community statistics, by the Member States and the Commission, on waste generation, recovery and disposal (waste), based on a specific prefixed nomenclature.

Title. Delegated Decision (EU) 2019/1597 - a common methodology and minimum quality requirements for the uniform measurement of levels of food waste

Description. Decision asks the quantities of food waste that are attributed to each of the stages of the food chain should be measured separately following food chain stages. The measurement is carried out by member states annually.

Title. Implementing Decision (EU) 2019/2000 - a format for reporting of data on food waste and for submission of the quality check report in accordance with Directive 2008/98/EC

Description. Decision establishes the format for food waste data reporting and quality control submission by Member States.

Title. Commission Regulation (EC) No. 782/2005 on setting out the format for the transmission of results on waste statistics

Description. The regulation defines the format for transmission of waste statistics.

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Num 50: Commission Regulation (EC) No. 1445/2005 on defining the proper quality evaluation criteria and the contents of the quality reports for waste statistics for the purposes of Regulation (EC) No. 2150/2002

Description. Regulation defines the quality assessment criteria and contents of waste statistics quality reports.

Member States legislations

Title. Action Programme: Foods are precious

Description. "Lebensmittel sind kostbar!/Foods are precious" is an initiative of the Federal Ministry for Sustainability and Tourism (BMNT), which has been striving for the sustainable prevention and reduction of food waste in close cooperation with the industry, federal provinces, municipalities and waste management associations, employees, consumers and social institutions for many years. The aim was and is to reduce food waste and losses along the entire value chain. In the meantime, around 100 organisations and companies from a wide variety of sectors have been won as cooperation partners, which consistently act against food waste.

Title. Strategies for the prevention of food waste

Description. National strategy plan for safe foods, sustain agrifood production, data reliability and food waste prevention.

Title. Food Waste Legislation and Action in Austria

Description. Description and quantification of the current food waste situation in Austria

Title. Food Rescue Action Plan

Description. Action plan for prevention of waste generation and promotion of high-quality food donation in Estonia for 2021-2026.

Title. Skövde municipality

Description. Skövde municipality has a meal policy for its public meals. It states, among other things, that food waste must be minimized at all levels. Before each new year, the municipality's politicians make a new decision about how the target for this year's food waste should be in the municipality's kitchen.

Title. Zero Waste Regulation

Description. The purpose of this Regulation: It is to determine the general principles and principles regarding the establishment, dissemination, development, monitoring, financing, recording and certification of the zero-waste management system, which aims to protect the environment and human health and all resources in waste management processes in line with the effective management of raw materials and natural resources and sustainable development principles.

Pursuant to article 1(d) of the "Principles on the Prevention and Reduction of Waste Generation" specified in Annex 2 of the Regulation; “In order to prevent the formation of food waste, necessary measures should be taken by the relevant parties throughout the production, supply chain and use of foods and food waste prevention plans should be prepared.

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The Zero Waste Regulation indicated for the first time the need for food waste prevention plans to prevent and reduce food waste. Therefore, it is directly related to FLW reduction.

Title. Regulation on Regular Landfilling of Wastes

Description. The purpose of this Regulation: It is to determine the general principles and principles regarding the establishment, dissemination, development, monitoring, financing, recording and certification of the zero-waste management system, which aims to protect the environment and human health and all resources in waste management processes in line with the effective management of raw materials and natural resources and sustainable development principles. Pursuant to article 1(d) of the "Principles on the Prevention and Reduction of Waste Generation" specified in Annex 2 of the Regulation; “In order to prevent the formation of food waste, necessary measures should be taken by the relevant parties throughout the production, supply chain and use of foods and food waste prevention plans should be prepared. The Zero Waste Regulation indicated for the first time the need for food waste prevention plans to prevent and reduce food waste. Therefore, it is directly related to FLW reduction. The regulation defines biodegradable waste as “waste such as food, garden waste, paper and cardboard that can degrade in an oxygen-free or aerobic environment”. In addition, all landfills that accept biodegradable wastes are obliged to collect the gases and use them in energy production directly or by processing. This regulation is indirectly related to FLW reduction.

Title. Swiss action plan against FLW 06.04.2022 - Postulat 18.3829 Chevalley (2022 - 2025)"

Description. Action plan against food waste. On April 6, 2022, the Federal Council adopted an action plan against food waste in response to postulate Chevalley 18.3829. The action plan is aimed at all companies and organizations in the food industry along the supply or value chains, as well as at the federal government, cantons and municipalities. The action plan against food waste pursues three goals:

1) halving the amount of avoidable food waste in Switzerland by 2030 compared to 2017;
2) definition of sector-specific reduction targets together with the sectors;
3) the greatest possible reduction in the environmental impact of avoidable food losses through the appropriate design and prioritization of measures.

Title. Waste regulation Art. 6 SR 814.600, Reporting & environmental protection law art. 46 abs. 1 and abs. 2, Obligation to provide information

Description. Cantons do have a reporting obligation about specific waste in their region. Moreover, everyone is obligated to provide authorities specific waste information, to let happen further clarifications and to tolerate them.

Title. Swiss action plan against FLW 06.04.2022 - Postulat 18.3829 Chevalley (2022 - 2025)

Description. Data collection food loss and food waste 2025 - 2031 among all food supply chains and investigation of environmental impact and comparison with FLW data from 2017.

Title. Estratégia de combate ao desperdício alimentar

Description. The National Strategy, with the vision of "combating food waste, a shared responsibility from producer to consumer", includes 3 strategic objectives - Prevent, Reduce and Monitor - with 14 measures to combat food waste being defined in the respective Action Plan from the work of the various entities that make up the CNCDA.

Title. The industry agreement on reducing food waste: Main report 2020

This project has received funding from the European Union’s Horizon Research and Innovation Action (HORIZON-CL6-2022-FARM2FORK-01) under Grant Agreement No. 101084222

Description. Under the industry agreement on reducing food waste, a main target has been set to reduce food waste in Norway by 50 per cent by 2030.

In addition, two sub-goals have been set:

- Reduce food waste in Norway by 15 percent by 2020.
- Reduce food waste in Norway by 30 per cent by 2025.

At the end of 2020, there were 103 players who supported the industry agreement through a declaration of support. Through the declaration of support, the businesses are obliged to measure and supply data on their food waste.

Title. National survey of Food Waste in Portugal

Description. Law which determines the performance of a national survey regarding FLW to the acquisition of realistic data for a further diagnosis on FLW (ongoing with no public time scale).

Title. Ministry of Agriculture Rural Development and the Environment' s Strategic Planning 2015-2017

Description. The vision of the Strategic Planning adopted by the Ministry of Agriculture, Rural Development and Environment for the period from 2015 to 2017 is a greener, blue and resource-efficient economy, as well as a more competitive and sustainable agriculture and fisheries, contributing to the stimulation of the economy with the creation of new employment opportunities and growth in rural and coastal areas, while ensuring the quality of life and the protection of the environment. This includes ensuring the quality and safety of food and feed, and reduction of food losses and food waste.

Title. National waste management plan (2021-2028)

Description. This strategic plan aims to improve the food donation system (changes to the regulatory framework; development of food donation guidelines; a study to evaluate the operations of food banks; 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.

Title. National Waste and Resource Management Plan (PNGDR)

Description. National waste and resource management plan set according to the amended Law of 21 March 2012 on waste management.

Prevention measures are based on:

- Working with other institutions to combat food waste.
- Adopt dedicated projects (e.g., Clever Lessen).
- Promotion of labels (e.g., EU Ecolabel).
- Launch of consumer information and awareness campaign (e.g., Antigaspi).

Recycling of food waste shall be enhanced, and the monitor must be done every three years.

Title. A plan for prevention of food waste

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Description. The strategical document adopted by the Ministry of Agriculture and Rural Development in 2016 includes the following measures for tackling with FLW issues on national level:

1) elaborating of a list of causes of FLW in individual segments of the food chain, together with a proposal for the possibility of mitigating their impact on waste or food waste (e.g., optimization of production processes, application of the best available technologies, etc);
2) changing behaviours through investment subsidies, economic incentives, price signals, taxes, sanctions, benchmarking (performance measurement and competitive pressure);
3) establishing a platform of cooperation to quantify and reduce food losses and waste;
4) encouraging the most efficient uses of food losses and waste (e. g., the use of former food as feed in accordance with applicable legislation); consider simplifying the rules for donating / handing over foods past their minimum durability date for feed purposes;
5) adopt provisions to facilitate food donations for charitable purposes.

Title. Waste prevention programme of the Slovak Republic for the years 2019-2025

Description. An overview of the specific waste prevention measures structured according to Art 9 WFD:

a) 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 United Nations Sustainable Development Goal to reduce by 50 % per capita global food waste at the retail and consumer levels and to reduce food losses along production and supply chains by 2030.
b) Encourage food donation and other redistribution for human consumption, prioritizing human use over animal feed and the reprocessing into non-food products.

Following objectives have been set up:

O.18. Ban on landfilling of food waste from wholesale, retail, and distribution in the Waste Act with effect from 1.1.2023.

O.19 Assess the possibility of abolishing exemptions for the obligation to introduce and ensure the separate collection of biodegradable kitchen waste from households.

O.20 Participate in the development of a methodology for consistent determination/measurement of the amount of generated food waste and methods of food waste management.

O.21. Actively support the implementation of measures Action plan to prevent food waste.

O.22 Information support of food waste prevention in terms of environmental impacts.

O.23 To support of zones of non-standard food (e.g., optically non-standard fruits and vegetables) in retail through information campaigns.

Title. Decision on adoption of the plan for prevention and reduction of food waste generation of the republic of Croatia 2019 – 2022

Description. Aiming to reduce FLW in align with the UN and EU goals, this Plan and activities are based on an analysis of critical measures and stakeholders, and through determinants for action, specifically: Improvement of the legislative framework; Contribution to facilitating food donations; Promotion FLW reduction actions among stakeholders; Improvement food education.

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Title. Long Term Waste Management Plan 2021 – 2030

Description. Through the Waste Management Plan, the Ministry's strategic objectives are to:

- Maximise the resource value in waste through different management options;
- Innovate by designing waste prevention initiatives to lower Malta's per capita generation rate;
- Reform the collection system to increase economies of scale, harmonise collection practices and modernise the collection fleet;
- Build the necessary waste management facilities to treat recyclable, organic and residual waste to achieve Malta's targets;
- Study the feasibility of an enhanced producer responsibility framework to complement Malta's transition to a circular economy and reflect further on the true cost of waste management;
- Promote further the involvement of the private sector in waste management.

Title. Waste prevention country profile

Description. 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 United Nations Sustainable Development Goal to reduce by 50 % per capita global food waste at the retail and consumer levels and to reduce food losses along production and supply chains by 2030.

The national agenda on food waste reduction 'Samen tegen Voedselverspilling' consists of four action lines, in which different measures are taken :

1. monitoring & impact: measure progress quantitatively;
2. working together against food waste in the chain: joining forces, networks and knowledge in order to better implement (existing) solutions;
3. together against food waste at the consumer level: sustainable behavioural change among households;
4. changing the rules: initiate or adapt laws and instruments, so that they contribute to the development of the circular economy.

Title. EPA Food Loss and Waste Measurement Protocol FOR THE FOOD AND DRINK MANUFACTURING SECTOR

Description. The purpose of this protocol was to help manufacturers identify and quantify their food waste and perhaps work towards reducing their food waste. The protocol presents 10 steps for manufacturers to follow, these are, as taken from the protocol (The Circular Economy Programme 2022):

1. Identify all potential food waste and related flows.
2. Establish the scope of what is included.
3. Identify available information for each flow.
4. Gather and check records/data available to your organization.
5. Calculate the annual quantity of food waste.

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6. Assess data uncertainty.
7. Report data for your first year.
8. Set targets and identify actions.
9. Take actions: working on food waste reduction.
10. Track progress over time.

Other Legislations besides implying on measurement and monitoring

Title. Bundes-Abfallwirtschaftsplan/Federal Waste Management Plan

Description. To achieve the goals and principles of the Waste Management Act 2002 (AWG 2002), Federal Law Gazette I No. 102/2002, the Federal Minister for Climate Protection, Environment, Energy, Mobility, Innovation and Technology at least every six years the Federal waste management plan (BAWP) and to publish it on the internet. The seventh update is now available, with the one on the hitherto made waste management measures and their efficiency is reported.

Title. Milan Food Policy - Integrated Action on Food Losses and Waste Management

Description. The Milan Food Policy is a strategic entry point for systemic changes, which have to be implemented, by involving several local players as research centres, private sector, civil society organizations and foundations. The policies designed to reduce food losses and food waste are combined with those regarding waste cycle management, in order to increase the overall sustainability of the system with a consistent approach to circular economy. Four guidelines were defined under the food waste priority of the Milan Food Policy and they establish the promotion at city level of: actions to inform and educate citizens and local players to reduce food losses and waste; the recovery and redistribution of food losses, creating local partnerships (among charities and food banks); a more rational use of packaging; a circular economy in food system management. Milan wants to achieve its goal of reducing food waste by 50 % by 2030 with the help of local players. A key feature of the success of the Food Policy of Milan is the multi-level governance approach, involving representatives from the local authorities with a wider relation with relevant local actors.

Title. Action Plan for Food Waste Prevention

Description. The overall aim is to reduce the generation of food waste and food loss 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 to reduce by 50 % per capita global food waste at the retail and consumer levels in Estonia and to reduce food losses along production and supply chains by 2030. This document will be integrated into a national waste management plan for 2021-2026, to be implemented by the Ministry of Social Affairs.

Title. Value Added Tax Law and Law on Amendments to Decree Law No. 178 with Certain Law

Description. This law contains tax regulations related to the fulfilment of lost goods. It is not directly related with FLW. However, it enables deductions on the value-added tax of donated goods in food banking donations. Encouraging retailers to donate the foods that is close to

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its expiration date or about to spoil or decay to food banks plays a significant role in preventing food waste.

Title. Turkey's National Strategy Document and Action Plan on the Prevention, Reduction and Management of Food Loss and Waste

Description. The National Strategy Document on prevention, reduction and monitoring of food loss and waste and its Action Plan is a national policy with a cross-sectoral approach. This policy lays down actions to ensure a more sustainable and resilient food system and to contribute to the sustainability of the global consumption and production agri-food system. The strategic goals of this policy are: (I) prevention and reduction of food loss and waste, (II) food recovery and redistribution for direct human consumption, (III) converting former foodstuffs to animal feed, without competing with recovery and redistribution for direct human consumption, and (IV) recycling of food loss and waste.

Title. Compost Regulation

Description. The purpose of the Compost Regulation; biodegradable wastes resulting from an activity or arising from businesses:

a) To ensure its management by collecting it separately at the source without harming the environment and human health.
b) Reducing the amount to be disposed of in landfills by recycling.
c) Determining the technical criteria of compost facilities.
d) To determine the procedures and principles regarding the determination of the quality criteria of the products obtained from the compost facilities.

Although it does not contain a regulation for the prevention and reduction of FLW, it is an important legislation as it regulates the conversion of biodegradable waste into a more useful product instead of disposal in landfills. Therefore, this regulation is indirectly related to FLW reduction.

Title. Regulation on the Procedures and Principles to be Followed in Determining the Tariffs of Wastewater Infrastructure and Domestic Solid Waste Disposal Facilities

Description. This regulation includes full cost-based tariffs that can cover the establishment, maintenance, repair, operation, closure and monitoring of wastewater infrastructure facilities and domestic solid waste disposal facilities, and all services provided in relation to these facilities; It has the aim of ensuring the sustainability of environmental infrastructure services through the determination, adjustment and implementation by wastewater infrastructure managements, metropolitan municipalities and municipalities. This regulation is indirectly related to FLW reduction.

Title. Regulation on Mechanical Separation, Drying and Biomechanization Plants and Fermented Product Management

Description. This regulation introduced a definition for biodegradable waste. Biodegradable wastes originating from parks, gardens, houses, restaurants, sales points, food production and similar facilities, which can degrade in an oxygenated and anaerobic environment.

The purpose of this Regulation:

a) To ensure its management without harming the environment and human health, reducing the amount of biodegradable waste to be disposed of in landfills.

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b) To manage the technical criteria of mechanical separation, bio drying and biomethanization facilities, which are material or energy recovery facilities.
c) To determine the procedures and principles regarding the quality criteria of the fermented product obtained in biomethanization facilities.

In this sense, the focus of the regulation is to ensure waste management and reduce the amount of biodegradable waste to be disposed of in landfills, rather than their prevention. This regulation is indirectly related to FLW reduction.

Title. Turkish Food Codex Regulation on Food Labelling and Consumer Information

Description. This regulation regulates the application of “expiry date” and “recommended consumption date” for foods. Expiry date: It shows the last date when foods that are easily perishable microbiologically and therefore likely to pose a danger to human health in a short time can be consumed. The recommended consumption date: It is the date that shows the time that a food retains its unique properties when properly stored. This regulation is directly related to FLW reduction.

Title. Regulation on Standard Practices to be Followed in Wholesale and Retail Trade of Vegetables and Fruits

Description. This regulation sets the standards for packaging, transportation, storage, retail and sales points. It is an important regulation that will prevent FLW, especially since the goods must have storage standards in cold storage or in suitable heat and humidity environments that will not cause deterioration or loss of quality. Therefore, this regulation is directly related to FLW reduction.

Title. The Environmental Law

Description. In this Law, waste is defined as “any kind of substance that is formed as a result of any activity, thrown into the environment or released.” Domestic solid waste, on the other hand, is defined as "solid waste from places such as residences, industry, workplaces, picnic areas that are not included in the scope of hazardous and harmful waste". In the Environmental Law, the concepts of biodegradable waste, organic waste or food waste are not encountered. The collection and transportation of household waste is regulated in the Environmental Law based on general principles. This law is indirectly related to FLW reduction.

Title. Veterinary Services, Phytosanitary, Food and Feed Law

Description. This Law protects and ensures food and feed safety in general, considering public health, plant and animal health, animal breeding and welfare, consumer interests and the protection of the environment. Some of the articles of the Law itself and/or some issues referred to in its articles and regulated in detail by other legislation are directly related to the issue of FLW. For example, it makes possible to use of animal products that could not be used for intended purpose as animal feed or for certain purposes in different sectors. Thereby, it helps reduce FLW.

Title. Agricultural Products Licensed Warehousing Law

Description. While the main purpose of the Law is to facilitate the trade of agricultural products, it is a regulation that directly contributes to the prevention of FLW, as it ensures the safe and healthy storage of agricultural products.

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Title. Law on the Regulation of Trade in Vegetables and Fruits and Other Goods with Sufficient Depth of Supply and Demand

Description. The trade of vegetables and fruits and other goods to be determined according to the depth of supply and demand is carried out in free competition conditions in accordance with quality standards and food safety, effective supply, distribution and sale of goods, protection of the rights and interests of producers and consumers, regulation of the activities of professionals, wholesalers It is to ensure that the market places are brought into a modern system and operated. The regulation of effective procurement, distribution and sales stages means the control of an important part in the food value chain, which in this sense contributes directly and positively to the reduction of losses and waste.

Title. Waste Management Regulation

Description. The purpose of the regulation:

a) Ensuring the management of wastes from generation to disposal without harming the environment and human health.
b) Reducing the use of natural resources and ensuring waste management through ways such as reducing waste generation, reuse, recycling, and recovery of wastes.
c) It is the determination of general procedures and principles regarding the production and market surveillance of products within the scope of this Regulation, which have certain criteria, basic conditions, and characteristics in terms of environment and human health.

The regulation regarding biodegradable waste in the regulation is the dual collection system introduced for the collection of biodegradable wastes and recyclable wastes in two different bags at homes and their separate collection. Although the reduction of waste generation is determined as a target in the Waste Management Regulation, there is no regulation on the reduction and prevention of biodegradable wastes. The focus is on the separate collection and proper disposal of waste at source. Therefore, this regulation is indirectly related to FLW reduction.

Title. Strategy to reduce food loss and food waste in the food supply chain "Respect food, respect the planet".

Description. The strategy is a short document that, in addition to introductory explanations, the situation in the field of FLW, donated food, a SWOT analysis from which 10 needs are derived, defines where food losses and food waste occur in the food supply chain. It sets strategic objectives for managing surpluses and reducing food losses and food waste, which will contribute to the achievement of SDG 12.3.

Title. Agriculture Act (ZKme-1, Official Gezette of the Republic of Slovenia; Articles 89a and 89b)

Description. 89a. and 89b. article of the Agriculture Act that applies to donated food: Donating food is the free distribution of food that meets all the prescribed requirements regarding food safety in accordance with Regulation 178/2002/EC.

Title. Federal constitution, Art. 104a Food security, SR 101

Description. Prerequisite for a resource-saving handling of foodstuffs.

Title. Environmental protection law SR 814.01 (Chapter 4: Waste)

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Description. The legal provisions oblige to avoid the waste as far as possible, the BAFU (Bundesamt für Umwelt --> Federal Office for Environment) and the cantons of Switzerland should prevent waste and promote suitable actions, sensibilisation and information towards the population and companies.

Title. Waste regulation Art. 11 Abs. 1, SR 814.600, Avoidance of waste

Description. Collaboration with federal office of the environment, cantons and concerned economical organizations to prevent waste.

Title. Waste regulation (Art. 11, Abs. 2, SR 814.600), Avoidance of waste

Description. Companies which produce food stuff, are encouraged to handle production processes in that way to reduce waste as much as possible.

Title. Law 7/22, of April 8, on waste and contaminated soil for a circular economy (Ley 7/22, de 8 de abril, de residuos y suelos contaminados para una economía circular)

Description. The purpose of the Law is to establish the principles of the circular economy through basic legislation on waste, as well as to contribute to the fight against climate change and protect the marine environment. In this way, it contributes to the fulfilment of the Sustainable Development Goals, included in the 2030 Agenda and to goals 12 sustainable production and consumption, 13 climate action and 14 submarine life.

Title. Food Loss and Waste Prevention law

Description. The law contains eighteen articles, structured in six chapters: general provisions, obligations of agents in the food chain, good practice measures, rationalization of best-before dates, instruments for promotion and control and sanctioning regime. Key points:

- Obligation of the hospitality industry to offer its customers leftover food at no additional cost and in recyclable containers.
- Companies will have to stipulate the destination of food to avoid its waste under the premise that the highest priority will always be human consumption through the donation or redistribution of food.
- The donation of surpluses will be regulated by collaboration agreements with companies, social initiative entities and other non-profit organizations or food banks.
- The social entities that receive donations must create a system for registering the entry and exit of the food received and delivered.
- If the food is no longer fit for human consumption, the preference will be, in this order: animal feed and feed manufacturing, use as by-products in another industry or as waste and obtaining compost or biofuels.
- Commercial establishments will have sales lines for "ugly, imperfect or unsightly" products.

Title. National Strategy and Action Plan to Combat Food Waste

Description. According to the ministerial Order No. 14202-B/2016 of November 25, the National Commission for Combating Food Waste (CNCDA) has the mission of “Promoting the reduction of food waste through an integrated and multidisciplinary approach” and is in charge of drafting the National Strategy to Combat Food Waste (ENCDA) and the Action Plan to Combat Food Waste (PACDA) and submitting them to the Minister of Agriculture, Forestry and Rural Development. The CNCDA has also the power to “Monitor, evaluate and identify

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the ENCDA and PACDA adaptation needs, and to prepare quarterly reports to be submitted to the Minister of Agriculture, Forestry and Rural Development."

Title. Regulatory framework on the donation of food items for social solidarity purposes and FLW action measure

Description. Law which approves the regulatory framework on the donation of food items for social solidarity and FLW action measures. Reviewed every 2 years.

Title. Waste Law of 2011 (L.185(I)/2011)

Description. The application of environmentally rational management of waste generated in Cyprus is achieved through the implementation of the Waste Law of 2011 (L.185(I)/2011) and the Packaging and Packaging Waste Law of 2002 (L.32(I)/2002) and their amendments, as well as the Regulations and Decrees issued in accordance thereof. The above legislation is the result of European policy and legislation harmonized and adapted to national law. The Cypriot policy on waste management is based mainly on waste hierarchy (prevention, reuse, recycling, recovery, disposal) and the correct environmental handling. The 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.

Title. 2015-2021 Municipal Waste Management Strategy

Description. The Strategy and Plan for municipal waste has been developed following wide consultation with all interested parties as well as consultation with the European Commission. The main axes of the strategy upon which this Plan is based, are compliance with the obligations arising from the European directives on waste management that fall under the municipal waste stream, full utilization of existing private and State waste management infrastructure, maintaining the waste management hierarchy, with emphasis on prevention and separate sorting of waste and the adoption of best practices with the lowest cost.

Title. Waste Management Law

Description. The main document regulating waste management in Latvia is the Waste Management Law, the aim of which is to determine waste management procedures in accordance with development strategies and including environmental and human health aspects, while promoting efficient use of natural resources to increase Latvia's competitiveness and facilitate the transition to a circular economy (Atkritumu apsaimniekosanas likums, 2010). The law classifies and defines different types of waste, and in the context of urban agriculture the most important is the group of bio-waste, which is biodegradable garden and park waste, food and kitchen waste from households, offices, catering establishments (restaurants, canteens etc.), wholesale and retail waste and other waste of food industry enterprises (Atkritumu apsaimniekosanas likums, 2010).

Title. Cabinet of Ministers Regulations No. 788 in 2016

Description. It rules on waste collection and sorting Issued under the waste management Act 6 paragraph 5 of article.

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Title. Republic of Latvia Cabinet Regulation No. 514/ Requirements for the Food Distribution after Expiry of the Date of Minimum Durability

Description. The regulation includes indicative timeframes for specific food categories past their minimum durability dates, which may be donated to charities, persons registered in the Register of Social Services, municipal social services or directly to the final consumer.

Title. Cabinet Regulation No. 145 of 17 March 2020/Requirements for Retail Establishments that Deliver Poultry Eggs or Donate Food of Animal Origin

Description. The Regulation includes rules to facilitate the donation of poultry eggs and food of animal origin, allowing more flexibility for retailers who wish to donate such products. It prescribes the requirements for retail establishments that perform the marginal, localised, and restricted activities in accordance with Regulation (EC) No. 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin.

Title. Más alimento, menos desperdicio

Description. Aims to limit food losses and waste and its impact on the environment and encourages all sectors of society to collaborate.

Title. Aquí no se tira nada

Description. This campaign wants to continue contributing to the awareness of all sectors of society, recovering the value of the food that makes up our gastronomic and cultural heritage, to improve these figures and reduce their impact on the environment.

Title. La alimentación no tiene desperdicio

Description. Establish prevention and efficiency practices, maximize the use of the surplus produced along the different stages of the value chain and increase awareness of society.

Title. New Common Agricultural Policy (PAC)

Description. Prevention of FLW, the first regulation on this matter to be enacted in Spain, with the aim of preventing the discarding of unconsumed food and encouraging better use made of it.

Title. Spanish Circular Economy Strategy – EEEC

Description. Promote a new model of production and consumption in which the value of products is maintained in the economy for as long as possible, in which the generation of waste is minimized and those that cannot be avoided are used to the greatest possible extent.

Title. Agenda to Reduce Food Waste 2022-2027

Description. The main objective of the agenda is to reduce FW *per* capita at retail and consumer level by 50% by 2030 compared to 2020, and to reduce FW along production and supply chains by 20% by 2030 compared to 2020.

Title. Food Loss and Waste Prevention Law

Description. Prevention and reduction of FLW by all actors in the food chain.

Title. The Romanian Law 217/2016 (amended in 2018)

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Description. The law includes several measures to reduce FW across the food supply chain. Following its evaluation in 2019, the law was modified 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.

Title. WASTE MANAGEMENT LAW OF THE REPUBLIC OF LITHUANIA

Description. Article 26 set the basis for the implementation of State Waste Prevention and Management Plan. It must include (also) measures promoting the prevention of FW are intended to combat FW at national, regional and municipal level.

Title. STATE PLAN FOR WASTE PREVENTION AND MANAGEMENT 2021-2027

Description. Implementation of the State Plan for Waste Prevention and Management, determined by the Waste Management Law.

In order to contribute to the United Nations Sustainable Development Goal 12.3, which aims to achieve by 2030 to reduce by 50 % the FW per capita at the retail and consumer level, to reduce food losses throughout the food production and supply chain, it is necessary to take measures to promote FW prevention. It is planned to implement the following measures:

- create a cooperation platform that ensures the sharing of good practices and the search for the best solutions for FW prevention (a measure specified in point 1.3.1 of Annex 2 of the Plan);
- to provide funding measures to encourage support and charity, food sharing or food donation initiatives (measure specified in point 1.3.2 of Annex 2 of the Plan);
- to finance economical food consumption initiatives in public catering establishments, schools, kindergartens, and workplace canteens, promoting meals based on the ""buffet table"" principle (a measure specified in subsection 1.3.3 of Appendix 2 of the Plan);
- to implement publicity measures on the topics of reducing food wastage and preventing FW, developing residents' food use skills (measure specified in point 1.3.4 of Annex 2 of the Plan);
- create conditions for the sustainable transformation of industrial small and medium-sized enterprises: promote the development, demonstration and implementation of innovative and environmentally friendly technologies (measure specified in clause 1.4.1 of Annex 2 of the Plan);
- promote and support short food supply chains (a measure specified in point 1.3.5 of Annex 2 of the Plan);
- establish requirements for large retail chains, catering establishments and food production companies to obligatorily donate food (suitable for humans) in accordance with good foreign practice. (Measure specified in paragraph 1.3.6 of Annex 2 of the Plan)

Title. National energy and climate action plan 2021-2030

Description. The planned policies and measures will focus on the prevention of FW generation and the promotion of waste sorting and reuse. The planned measures focus on educating and informing the public about the problem of FW and how to prevent it, improving waste sorting skills, creating information websites, applications, and interactive maps. All planned measures will reduce the amounts of landfill waste, which will gradually reduce GHG emissions.

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Title. Food Law

Description. Article 4(4) - Basic requirements for food safety, quality and handling established that:

- Food that does not meet the requirements of the food field and other legal acts, but is safe and suitable for consumption, can be transferred to charity and/or support in accordance with the procedure established by the Director of the State Food and Veterinary Service.
- Taxpayers entitled to provide charity and support - including food donation as per the law above - can benefit from a tax rebate of up to 40% of their profit.

Title. APPROVAL OF THE DESCRIPTION OF THE PROCEDURE FOR THE USE OF NON-ANIMAL FOOD FOR FEEDING ANIMALS

Description. In accordance with the Food Law of the Republic of Lithuania, the Veterinary Law of the Republic of Lithuania, the Feed Law of the Republic of Lithuania, it ensures the proper use of unmarketable non-animal food (i.e. a product or raw material obtained from plants or their parts, microorganisms, minerals, chemicals and intended for human consumption) collected in food processing entities for feeding animals.

Title. Buffet recommendations

Description. Buffet (organization of children's meals based on self-service) is a system of meal organization, the essence of which is to enable children to choose the dishes, their ingredients and amounts specified in the menus. The aim of this system is to better satisfy children's taste needs, increase the consumption of healthy food (especially vegetables and fruits) and reduce FW. The buffet principle is one of the effective ways of reducing FW when organizing meals in children's groups, but it also has other advantages.

Title. Lithuanian Bioeconomy Strategy (draft)

Description. The collection and use of FW from the population for biogas production is underdeveloped. The main opportunities for the Lithuanian biogas sector are: EU (and Lithuanian) policy on FW reduction and strategic decisions on its use in biogas production. Provide state financial support to municipalities and communities to establish systems for FW collection and use for biogas production. When providing support, it is appropriate to give priority to integrated biogas production systems that include the use of not only food but also biomass waste of other origin. The main opportunities for the Lithuanian biofuels sector are: Increasing use of animal fats, used oils and cooking oils and other FW, as well as algae in the production of advanced biofuels. Rapidly develop the production of advanced biofuels from biological wastes and residues, including animal fats, used oils and cooking oils and other FW, as well as algae, and use in the transport sector. It is appropriate to provide financial support: i) for scientific research projects in the fields of advanced biofuels raw materials, production, and use technologies; ii) to create and implement collection and logistics systems for biological waste and residues, including fats of animal origin, used oils and cooking oils and other FW, as well as algae; iii) for investments in advanced biofuels production capacities.

Title. Food Waste Disposers - An integral part of the EU's future waste management strategy

Description. Proposal against the ban of FW disposers in the EU.

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Title. Law of 21 March 2012 on waste management (amended by Law of June 9, 2022)

Description. The regulation imposes:

- the development of Waste Prevention Programmes, integrated into the national waste and resource management plan provided for in Article 36, or into other environmental programmes, as appropriate as separate programmes. The programmes also describe existing waste prevention measures and their contribution to waste prevention. Specific programs on the prevention of FW are also part of it,
- food donations and other forms of redistribution for human consumption have priority over animal feed and processing into non-food products,
- the obligation for supermarkets with a sales area of at least 400 square meters to develop, implement and maintain a FW prevention plan. This plan must include a methodology and measures to reduce FW. It may form an integral part of the waste prevention and management plan referred to in Article 27(3). The FW prevention plan must be communicated annually to the competent administration by 31 October at the latest year preceding the year to which the plan applies. The supermarkets concerned shall publish the plans on a website accessible to the public,
- rights for any customer of a restaurant to have his leftover meals given to him to be taken away,
- tax incentives for product donations, especially foodstuffs as an example of economic instruments and other measures to incentivize the application of the waste hierarchy referred to in Article 9

Title. NULL OFFALL LËTZEBUERG': THE WASTE PREVENTION STRATEGY

Description. Luxembourg aims to significantly reduce the amount of waste produced nationwide. In this context, a roadmap has been drawn up to achieve this target. The strategy is based on the principle of the circular economy. The best waste is waste we don't produce.

Title. Eco Box (part of Clever Lessen initiative)

Description. The ECOBOX is a deposit-return scheme for multiple purposes developed in Luxembourg for transporting meals. Whether it's at a restaurant, canteen, or for takeaway food, the ECOBOX can be used almost anywhere. ECOBOX's multiple use will eliminate many single use packages. This initiative allows for the reduction of volume of waste, because it reduces not only the number of packages but also the quantity of FW. Ecobox is not the only reusable system in Luxembourg.

Title. Managing waste

Description. Luxembourg law on the management of waste requires municipalities to manage household and similar waste – including organic waste and other recoverable waste fractions – produced on their territory, and to implement measures to reduce waste. The Service Hygiène (Sanitation Department) is charged with this task in Luxembourg City. In accordance with the law, the City of Luxembourg seeks to organise waste management to limit energy use and the impact on the environment. It does so by carrying out actions in the following order of priority:

- prevention
- preparation for reuse
- recycling

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- other forms of recovery, in particular energy recovery
- disposal

According to a study on the optimisation of household waste recovery, the portion of organic waste in grey bins represents a significant potential source of renewable energy.

In October 2010, the Service Hygiène introduced a specific collection service for organic household waste. By the end of May 2012, the service had been extended to all city districts. The biomethanation process is carried out at the Naturgas Kielen plant in Kehlen and the Bakona plant in Itzig. The collection service was gradually improved and has been implemented in its current form since 2013. door-to-door collection of FW in brown bins

Title. Circular Economy Strategy Luxembourg

Description. The current government agreement advocates the active development of the circular economy in all areas: the production of goods and services, the extension of the use phase of products, their reuse and the recovery of secondary materials. By counteracting the excessive consumption of resources, circularity creates positive impacts. It is crucial for increasing the overall efficiency of the economy and reducing our ecological footprint while at the same time supporting our efforts to protect the climate. As a driver of innovation, the circular economy contributes to the further diversification of the Luxembourg economy and to the creation of new value chains in the Greater Region.

There is a set of 3 categories: 1) Regulation and standards, 2) financial aspects, and 3) knowledge creation and management.

There is distinction between bio-materials that can be reused (e.g., wood) and those that are consumed once (e.g., food).

The relevant dispositions for food and loss waste are:

- Definition of a regulatory framework prohibiting the destruction of edible food.
- Explore incentives (such as support schemes, subsidies, or taxation) that would reduce FLW.
- Act on the reduction of FLW, including digital sharing platforms, consider concepts such as ‘nose to tail’ and ‘leaf to root’, promote education in food nutrition and sustainable food.
- Antigaspi.lu strategy for reducing FW.
- Take-back system for ‘Ecobox’, reusable and recyclable container for food leftovers.

Title. Redistribution/donation of foodstuffs for human nutrition

Description. The document is intended for companies in the food sector to enable foodstuffs donation (redistribution) for human consumption in compliance with legislative requirements. It forms an integral part of the respective sectoral Guides to Good Hygiene Practice.

Title. Policy Paper -Making the Slovak Republic a more resource efficient economy

Description. The aim of the paper is to contribute to a policy debate on the actions and decisions that are needed for a transition towards a green economy in the Slovak Republic. One option that could help to further strengthen the implementation of FW prevention in Slovakia is the introduction of a landfill ban for FW originating from the retail sector. This measure has been implemented successfully in a number of OECD member countries (e.g., Scotland, France, Germany, Korea, Massachusetts and Norway) and produced positive

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results, by encouraging retailers find ways to give food away that has reached the expiration date to charities and producers of livestock feed. There is also a possibility to extend the measure to cover restaurants, food producers and agricultural sector.

Title. Decree of the Ministry of the Agriculture and Forestry & 16088/5, 19.1.2013 Evira Instructions

Description. Animal origin FW should be recorded by retailer. For retailers generating waste exceeding 50 kg per week (2015: 20 kg per week), it is mandatory to collect and properly handle the waste.

Title. Strategy of the Environmental Policy of the Slovak Republic until 2030

Description. Objective 10.5: Prevention of the Production of Biodegradable and FW

Slovakia will limit FW production by 2030. Restaurants and supermarkets will be obliged to make use of the food, for example, by charity donation of the food that fulfils food safety requirements. If they are no longer suitable for consumption, they will be able to compost them or energetically utilize (e.g., by selling at a reduced price for feeding purposes, except for the feeding of wild animals).

Slovakia will remove ""best before"" food labelling and introduce uniform ""use by"" foods after the date of minimum durability may still be suitable for consumption if they are well stored. Labelling ""minimum durability"" increases FW production and is therefore abolished in most European countries. Other legislative restrictions and unnecessarily stringent standards that can lead to the generation of waste from still usable foods will also be reviewed. The prevention to limit the biodegradable waste will be encouraged, with an emphasis on biodegradable municipal waste. Households will be able to compost comfortably the waste they produce. A sufficient network of collection and recovery facilities for separated biodegradable kitchen and restaurant waste will be built.

Title. Evira Instructions 16035/1 – Under Decree 1367/2011 Decree of the Ministry of Agriculture and Forestry on the food hygiene of the notified food premises

Description. Food donations can be permitted to operate under different procedures from commercial operations, but it must be conducted giving the priority to food safety. Either food donation companies or charity organizations should take the responsibility to ensure this approach.

Title. United Against Food Waste

Description. The campaign focuses on educating people to not discard packaged food that is still edible, focusing specifically on the difference between “Use By” and “Best By” dates. A series of videos featuring a cartoon character named Becky explains that smell and visual cues can be used to determine if a product can still be consumed safely after the “Best Buy” date, but that products should not be eaten after the “Use By” date.

Title. Law 166/2016 - Disposizioni concernenti la donazione e la distribuzione di prodotti alimentari e farmaceutici a fini di solidarietà sociale e per la limitazione degli sprechi (Provisions concerning the donation and distribution of food and pharmaceutical products for the purposes of social solidarity and to limit wastage)

Description. The objective of Law 166/2016 is to reduce food waste in each stages of the food supply chain (FSC), from production to consumption. This law is mainly focused on the

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recovery and donation of surplus food generated in the different stages of the FSC for charitable purposes.

Title. Decree No. 9084 of August 28, 2014 "National provisions regarding the approval and control of fruit and vegetable producer organisations and their associations, operational funds and programs"

Description. Article 17 allows the free donation of fruit and vegetable which withdrawn from the market to the following destinations: production of biomass; animal feed; distillation in alcohol; industrial processing; non-food industrial processing; biodegradation or composting.

Title. LOI n° 2016-138 du 11 février 2016 relative à la lutte contre le gaspillage alimentaire (relating to the fight against food waste)

Description. This law asks specific actions to be taken to avoid food waste, especially in supermarket, through food donation. A anti food waste hierarchy is proposed here: Food waste prevention through, Donation, Animal feed, Composting or anaerobic digestion, Disposal.

Title. Ordonnance n° 2019-1069 du 21 octobre 2019 relative à la lutte contre le gaspillage alimentaire (relating to the fight against food waste)

Description. Compared to the LAW n° 2016-138, the obligation of food donation is extented to food catering and food industry sectors.

Title. LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire (relating to the fight against waste and the circular economy)

Description. Raise the fines for destroying unsold food which is still edible up to 0.1% of the annual turnover. Integrating food labels like “Best before” and “Use by” into the food products codification.

Title. S.I. No. 190/2015 - Waste Management (Food Waste) (Amendment) Regulations 2015

Description. The regulation “No. 190/2015 – Waste Management (Food Waste) (Amendment) Regulations 2015)” along with the original version, “No. 508/2009 - Waste Management (Food Waste) Regulations 2009”, focuses on segregation and processing of food waste. This includes “Food safety and hygiene”, “Handling and prohibition on contamination of food waste before and after collection”, “Requirement to use a segregated collection service for food waste”, and “Food Waste Management Plans” to name a few. The regulation applies to food waste that occurs at or is collected from a list of producers specified in the regulation. The regulation also states that food waste collection needs to be segregated from other collections and needs to occur at least once per fortnight, or at least as often as residual waste is collected, if residual waste is collected more often than once per fortnight. It also states that collected food waste cannot be mixed with waste that is not food waste or specified biowaste and it needs to be disposed of by an authorized waste collector and be handled by an authorized treatment facility. A person is guilty of an offence, if they do not follow these regulations. Households are also obligated to source segregate food waste, so that it is not mixed with non-biodegradable materials.

Title. National Strategy for Food Waste Reduction

Description. The federal government announced a strategy to decrease food waste in 2019 that consists of a number of preventative and recycling actions. They include encouraging

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research and development, enhancing consumer education and information, assisting companies in decreasing food waste, and increasing societal and policymaker involvement.

Title. Act on Counteracting Food Waste

Description. This act aims to reduce food waste and loss throughout the food supply chain in Poland by establishing obligations for food businesses, such as the obligation to prevent food waste, donate surplus food, and report on their waste prevention activities.

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Appendix V. National level survey - Agencies identification

WASTELESS - Food Loss and Waste Agencies Identification

Please list the agencies involved, directly or indirectly, in measuring and monitoring food loss and waste, and/or in developing and implementing relevant policies.

** Indicates required question*

1. Contribution partner *

Please indicate here your affiliation.

2. Agency name *

Official name of the agency.

3. Food Loss and Waste Action (multiple choice) *

The main areas of work of the agency related to food loss and waste.

- Measurement and monitoring
- Policies and legislation
- Other:

4. Country *

The country of the agency.

5. Agency Type *

The classification or categorization of the agency.

- Government department
- Statistical departments
- Environmental agency
- Research institution
- University
- Non-governmental organization
- Private company
- Non-profit organization
- Other:

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6. Agency Website *

The official website of the agency.

7. Contact Person *

A person that serves in this agency as the main point of contact for communication.

8. Email Address *

The agency's email address for communication.

9. Please provide any additional contact information

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Appendix VI. National level survey – FLW measurement and monitoring practices mapping

WASTELESS - Food Loss and Waste Measurement Practices Mapping

Please list the food loss and waste measurement and monitoring practices.

** Indicates required question*

1. Contribution partner *

Please indicate here your affiliation.

2. Measurement practice title *

Official name of the practice.

3. Country *

Country where the practice is carried out.

4. Responsible agency *

Agency that is in charge of the practice implementation.

5. Practice description *

Please provide a brief description of the practice and/or a reference link.

6. Food loss and waste definition *

The food loss and waste definition that was used for the measurement practice.

- *FAO (2019).* ***Food loss and waste****: the decrease in quantity or quality of food along the food supply chain.* ***Food Loss****: the result of decisions and actions by suppliers – affects the supply of food: if food losses are reduced, the supply of food into the food supply chain increases. Strictly speaking, FL therefore concerns all stages of the food supply chain up to, but excluding, the point where there is interaction with the final consumer and thus excludes retail, food service providers and consumers.* ***Food Waste****: the result of purchasing decisions by consumers, or decisions by retailers and food service providers that affect consumer behaviour. For more information please refers to: State of Food and Agriculture 2019. Moving forward on food loss and waste reduction*

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- *FUSION (2014).* ***Food Waste****: fractions of "food and inedible parts of food removed from the food supply chain" to be recovered or disposed (including - composted, crops ploughed in/not harvested, anaerobic digestion, bioenergy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea), excluding food valorisation and conversion (animal feed, biobased materials, and biochemical processing). For more information please refers to: Definitional Framework for Food Waste*
- *For other definition, please provide further clarification or a reference link.*

- FAO definition (FAO, 2019)
- FUSION definition (FUSIONS, 2014)
- Other:

7. Target food supply chain stages (multiple choice) *

Specific sectors that the practice is focusing on to measure food loss and waste.

- Whole stage
- Primary production
- Handling and storage
- Processing and manufacturing
- Distribution and logistics
- Retail and wholesale
- Food services
- Households
- Other:

8. Geographic scope *

Geographic coverage of food loss and waste measurement/monitoring.

- National
- Regional
- Municipal
- Case studies

9. Practice start date *

Specific date that the practice is carried out.

10. Time scale *

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Duration of the practice.

- 1 month
- months
- 6 months
- months
- Over 1 year

11. Data originality (multiple choice) *

The origin or location from which food loss and waste data is obtained or collected.

- ***Primary data**: data measured directly, for example by weighing or by waste composition analysis.*
- ***Secondary data**: data from an indirect source (mass balances, statistics, and economic transactions).*
- ***Literature data**: data from literature or databases.*

- Primary data
- Secondary data
- Literature data

12. Data resources

Please provide the data resource if the measurement practice is based on secondary or literature data.

13. Food loss and waste measurement method (multiple choice) *

Method that is used for data collection.

- Digital weighing
- Visual estimation
- Diaries
- Mass balance
- Surveys and interviews
- Modelling
- Food balance
- Proxy data
- Literature data
- Other:

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14. Target food commodity (multiple choice) *

Specific food commodities that the practice is focusing on to measure food loss and waste.

- Fruit
- Vegetables
- Meat
- Dairy
- Fish and fish products
- Bakery products
- Cereals
- Other:

15. Please provide a detailed list of target food categories.

For example, you may use "apple" to indicate the target fruit category.

16. Food loss and waste destination (multiple choice) *

The way in which the lost or wasted food is being managed, such as being sent to a landfill or redistributed, or to other purposes.

- Animal feed
- Biomaterial/processing
- Co/anaerobic digestion
- Compost/aerobic
- Controlled combustion
- Land application
- Landfill
- Left on field
- Refuse/discards
- Sewer
- Upcycling
- Other:

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Appendix VII. National level survey – Legislations mapping

WASTELESS - Food Loss and Waste Policies Mapping

Please list the food loss and waste policies and regulations.

** Indicates required question*

1. Contribution partner *

Please indicate here your affiliation.

2. Policy title *

Official title of the policy.

3. Country *

Country where the policy is carried out.

4. Responsible agency *

Agency that is in charge of the policy implementation.

5. Short description *

Please provide a summary of the policy, especially its connection and potential impacts on food loss and waste.

6. Policy reference link *

7. Target food supply chain stages (multiple choice) *

Specific sectors that the policy is focusing on.

- Whole stage
- Primary production
- Handling and storage
- Processing and manufacturing
- Distribution and logistics
- Retail and wholesale
- Food services

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- Households
- Other:

8. Geographic scope *

The extent or range of a particular geographic area that is the policy is focusing.

- National
- Regional
- Municipal

9. Policy start date *

Specific date that the policy is carried out.

10. Time scale *

Duration of the policy.

- Less than 1 year
- 1 year
- 2 years
- 3 years
- 5 years
- Over 5 years

11. Policy type *

The classification of the policy, based on its purpose, scope, and approach.

- Policy
- Regulations
- Directives
- Decisions
- Communications
- Parliament resolution
- Other:

12. Policy area (multiple choice) *

Specific issue or domain of policy concern.

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- Agriculture protection.
- Fisheries
- Industrial policy and internal market
- General financial and institutional matters
- Taxation
- Economic and monetary policy and free movement of capital
- Environment
- Consumer health
- Other:

13. Food loss and waste implications (multiple choice) *

Specific food loss and waste issue or area of policy concern.

- Food loss and waste generation
- Food loss and waste measurement and monitoring
- Food loss and waste management
- Food loss and waste reduction
- Food loss and waste use optimization
- Other:

14. Food loss and waste related topics (multiple choice) *

Specific topics that may be relevant to food loss and waste.

- Animal by-products and feeding stuffs
- Catch restrictions
- Contaminants in food
- Food information
- Free distribution
- Hygiene rules
- Marketing standards
- Packaging
- Producer liability
- Resource efficiency and waste Statistics
- VAT
- Food Safety
- Norms
- Date Labelling
- Dumpster Diving

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- Disposal Bans
- Foodsharing
- Other:

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Appendix VIII. Food supply chain level survey

WASTELESS survey Food Losses and Wastes

WASTELESS project is an EU project funded by. Horizon Europe Programme. The aim of the project is to develop and test a mix of innovative tools and methodologies for Food Loss and Waste (FLW) measurement and monitoring.

The purpose of this survey is to identify what are the best practices for FLW measuring, monitoring and reporting and investigate business strategies for FLW reduction across the food supply chain actors namely: primary production, food processing industry, retailers, and food services.

All contributors will receive the analysis of survey results accompanied with recommendations for an improved framework for FLW measurement and monitoring.

This survey ensures the anonymity of the survey participants.

The data will be processed in aggregate form ensuring compliance with privacy legislation.

** Indicates required question*

1. TYPE OF ACTOR *

- PRIMARY PRODUCTION
- FOOD PROCESSING INDUSTRY
- RETAILER
- HO.RE.CA / FOOD SERVICE

2. DID YOUR ORGANISATION PUT IN PLACE SYSTEM FOR MEASURING FLW ALONG YOUR PRODUCTIVE SYSTEM?

- YES
- NO
- PROCESS IS IN PROGRESS

3. IF YES TO QUESTION NR. 2

WHICH TOOL OF MEASUREMENT DID YOU USE? PLEASE DESCRIBE SHORTLY

4. IF YES TO QUESTION NR. 2

WHICH TOOL OF MONITORING DID YOU USE? PLEASE DESCRIBE SHORTLY

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5. IF YES TO QUESTION NR. 2

WHICH TOOL OF REPORTING DID YOU USE? PLEASE DESCRIBE SHORTLY

6. IF YES TO QUESTIONS 3, 4 AND 5 WHICH IS THE ESTIMATED VOLUME OF FLW IN PERCENTAGE OF YOUR TOTAL PRODUCTION/PRODUCTS/VALUE?

- LESS THAN 2%
- FROM 2% TO 5%
- FROM 5% TO 10%
- MORE THAN 10%

7. IF YES TO QUESTION NR. 3 OR 4 OR 5 DID YOU REGISTER A REDUCTION OF FLW VOLUMES AFTER THE USE OF MEASUREMENT, MONITORING AND REPORTING TOOLS?

- YES
- NO

8. IN WHICH PROPORTION FLW ARE (please indicate % on the total annual)

	%
Disposed as waste	☐
Transferred or sold to processing companies for the production of renewable energy and/or animal feed	☐
Donated (if applicable) to NGOs or Charities	☐
Sold on secondary markets	☐
Reused within the production process	
Other	☐

9. WHAT IS THE ANNUAL COSTS OF FLW HANDLING/DISPOSAL? Consider only the external costs of disposal (including waste tax). Indicate the cost in Euros per year

10. WHAT IS THE ANNUAL COSTS OF FLW MANAGEMENT? Consider only the tools' costs for measurement, monitoring and/or reporting. Indicate the cost in Euros per year

11. HOW MANY MAN/DAYS (1 man/day = 8 hours of work) ARE DEDICATED ON AVERAGE BASIS EACH YEAR TO THE OVERALL FLW MANAGEMENT?

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12. WHICH OF THE FOLLOWING STRATEGIES HAVE BEEN IMPLEMENTED (OR WILL BE IMPLEMENTED IN THE FUTURE) ABOUT FLW REDUCTION?

- Improvement of the efficiency of the production process
- Change in internal product management
- Activation of supply chain agreements
- Product modifications
- other

13. DID YOUR ORGANISATION IMPLEMENTED ANY COMMUNICATION ACTIONS OF FLW MANAGEMENT/REDUCTION?

14. DID YOUR ORGANISATION CARRIED OUT ANY NATIONAL/EU PROJECT ON THIS TOPIC?

15. DO YOU WANT TO RECEIVE FUTURE UPDATE ON THE PROJECT RESULTS?

- YES
- NO

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Appendix IX. SWOT analysis description

Table 7. Measurement and monitoring practices SWOT analysis - Strengths

Strength Dimensions	Description
Implementation of national reporting system	Collectively, current practices enable the understanding of the landscape of FLW generated in EU Member States.
	Many countries started monitoring their own FW levels by the national reporting system.
Sufficient benefits	Measurement and monitoring practices are essential to governments, businesses, non-profit organisations, and individuals, due to the economic and environmental impacts.
Improved data collection methods	There are some precisely defined measurement approaches conducted (weight of waste in comparison to product, percentage of participants answering a certain option in a survey, etc).
	Some household FW were measured following the FUSIONS methodologies - comparable data.
	There is a general harmonisation for the methods to be used (i.e., Decision (EU) 2019/1597).
Availability of knowledge sharing	There are some attempts to collaborate and share the knowledge with the numbers of campaigns and projects at national and international level.
Wide geographic and food commodity coverage	Some practices cover very wide scopes (whole industries, national coverage, food commodities).

Table 8. Measurement and monitoring practices SWOT analysis - Weaknesses

Weakness Dimensions	Description
No harmonized framework	There is a lack of a well-accepted framework to track FLW through the food supply chain across different countries.
	FW monitoring and reporting practices needed improvements targeting EU FW reduction targets.
Inconsistent and weak data collection	Current practices seem to have different tactics, there is no common ground.

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methods	Differences along EU Member States (there is no single method to compare different data).
	Struggles exist in tracking a certain food though the entire food supply chain and recording the data for measurement and monitoring of FLW at each stage.
	Insufficient data to comprehensively evaluate the entire situation due to the reliance on survey-based data collected through household interviews, which indirect measurements dependent on individual responses.
	Challenges to differentiate food commodities by food types in some cases, especially at household level and within HoReCA sector.
	Some practices not being well received in certain regions.
Incompatibility in the universal context	Practices not working when blended into a universal solution.
Absence of standardized food categories	There is a lack of a common food categorization to measure FLW by differentiating the food commodities.
	There are no standardised food categories in the EU.
Unbalanced FSC sector / actor coverage	Limited coverage of the measurement and monitoring practice, focusing on food system sectors of handling and storage, as well as distribution and logistics.
	Insufficient attention to the production process.
	Ineffective FLW evaluation of surplus products at the production stage.
Limited information sharing / dissemination	The limited accessibility of information on food loss and measurement and monitoring practices in different countries.
	Manufacturers lack of sufficient information in measuring and monitoring practises.
Less stakeholder engagement	Some practices are only destined to specific actors (e.g., retailers).
	Issues in involving consumers.

Table 9. Measurement and monitoring practices SWOT analysis - Opportunities

Opportunity Dimensions	**Description**
General	Linking FLW statistics to other parameters of policy

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	implementation such as economic conditions, job creation, training and education.
High governing awareness	There is an increasing awareness for the necessity of measurement and monitoring the FLW through food supply chain.
	Awareness of countries to contribute to sustainable food systems in terms of both consumption and production by preventing, reducing, and managing FLW.
	Clear and prominently defined goals for food loss and waste reduction.
Improved data collection method	Combining the results from different methods to identify the single harmonised one to adopt in the EU
Financial supported	Sufficient investment and funding for research and innovations to develop better practices to measure and monitor FLW.
Innovative technology	Applying emerging technologies and innovations such as mobile phone apps to effectively measure and record food loss and waste.
	Using electronic data management system to record food loss and waste is being developed in certain countries
	Developing data management systems to record the amount of food by storage, distribution, donation, as well as FLW.
	Implementing apps and IT programmes for a better monitoring analysis.

Table 10. Measurement and monitoring practices SWOT analysis - Threats

Threat Dimensions	Description
Governance issues	Lack of institutional or policy conditions to establish coordination among actors, enable investment and facilitate the adoption of good practices.
	New regulatory dispositions might render applied methods invalid.
Inefficient management and monitoring of practices	Financing problems may occur.
	Frauds in the food and waste sector, with menace to the real measurement of FLW.

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Overlook ethical impacts	Weak security of new measures adopted.
Low public engagement / collaboration	Resistance to change among actors.
	Sustaining policy and bottom-up initiatives requires great efforts and multi-stakeholder collaborations.
	Lack of consumers interest, involvement, and awareness.
	The prioritization of profits over measuring FLW among food service sectors.

Table 11. Legislation actions SWOT analysis - Strengths

Strength Dimensions	**Description**
Strong legislative base	Numbers of regulations to encourage waste prevention and management at certain stage of food supply chain.
	Wastes and its categories are clearly defined (i.e., Decision 2000/532/EC).
Wide legislative coverage	Many initiatives to inform and influence consumers to create less FW are supported by legislation.
	Across countries, there are various legislation to measure, prevent and reduce FLW.
Less economic impact	A number of actions factor in economic aspects, to create solutions without negative economic impacts.
Adaption to local contexts	Policies and regulation are more nationally/regionally/locally tailored.

Table 12. Legislation actions SWOT analysis - Weaknesses

Weakness Dimensions	**Description**
Implementation challenges	Many ways to analyse and report waste formation, but less direct action affecting all EU-member states.
	The legislation is not constantly renewed to keep up with changing conditions.
	Misalignment between management and prevention policies.
Legislation gaps	There is a lack of specific legislation for food loss and waste measurement and monitoring compared to reduction.

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	There is a lack of standard framework including legislations, rules, and recommendations to manage food loss and waste at each stage of the food supply chain.
	Additional legislative implications are needed for data reporting and donation in addition to food loss and waste measurement and monitoring.
	Legislation often just "This is the least we can do" rather than most effective methods.
	There is no definition related to food loss.
	Lack of harmonized EU framework.
Disparities in development across counties/regions	Specific legislations on FLW, differentiating them from other types of waste instead of relying on indirect regulations, are lacking in most of countries.
	Effective legislation seems to be mostly regional, national solutions rarely exist.
	Public services differ a lot in quality among counties.
	Implementations are different for each Member States (being 'waste' regulated by a Directive).
	Poor National Legislation, absent in some MSs.
Harmonization issues	Legislation not working when blended into a universal solution

Table 13. Legislation actions SWOT analysis - Opportunities

Opportunity Dimensions	**Description**
Promotion of cooperation among sectors and actors	Efforts coordination among different government agencies responsible for implementing the legislation.
	Initiatives for legislations and regulations in collaboration with all stakeholders at national and international levels to manage FLW.
	Fostering cooperation among institutes and different sectors.
	Implementing new policies and regulation (or update) through exchanges between different Member States.
	Joint initiatives at EU level to work on common goals.
Ambitious governing actions	Heightened governmental awareness regarding the reduction of food loss and waste.
	National Waste Management Plan is in line with the SDG 12.3.

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	Increase government attention to face this global challenge in a harmonized approach.
	Adequate efforts for FLW management and related action plan for sustainable development goals in different countries.
	The existing public structure has strong authority in agricultural production, food control, forest, and water resources management.
Increased public awareness / engagement	Implementing the regulations along with whole stakeholders could be easy due to the increased public awareness on food loss and waste reduction.
	Involvement of different stakeholders in the regulatory and policy development process (e.g., European Citizens' Food Waste Panel, EU Platform on Food Losses and Waste, European Consumer Food Waste Forum).
Boosted dissemination and sharing	Establishing successful methods in other regions
	Spreading environmental awareness among actors.
	Integrating food waste into education (e.g., alimentary courses).
Legislation evolution	Creating a mixture of successful legislations to allow for a 'fits all'-policy
	Introduction of new laws for data accuracy.
	Include the issue of food loss in strategic plans and other guidance documents of public institutions and organizations, from primary production to final consumption.
Technology updating	Developing methods that transform wastes into new products.
	Improve technological infrastructure.

Table 14. Legislation actions SWOT analysis - Threats

Threat Dimensions	Description
Potential conflicts with existing legislative actions	Potential conflicts with other existing regulations or policies, in particular actions governing the marketing standards of agricultural products.
	Resistance and opposition from stakeholders towards the rules and regulations about food loss and waste to be imposed.
	Difficult implementation due to other policy and regulation, that obstacles initiatives intended to be imported/exported.
	Fear for lost revenue in companies when dealing with FLW.
	Possible need for adaptation of existing regulations with updated common policies, implying a longer timeline for

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	updates.
Less acceptance among stakeholders	Some policies are not being well received in certain regions.
	Resistance to changes caused by adoption to new legislations.
	Forcing all stakeholders due to the sanctions and mandatory articles of the legislation that needs to be complied with.
Ineffective communications	Delays in the implementation of regulations due to inconsistencies and disagreements arising from the involvement of multiple different government organizations.
	Inability to reach all segments of society regarding the importance of food waste and losses.
Limited stakeholder engagement	Stakeholders who are expected to comply with the legislation set rules that not only large companies, but also other small and medium-sized enterprises can comply with.
Poor monitoring	Lack of monitoring process for tracking the proper implementation of regulations and laws.
	Lack of control over whether the legislation in force is being implemented in accordance with the objectives.

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