Prevention of food losses and food waste by legal instruments

Deliverable 4.6

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Technical References

Deliverable Information

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[1] PU = Public
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CO = Confidential, only for members of the consortium (including the Commission Services)

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List of Acronyms

AFN	Alternative Food Networks
CAP	Common Agriculture Policy
CEAP	Circular Economy Action Plan
CO_2	Carbon Dioxide
CSA	Community Supported Agriculture
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FB	Food Bank
FL	Food Losses
FLW	Food Losses and Waste
FSC	Food Supply Chain
FVC	Food Value Chain
FW	Food Waste
GHG	Greenhouse Gas
HH	Households
HORECA	Hotels Restaurants and Catering services
JRC	Joint Research Center of the European Commission
MS	Member State
PP	Primary Production
TBA	Take-Back Agreements
UNEP	United Nations Environmental Program

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Executive Summary

The aim of the FOODRUS project is to co-create and test 23 circular solutions to significantly reduce food loss and food waste across three key food value chains: vegetables and prepared salads (Spain), meat and fish (Denmark) and bread (Slovakia). This report is part of the activities carried out in WP4 Sustainability, under task T4.4 Policy Outreach. D4.6 Prevention of food losses and food waste by legal instruments provides an overview of the results of the investigation process carried out by the Foodrus partners across 8 countries in Europe (Spain, Slovakia, Denmark, Austria, Bulgaria, Greece, Romania and Hungary).

The document is composed of 7 main chapters. Chapter 1 provides an overview of the aims of the deliverable and of the methodological approach that partners have followed for the data collection and data validation process.

Chapter 2 provides information regarding the current status of food loss and food waste across Europe, presenting the baseline information that has been collected through previous studies. The chapter also describes what are the identified food loss and food waste hotspots that partners in the project pilots (Spain, Slovakia, Denmark) have identified as key challenges to reduce food losses and waste given the food loss assessment carried out locally.

Chapter 3 provides a glimps of the different European policies, directive, regulations and guidelines that prescribe - either directly or indirectly - actions and targets related to the functioning of food systems in Europe.

In Chapter 4 a closer look at the existing food legislation in the FOODRUS pilots and Associated Regions is provided, with specific investigation of aspects related to the existance of prevention and reduction taregets and measures, the existence of measuring and monitoring tools, and the handling of food donations and food surplus redistribution.

Chapter 5 and Chapter 6represent the bulk of D4.6 as they present, respectively, the stage specific legal and economic barriers identified for each stage of the food value chain (Chapter 5) and, the cross-sectoral barriers that to food waste reduction that affect multiple stages of the food value chain at the same time (Chapter 6).

Finally, Chapter 7 provides the final recommendations on what are the approaches to correct the existing barriers, and what are the game change factors that can support an accelerated transition towards more sustainable food systems. In terms of results, the investigation process has led to the identification of 40 key barriers across the entire value chain. These barriers have been classified in legal barrier, when they were the result of the application of EU or national regulation, and in economic barrier, when the nature of the barrier closely related to the practices dictated by the specific economic system in which European food businesses operate.

A series of technical barriers have also been identified at the early stage of the process, but their influence for food waste reduction has been linked to operational performance aspects that were more related to the choice of the processing machinery, a factor that was out of scope for the objectives of the deliverable. At a secondary stage the 40 barriers have been re-grouped and classified in broader categories, which led to the listing of 11 key legal and economic barriers to food waste prevention.

Once the barriers have been identified, ACR+, as responsible partner for the preparation of D4.6 initiated a consultative process with European food sector stakeholders to jointly elaborate on a correction strategy for the identified hindrances.

Therefore, D4.6 not only describes the barriers as they have been identified through empirical evidence, relating them to the specific stage(s) of the food value chain but also provides a series of barrier-specific recommendations that can improve current legislation and current practice ruling business operations across the food value chain. Among the identified barriers, very important are the ones that relate to the legislation on

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transmissible animal diseases, the handling of damaged and wrongly labbed food items, the heterogeneity of Value Added Tax (VAT) systems for food donations, the Take Back Agreements (TBA) used by retailers, and the weak policy coherence among some of the EU Green Deal policies. As a result, the recommendations that arise from the document focus on 3 key actions: prevent, measure and regulate. For each of these actions, an explanation of the benefits to adopt these approaches at wider EU level is provided in the document.

Finally, the report concludes with a brief discussion of how a set of 6 key game changers can provide benefits to accelerate the move towards a more sustainable food system where food waste is no longer generated. Among these game changers, we find existing initiatives such as the Alternative Food Networks (AFN) and the actions performed by food redistribution agents (i.e. Food Banks).

Attention is also given to the risk of emerging new bio-technology for food upcycling, and on the need to regulate the developments in this sector to avoid generating a demand for food waste and food surplus to make a viable business case for these new technologies.

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1. Introduction

1.1 Aims of the deliverable

Deliverable 4.6 *Prevention of food losses and food waste by legal instruments* aims to highlight the current legal, economic and structural barriers preventing food sector stakeholders from improving or implementing innovative solutions to reduce food losses and food waste across the food supply chain. The report does not limit itself to identify these barriers. It also puts forward propositions on how these barriers can be overcome and describes the system change needed to achieve a considerable reduction of FL and FW in the European food systems.

For this reason, this deliverable identifies proposed solutions and amendments to current legislation and economic system *modus operandi* that, when adopted at the wider scale, can deliver high impact on food waste reduction effort. The results presented in this report are evidence-based. They are relevant to both FVC actors, from farm to fork, and to public authorities entrusted with the role to develop effective legislation, and transpose or adopt EU regulation at national and regional level.

The content of this deliverable has been developed by the FOODRUS partner ACR+. It is based on the work developed by ACR+ (literature review, EU survey, policy workshops) and on the contributions received from FOODRUS partners in pilot and associated regions. The Region of Catalunya, and the Amsterdam Metropolitan Region have also contributed valuable inputs through their engagement as non-partner Associated Regions.

1.2 Methodological approach

The content of this deliverable includes the results of a 4-step process made up of the following building blocks:

1. A literature review on factors causing food losses and food waste in different European countries, and across the different food value chain stages;
2. An evidence-based component where FOODRUS pilots and Associated Regions have been engaged in the process of barriers identification and analysis of legal and economic factors that are at the base of FL and FW in their respective territories;
3. A broader EU-level assessment of existing economic and legal barriers to FL and FW prevention carried out through an open EU-level survey
4. A validation process of the relevance and presence of the identified barriers at EU -level scale, and an open discussion on the proposed corrective actions carried out through 2 online policy roundtables focusing, respectively on, Barriers and Recommendations.

Based on the collected results and looking at the current trends in FL and FW prevention unfolding in Europe, we drafted recommendations on needed policy adjustments that can potentially support EU Member States in achieving better performance in FLW reduction, supporting the FVC actors in their territories to considerably reduce the amount of edible food that goes to waste.

During the analysis, wherever possible, we analyzed barriers at each level of the food supply chain, focusing on those stages where we identified the greatest hampering factors, and where room for improvement is wider.

The literature review has provided a first baseline to list all existing legislative and economic bottlenecks that FVC actors face in their daily operations. However, during this initial exercise we observed a researchers' and institutional overfocus on the role of the end-consumer as a food waste generator, with less literature and policy attention available on the role of the other actors and stages of the food supply chain, especially for what concerns the food processing and food retail stages. This is why in our work we decided to prioritize a more in-depth analysis of the barriers occurring at the earlier stages of the food value chain.

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The work on this deliverable started in the early months of 2021 when no information from the mandatory reporting of food waste by member states was yet available (first results only became available in the second half of 2022). The amount of data that have since then being generated at EU level from the start of the project till its end has, as a consequence, evolved rapidly through time. Meanwhile, in the absence of an empirical, and statistically representative, quantification of the volumes of food waste generated by actors across the different FVC stages, reliance on existing literature for the identification of the barriers resulted somewhat only partial. To overcome this information gap, the *Legal and Economic Barriers to Food Waste Survey* was produced at the end of 2021, and launched in the spring of 2022. The survey has been distributed to more than 140 FVC actors across Europe, including FOODRUS partners, FOODRUS sister projects, projects of the FOODRUS Cooperation and Collaboration Network (CCN), and FVC category associations. The survey has also been advertised across existing European platforms, as the European Platform on FL and FW, the European FLW Prevention Hub, and several other FL and FW prevention working groups. Overall, we collected a total of 54 responses from 13 representative European countries, and from a diverse range of FVC actors. In parallel, we asked FOODRUS pilots and Associated Regions' partners to identify current legislative or economic obstacles that produced FL and FW in the value chains where they operated, while continuing to run the literature review. With the results of this steps we then prepared the 2 policy workshops to discuss and refine the findings, which culminated in the reparation oof this deliverable.

Overall, the analytical approach used to produce this deliverable has undergone the steps highlighted in the timeframe of Table 1-1 below.

Table 1-1 Building blocks of the analytical work for the production of D4.6 deliverable

Period	Activity
Nov. 2020 – Apr. 2021	Preparatory work for the assessment of legal barriers
Aug-Oct 2021	Identification of legal and economic barriers based on literature review
Oct 2021- March 2022	Development and dissemination of the Survey on Legal and Economic Barriers to FL and FW prevention
Jun 2022 - March 2023	Collection and *analysis* of survey results
Oct 2021- Aug 2023	Identification of economic and legal barriers based on the combined input from project partners, the literature review, and the survey
Nov. 2023	1st Policy Roundtable on BARRIERS to Food Waste prevention
Jan. 2024	2nd policy Roundtable on RECOMMENDATIONS to Food Waste Prevention
Nov 2023 – Feb 2024	Preparation of final version of D4.6 and dissemination of results

One important note to the reader is that, although we recognize the difference between the two terms, in this document we use the term of food waste *prevention* and food waste *reduction* as synonyms This is because any action preventing food to become waste is also a food waste reduction measure. However, generally speaking, in compliance with the waste hierarchy, the perspective we used to draft this deliverable, and the research work behind it, has been to give priority to FLW prevention action over reduction measures alone.

1.3 Structure of the deliverable

Excluding chapter 1 (Technical References) and chapter 2 (Introduction), deliverable D4.6 consists of 6 core chapters.

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Chapter 3 provides an overview of the current situation of FL and FW generation in Europe, also bringing evidence of critical hotspots directly identified in the project pilots.

Chapter 4 sets the baseline in terms of governing EU regulatory framework on food losses and food waste, providing an overview of the major EU policies and strategies that address the food waste challenge.

Chapter 5 provides information on the current food legislation in the 3 pilots, the 5 partner Associated Regions, and the 2 non-partner Associated Regions of the FOODRUS project. In this chapter we briefly touch upon different aspects related to national regulation, FL and FW quantification and monitoring, FL and FW prevention and reduction targets and available supporting policies for food donations.

After analyzing the legal landscape in Europe and in some of its member states, in Chapter 6 we present the stage-specific legal and economic barrier that affect actors at the different levels of the food supply chain.

In Chapter 7 we continue the analysis of the barrier by looking at those transversal challenges that multiple actors across the FVC are called upon to face. This the chapter where we focus on the cross-sectoral barriers to food losses and food waste.

Finally, in Chapter 8 we reflect on the analysis performed in the previous chapters and we draw the final summary conclusions and recommendations to improve the legal and economic framework around food losses and food waste prevention action in Europe.

This deliverable also contained 3 Annexes.

In Annex A we report more detailed information on the national and regional legislation around food waste across some of the FOODRUS Associated Regions.

In Annex B, we have compiled a Policy Brief on Fiscal instruments, where we present 3 main topics, namely:

- an overview of the regional and municipal policy approaches to food waste prevention and reduction in the Region of Catalunya (Spain) and in the city of Ghent (Belgium);
- existing fiscal regimes for food donations across 11 countries in Europe;
- the Pay As You Throw (PAYT) municipal taxing system, and its developments inn the city of Zamudio (Spain)

In Annex C we report comparative tables on the legislative frameworks adopted in a number of selected European countries that address FLW prevention strategies, monitoring frameworks and strategies for food surplus redistribution and food donations.

Finally, to ease reference to the supporting documents used in this deliverable, throughout the text we made use of hyperlinks and in-text references to redirect the reader towards the relevant mentioned documents, reports or sources of information.

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2. Food losses and waste: a shared European challenge

2.1 The food losses and food waste landscape in Europe

In 2019, the EC Joint Research Centre published a comprehensive study assessing the level of food waste in Europe. The study was conducted by Caldeira, De Laurentis and Corrado (Caldeira C., 2019) and it estimates that as much as 129 million tons of food waste (incl. food losses at primary production level) were generated in the EU-26 in the year 2011[1]. This equates to 20% of the overall production of food (638M tons) in Europe for that year, and to about 10% of the global food waste figure estimated by FAO for 2009 (1.3B tons)[2]. These figures are also in line with the 2019 global figure of food waste calculated by UNEP in its last 2021 Food Waste Index Report, which uniquely refers to food waste generated from retail to household level. According to UNEP, in 2019 food waste produced in the above-mentioned food supply chain stages accounted to 931M tons, of which 61% was generated at the household level, 26% at service and 13% at the retail level[3]. In 2019 the European Commission introduced mandatory reporting of food waste generation in European Member States starting from 2020. The first data on the 2020 reporting exercise became available in mid-2022. Data reported in 2022 and 2023, which for about 50% of the data provided are still estimates, report food waste production per food value chain stage. According to these data, in 2021 (the latest available year at the time of this publication), the average per capita food waste production in Europe (covering all economic sectors) was 131 kg per inhabitant, equating to about 58.4 million tons of food waste on that year. The figure reported for 2020 was 130 kg per inhabitant. Comparing the data from Caldeira et al. (2019) and the results published by Eurostat it can be noted that there is a large (double) discrepancy between the 2 estimations. This suggests that both member states and researchers are still far from knowing the actual figures of the food waste phenomenon. Such a knowledge gap can only be bridged by intensifying the quality and capillarity of measuring as further recommended in Chapter 6 and Chapter 7 of this report.

> Key terms
>
> **Food Loss (FL)**: food that gets spilled, spoilt, or otherwise lost, or that incurs reduction of quality and value during the primary production stage. Food loss typically occurs at production, post-harvest and primary distribution stages (before food processing).
>
> **Food Waste (FW):** food that is successfully transformed into a final edible product, but that is not consumed because it is discarded, after being left to spoil or to expire. Within the food supply chain, food waste typically occurs at any stage from food processing to end-consumer level.
>
> Source: adapted from UNEP definition

Yet, the type of analysis performed in the 2019 article by Caldera et at. Is still instrumental to provide a preview of how food waste production patterns differ, not only by food value chain stage, but also per food category. This is well illustrated in Figure 2-1 on the next page.

. For example, the figure shows how food wastage for fruits, vegetables and root crops in Europe is still considerably high at the primary production stage, and how processing and manufacturing processes are still influential in producing food waste especially for oil crops, meat, fish and fruit categories.

[1] Based on the methodology used in the study, *food waste* computation in this case also includes *food losses* occurring at primary production, and processing and manufacturing level which, according to the definition in the Key Terms box should rather be part of the *food losses* category.

[2] Source : http://www.fao.org/3/mb060e/mb060e00.pdf

[3] https://www.unep.org/resources/report/unep-food-waste-index-report-2021

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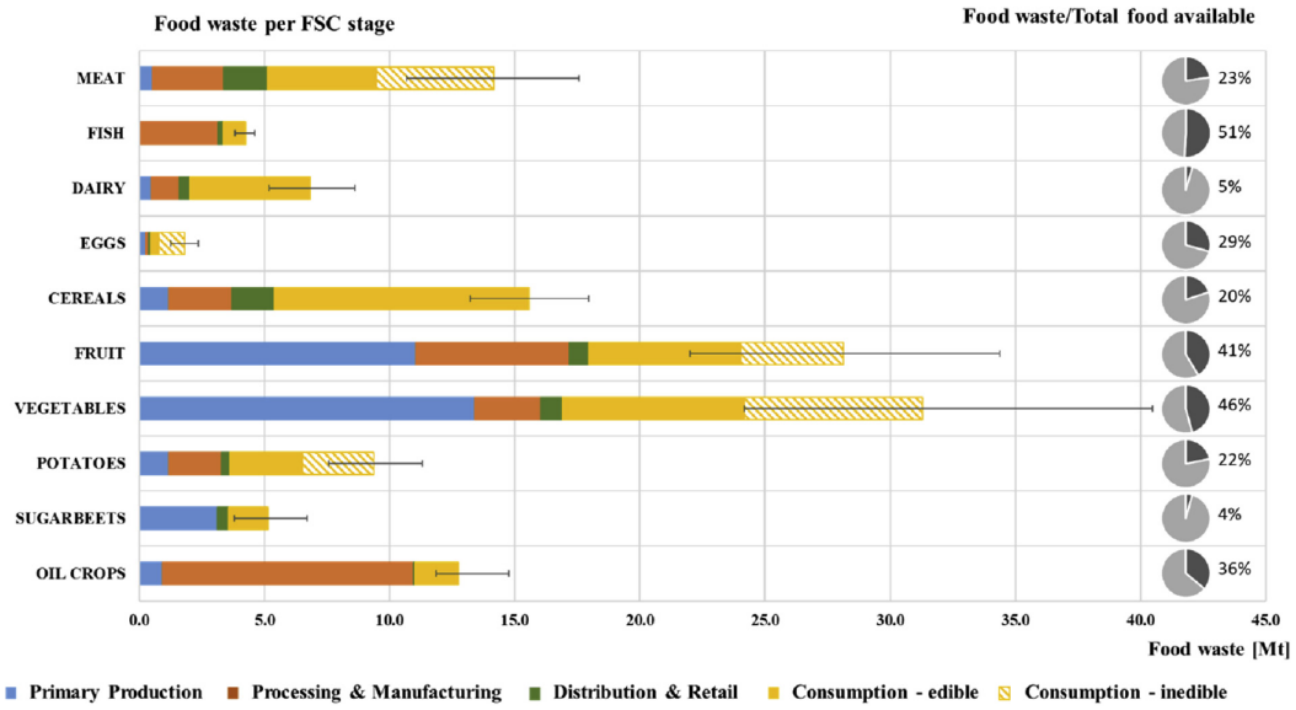

Figure 2-1 Distribution of food waste by food category and by food supply chain stage

Source: Caldeira et al., June 2019

Moreover. the right-hand pie charts in Figure 2-1 provide another important information: an indication of the relative food waste percentage per food category. Based on these results, **fish, vegetables and fruits are the food categories where food wastage is the highest (41 to 51% of total production**) when compared to the weight of food production for that category. This allows for ample room for intervention to reduce food losses and food wastage in these specific categories.

Table 2-1 Estimates of food waste by food category and by food supply chain stage in the EU

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Food available in the EU, and food waste calculated for each food group and FSC stage for 2011.

Food groups	EU available (Mt)	Food Waste (Mt)					
		Primary Production	Processing & Manufacturing	Retail & Distribution	Consumption		Total FW
					Households	Food services	
Meat	61.7	0.5	2.9	1.7	7.3	1.7	14.2
Fish	8.2	0.0	3.1	0.2	0.5	0.3	4.2
Dairy	150.2	0.5	1.1	0.4	4.2	0.6	6.8
Eggs	6.2	0.3	0.1	0.1	1.1	0.3	1.8
Cereals	78.2	1.2	2.5	1.7	8.0	2.2	15.6
Fruit	67.9	11.1	6.1	0.8	8.6	1.5	28.1
Vegetables	68.5	13.4	2.6	0.9	12.2	2.2	31.3
Potatoes	42.8	1.2	2.1	0.3	4.9	0.8	9.4
Sugar beets	118.7	3.1	0.0	0.4	1.3	0.3	5.1
Oil Crops	35.4	0.9	10.0	0.1	1.4	0.3	12.7
TOTAL	**637.8**	**32.2**	**30.6**	**6.7**	**49.6**	**10.3**	**129.2**

Source : Caldeira et al., June 2019

The study conducted by Caldeira and colleagues is instrumental in understanding the heterogeneity of the generally used "*food"* term, which in reality encompasses a wide range of food categories and food processes, each characterized by different production, processing and consumption patterns. This heterogeneity in both food waste production across food categories and across FSC stages tells us about the importance of addressing food losses and food waste challenges in a tailored manner, by understanding well the distinguished functioning of each food category supply chain functioning, and by looking where and why FL and FW occur across the FVC different stages. This difference is also important when considering the recent EU mandatory requirements for food waste monitoring and reporting, resulting from the 2019 revised version of the Waste Directive (Commission delegated decision (EU) 2019/1597). The latter indeed requires EU member states - through annual mandatory reporting - to quantify food waste across the 5 stages of the food supply chain, and to provide food waste data distinguishing between food categories, as it is the case for primary production food products to be differentiated by origin (i.e. crop, animal or fish products). Yet, at the current state of Food Waste reporting, only the overall food waste figures per food stage are showed (Figure 2-2). An aggregation of data at the level carried out by JRC in 2019 (Caldeira et al.) would provide a valid tool for food sector operators and for the national governments to define more targeted (food category specific) strategies to halt avoidable food waste.

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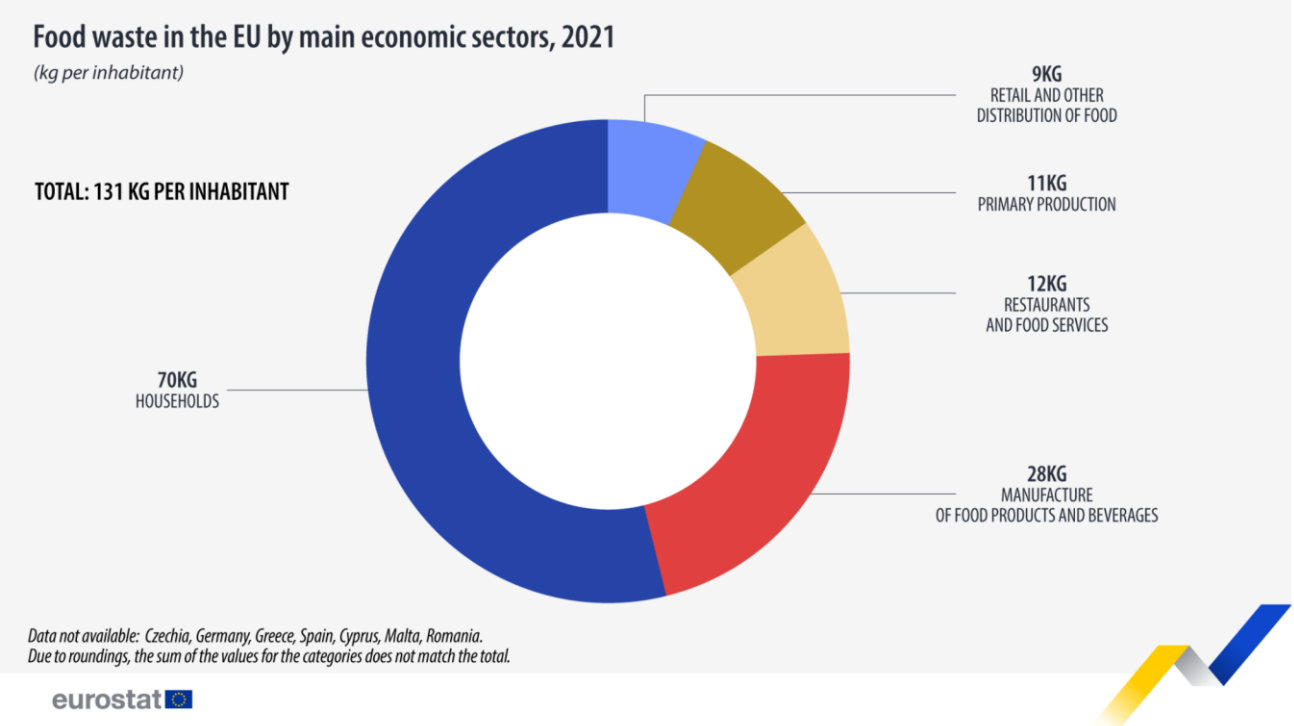

Figure 2-2: Food waste in the European Union by economic sector, 2021

As highlighted in several reports, food waste does not only represent a socially unacceptable practice and a misuse of precious depletable physical resources like soil, water and mineral fertilizers. It also entails a waste of energy and a direct contribution to Greenhouse Gas (GHG) emissions, eventually manifesting in adverse climate change impacts. To this extent, the FP7 FUSION project has estimated that *in 2012 food waste (all steps of the lifecycle) in the EU accounted for at least 227M tons of CO2 eq. a year, or about 6% of total EU emissions*[4]. A data in line with the FAO 2011 estimates reporting that global FL and FW generate annually 4.4 GtCO2 eq., or about 8% of total anthropogenic GHG emissions (FAO, 2013)[5]. The same FAO study also highlight how wasting food like bread or vegetables, does not only have a strong climate impact for the GHG emissions that derive from the food waste fermentation processes, but equally represent an important source of CO2 emissions when we look at the carbon footprint[6] of each of these food categories. This is showed in more detail in Figure 2-3 which also shows that 3 out of the 4 food value chain categories analyzed in FOODRUS (bread, vegetables and meat) are the largest contributors to CO2 emissions during their production processes. Two of these categories (cereals and vegetables) are also the largest contributors of food waste across all food categories. Accounting for about 50% of overall volumes of food waste.

[4] Source : https://www.eu-fusions.org/index.php

[5] Source: http://www.fao.org/3/bb144e/bb144e.pdf accessed on 02 August 2021

[6] The carbon footprint of a food product is the total amount of GHG emitted throughout its lifecycle, expressed in kilograms of CO2-equivalents. GHG emissions of the production phase (including all agricultural inputs, machinery, livestock, soils) and successive phases (such as processing, transportation, preparation of food, waste disposal) are all included in this calculation. Source: FAO, 2011

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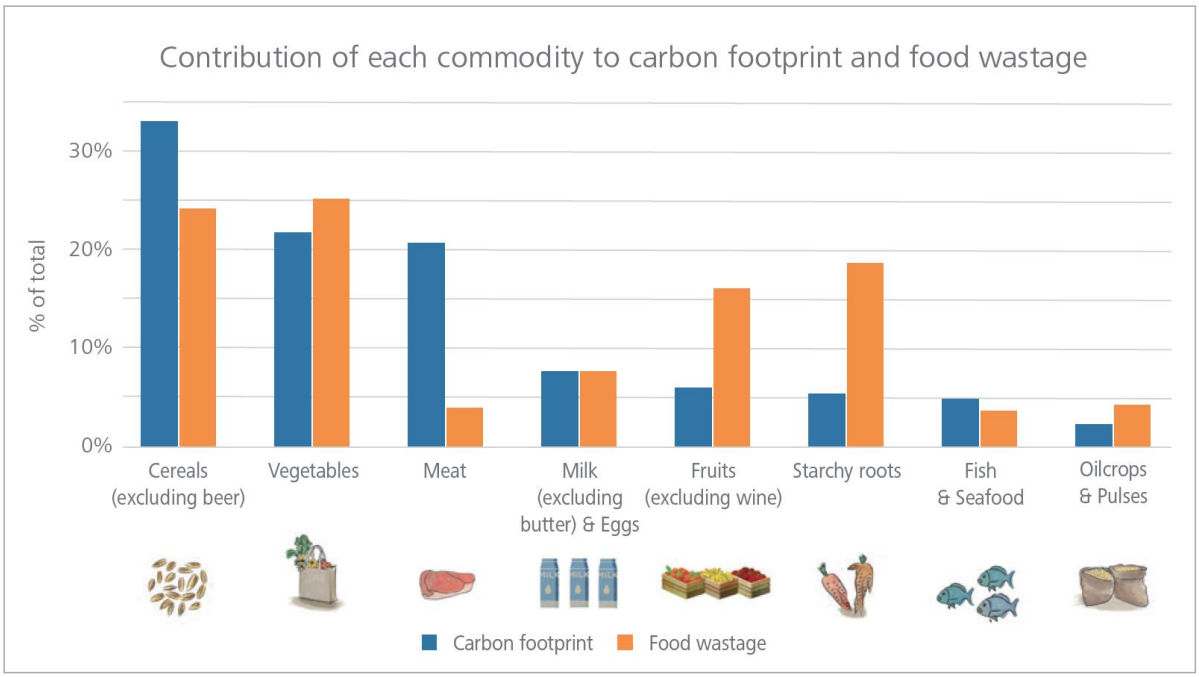

Figure 2-3 Carbon footprint and food wastage by food value chain(Source: FAO, 2011. Food wastage footprint and climate change)

Within this context, the numerous initiatives resulting from the launch of the European Green Deal in December 2019 offer food value chain actors the opportunity to play a significant role in reducing food waste and climate impact, contributing to the transition towards more sustainable production and consumption patterns. Moving up the food waste prevention hierarchy (Figure 2-4) becomes then fundamental. Measures aiming at preserving the nutritional value of food (food loss and food waste prevention at source, food reuse for human consumption) are to be preferred over other types of interventions where the nutrition value of food is somewhat lost in the transformation or reuse process.

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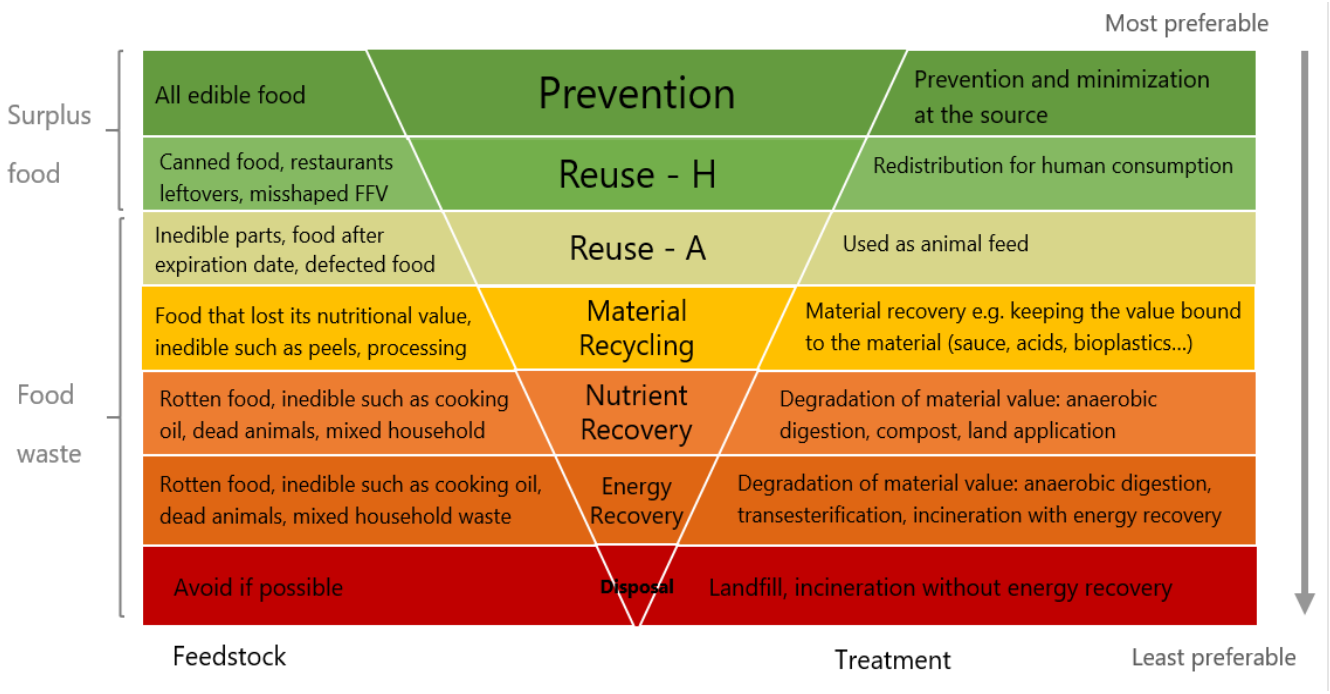

Figure 2-4 Food loss and food waste prevention hierarchy

2.2 Identified FL and FW hotspots in the project pilots

In this section, we present the collected evidence from the FOODRUS project pilots on the causes of FL and FW generation in the respective country contexts. Specific reference to food categories is made where applicable. Table 2-2 lists the sources of food loss and waste (the hotspots) identified by the pilots in M9 (July 2021) of the project for each stage of the food value chain. These hotspots and the barriers that produce them are further analyzed in Chapter 6 and Chapter 7 of this report.

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Table 2-2 Preliminary identification of FL and FW hotspots in project pilots

FSC stage	Spain (ready salad)	Identified barrier	Denmark (meat and fish)	Identified barrier	Slovakia (bread)	Identified barrier
Primary Production	FL02- Product not harvested	Variable market demand / buyer purchasing power / producer-buyer contractual arrangements				
Transportation	FW01- Product on expiration date between supplier transport to the logistic platform FW03- Reduced compliance with quality standards- visual or expiration date between transport platform to retailer	Long FSC; time; food deterioration during transport; breaking of cold chain				
Food processing and packaging	FL03-Product declared as out of specification at industrial level (lettuce)	Excessive marketing standard			Overproduction of bread	Marketing standards (retail); poor demand forecasting
Distribution / Wholesale / Retail	FL05- out of shelf-life raw materials FL12- Short shelf-life products not able to be sold at Milagro´s distribution center (consumers orders lower than production)	Over supply, poor demand forecasting; absence of redistribution systems for unsold products already at distribution centers	Contractual requirements of 7-10 days before “the best before date” at the day of transaction turns	Tight Food Safety requirements on date marking	Overproduction of bread + limits on food donation: According the Slovak Ministry of agriculture donation of unpacked bread and pastry is not allowed.	Too strict regulation on food donation (definition, responsibilities and clarity of rules) Insufficient and uneven coverage of

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FSC stage	Spain (ready salad)	Identified barrier	Denmark (meat and fish)	Identified barrier	Slovakia (bread)	Identified barrier
			surplus food into food waste		Fresh unpacked bread cannot be donated for human consumption since the legislation requires that it can be sold up to 12hours from its baking time and it is not clear how it should be handled afterwards. The surplus fresh bread cannot be sold for animal feed but can still be donated (to zoos) for non-human consumption. Low price of bread is not an incentive to reduce waste	distribution networks for bread donations.
HORECA			Surplus foods served in the canteens cannot be donated due to regulatory barriers	Strict regulation on food donation		
End-consumer	No information on actual salad wastage at consumer level, as unused salads are mixed with other type of organic and inorganic waste	No measuring tool available to monitor organic waste at HH level			Consumers purchase more bread than what they eat, wasting it later on	Behavioral habit

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3. The EU regulatory framework on food losses and food waste

Adoption of the European Green Deal in December 2019 came as a further confirmation of the sustainability and climate commitments that the European Commission has pledged to on the international arena. Among these, the Sustainable Development Goals (SDGs) arising from the United Nations Conference on Sustainable Development held in Rio de Janeiro (2012), and the COP21 Paris Conference on Climate held in Paris in December 2015. By implementing the European Green Deal, Europe's aim is to become the first climate neutral continent by 2050. Europe's action will help achieve the global objective to keep global temperature rise at maximum 1.5˚C above the pre-industrial levels (Paris Agreement), and will significantly contribute to social, environmental and economic transformation processes that can deliver on the SDGs targets.

The food system has an important role to play for the achievement of the European Green Deal's objectives. Globally, it is estimated that food systems today account for nearly one-third of global GHG emissions[7], and for this reason they play a fundamental role in our capability to address the climate change challenge. In this respect, Eurostat reports that GHG emissions from the agricultural sector in 2015 represented about 10% of the total EU's emissions[8], with enteric fermentation of feed in the stomachs of livestock being the largest single source of methane (CH4) emitter in the EU-28. The link between climate impact and the meat value chain through animal farming is therefore obvious. At the same time, food waste per se also contributes to climate change mainly through methane emissions from food decomposition processes in landfills. In its last 2021 Food Waste Index, UNEP estimates that food waste alone generates 8-10% of global GHG emissions[9]. Reducing the amount of food wasted has therefore an impact also on the fight against climate change. Conscious of the impact of the food systems on climate, in July 2023 the European Commission proposed a new binding target of 30% food waste reduction across the retail , HORECA and consumer sectors together, and a 10% reduction in FW generation across the food processing and manufacturing stages. Unfortunately, this target is below the 50% reduction target earlier approved through the SDG commitments. Indeed, on the international arena, by pledging to the SDG 12.3 target, the European Union had committed to halve the share of global per capita food waste by 2030 from retail to end-consumer stages, as part of the SDG12 on *Responsible Consumption and Production.*

In this chapter, section 4.1 provides an overview of the EU initiatives and policy documents directly and indirectly addressing food waste reduction and prevention strategies. Section 4.2 presents the current EU regulation governing food waste, and section 4.3 offers some final remarks on the current legislative framework.

[7] https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en accessed on 04.08.2021

[8] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Agri-environmental_indicator_-greenhouse_gas_emissions&oldid=374989

[9] https://ec.europa.eu/food/safety/food-waste_en

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For sake of clarity, the following specification is provided with reference to the different types of EU legislation and their connection to national law[10].

Regulations are legal acts that apply automatically and uniformly to all EU countries as soon as they enter into force, without needing to be transposed into national law. They are binding in their entirety on all EU countries.

Directives require EU countries to achieve a certain result but leave them free to choose how to do so. EU countries must adopt measures to incorporate them into national law (transpose) to achieve the objectives set by the directive. National authorities must communicate these measures to the European Commission. Transposition into national law must take place by the deadline set when the directive is adopted (generally within 2 years). When a country does not transpose a directive, the Commission may initiate infringement proceedings.

Decisions are legally binding instruments. A decision which specifies those to whom it is addressed shall be binding only on them.

Delegated acts are legally binding acts that enable the Commission to supplement or amend non-essential parts of EU legislative acts, for example, to define detailed measures.

3.1 Guiding EU policies

December 2019 marked a dividing line in Europe's history. Since the Commission presented its first communication on the European Green Deal to the EU Parliament and to the Council, EU initiatives to transform Europe into the world's first carbon-neutral economy have produced a considerable package of new regulations addressing the environmental and social challenges that the world as a whole is facing today. The European Green Deal embraces a new growth strategy for Europe, where economic growth is decoupled from resources use, a competitive economy with zero GHG net emissions by 2050, an equitable and prosperous society for all.

The new regulation package addresses all sectors of the economy, from industry to energy, from transport to agriculture. Within this new set of norms, the food system sustainability challenge is being addressed in, among others, the provisional agreement on the new European climate law (approved by the Council in May 2021), the EU Biodiversity strategy for 2030 (adopted by the EC in May 2020), the new European Industrial Strategy for 2030 (March 2020), the Circular Economy Action Plan (March 2020), the Just Transition Mechanism and the Just Transition Fund (June 2021), the Farm to Fork Strategy (October 2020) and the ongoing process of revision of the Common Agriculture Policy (new CAP reform). All the relevant direct and indirect aspects related to FL and FW prevention in the food value chain that are addressed in these regulations, are presented in this section.

In addition to the above, there are a number of other international and EC recent initiatives related to the environmental footprint of FW and FL practices. These initiatives don't refer specifically to food and food waste flows per se, but rather look at the input and output factors related to food production. For matters of conciseness, these strategies have therefore been excluded from the analysis in this report.

The relevant regulations prescribing norms or targets in terms of food loss and food waste prevention or reduction are listed below. Information is drawn directly from official EU Regulations, European Commission websites and EU official communication channels.

[10] Source : https://ec.europa.eu/info/law/law-making-process/types-eu-law_en

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3.1.1 Farm 2 Fork Strategy

The **Farm to Fork (F2F) strategy** is one of the pillars of the European Green Deal. It aims to develop a sustainable European food system that is fair, healthy and that causes no harm to the environment. The F2F strategy wants to ensure the robustness and resilience of the European food systems over the long run, and for this reason, it sets out a number of policy instruments to accelerate the transition towards sustainable food systems.

At its present state, the F2F strategy sets out both regulatory and non-regulatory measures supporting the strategy implementation process, with the common agricultural and fisheries policies as key tools to support a just ecological transition. A proposal for a legislative framework for sustainable food systems is currently being developed and expected to be completed by the end of 2023. This new framework will support the implementation of the F2F strategy and the development of sustainable food policies.

Figure 3-1 The 4 components of the EU Farm to Fork Strategy

The three sections below report the key points of the F2F strategy in relation FL and FW reduction strategies (I) and the sustainability of food systems more in general (II).

I. Relevant actions related to the F2F strategy that address FL and FW prevention are:
   - EC committed to per capita food waste reduction at retail and consumer level by 2030 (SDG 12.3). To do so it employs a new methodology to measure food waste (Commission Delegated Decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste (OJ L 248, 27.9.2019, p. 77), and it will elaborate on the data to be received by MSs in 2022 to set a baseline and to propose **legally binding targets** to reduce FL and FW across the EU.
   - Proposal for **EU-level targets for food waste reduction by the end of 2023** based on the first Eu-wide FW monitoring (European Commission, n.d. c). This target will be part of the revision of the Waste Framework Directive. As of the end of 2023 they have been set into 10% reduction oof FW at food manufacturing and processing level, and 30% overall FW reduction (per capita) across retail, HORECA and end-consumer levels.
   - EC intents to review its policy on **date marking** (“use by” and “best before” dates) to prevent food waste;
   - EC to investigate FL at the production levels, and look into ways to reduce them;

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- Everybody has access to sufficient, nutritious and sustainable food (equity consideration)
- The Commission will use the Common Fisheries Policy (CFP) to step-up efforts to bring fish stocks to sustainable levels, also with interventions on reducing wasteful fish discarding (see section 3.1.4).
- EC to develop a **EU Code of Conduct for responsible business and marketing practices** for food industry and retail sector actors to increase the availability and affordability of healthy, sustainable food options, and to reduce the overall environmental footprint and energy consumption of the food system (Q2 2021). The Code of Conduct has eventually been launched on 5 July 2021[11];
- EC will launch initiatives to stimulate the shift towards healthier diets and stimulate product reformulation, including the setting up of nutrients profiles to restrict the promotion of food high in fat, sugar and salt;
- The EC is set to revise **marketing standards** of food products, taking into account their possible impact on FL and FW (2021-2022).
- EC will strengthen the legislative framework on **geographical indications (GIs)**
- The Commission recognizes the importance of resilient regional and local food systems. To create **shorter supply chains**, the EC will support reducing dependence on long-haul transportation (p14)
- Coordination action on FW and FL will be ensured through the EU Platform on Food Losses and Food Waste, an initiative born in 2016, now being extended for the period 2022-2026 as part of the F2F strategy[12].

II. Other relevant points of the F2F strategy not directly related to Climate or FL-FW prevention are:

- The FVC stages need to have a neutral or positive environmental impact (link with the European green Deal and the European Climate Law)
- The most sustainable food becomes the most affordable (price consideration);
- The Commission will work on general principles and requirements for sustainable food systems;
- Introduction of certification and labelling on the sustainability performance of food products to empower consumers to make informed food choices (2024)
- The Commission objective to have at least 25% of the EU's agricultural land under organic farming by 2030
- EC to scale-up and promote sustainable and socially responsible production methods, along with circular business models.
- The Commission will propose harmonized mandatory front-of-pack nutrition labelling and will consider proposing the extension of mandatory origin or provenance indications to certain products;
- The EC to create a sustainable labeling framework covering nutritional, climate, environmental and social aspects of food products. Provision of this information can take also new innovative forms, as digital instruments;
- The EC to set **minimum mandatory criteria for sustainable food procurement** in institutional catering (schools, hospitals, public institutions), incentivizing cities, regions and public authorities to source food from sustainable farming systems, such as organic farming (Q3 2021).
- The EC is working on a **tax incentives scheme** where different VAT rates are attributed to food items with different nutritional value, and where MSs can have a more flexible use of tax rates to ensure that the price of different foods reflects their real costs in terms of use of finite natural resources, pollution, GHG emissions and other environmental externalities

[11] More info on CoC : https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy/sustainable-food-processing/code-conduct_en

[12] Source : https://ec.europa.eu/food/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste_en

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- The EC will develop legislative initiatives to enhance cooperation of primary producers to support their positioning in the food value chain, and non-legislative initiatives to improve transparency (period 2021-2022)

3.1.2 Food 2030

Food 2030 is the EU's research and innovation vision and policy narrative to accelerate the transition towards a resilient global food system. It is a multi-actor engagement process which aim is to ensure that everyone has sufficient, affordable and nutritious food to lead a healthy life. Launched in 2015, Food 2030 covers the entire food system in a systemic approach, linking multiple sectors from primary production (both land- and water-based) to food processing, packaging, retail and distribution, catering services, consumption, waste and recycling.

Food 2030 set out **4** key food and nutrition **priorities**, and **10 pathways** to action to achieve these goals.

Priority 3 on *Circularity and resources efficiency* sets - among others - the following objectives:

- achieving zero food waste,
- tackling primary production waste streams,
- using unavoidable biomass and waste as a resource,
- increase *the share of local food on demand (short food value chains).*

This Priority supports the updated CAP (see section 3.1.3), the European Circular Economy Package including the Waste Directive (see section 3.2.1) and the Climate Action policies (European Commission & Directorate-General for Research and Innovation, 2018).

Priority 4 on *Food systems innovation and empowerment of communities* addresses, among others, the objective to foster sustainable and accessible food for all in towns, cities and regions, the goal of supporting a place-based food sharing economy from farm to fork, and the development of data-driven food and nutrition systems that meet societal needs.

Pathway 5 on Food Waste and Resources Efficiency, addresses the challenge of food waste reduction. Pathway 10 addresses the topic of Food Systems and Data.

Food 2030 is being developed through Horizon Europe funding.

3.1.3 Common Agriculture Policy (CAP)

CAP is the Common Agriculture Policy of the EU. The CAP was originally established in 1962, and in the decades has undergone a series of reforms. The latest reform of the CAP (CAP 2023-27) was adopted in December 2021 and entered into force on the 1st of January 2023 (European Commission, n.d. b). This new CAP seeks to ensure the sustainable development of agriculture and aims to support small farms while having a strong focus on results and performance. The new CAP has the 10 following key objectives (European Commission, n.d. a):

i. To ensure a fair income for farmers: support viable farm income and the resilience of the agricultural sector across the EU, in order to enhance long-term food security and agricultural diversity, as well as to ensure the economic sustainability of agricultural production.
ii. Increase competitiveness: enhance market orientation and increase farm competitiveness both in the short and long term, including greater focus on research, technology and digitalisation.
iii. Improve the position of farmers in the value chain.

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iv. Climate change action: contribute to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and enhancing carbon sequestration, as well as promoting sustainable energy.
v. Environmental management: foster sustainable development and efficient management of natural resources such as water, soil and air, including by reducing chemical dependency.
vi. Preserve landscapes and biodiversity: contribute to halting and reversing biodiversity loss, enhance ecosystem services and preserve habitats and landscapes.
vii. Support generational renewal: attract and sustain young farmers and new farmers and facilitate sustainable business development in rural areas.
viii. Vibrant rural areas: promote employment, growth, gender equality, including the participation of women in farming, social inclusion and local development in rural areas, as well as the circular bio-economy and sustainable forestry.
ix. Protect food and health quality: improve the response of EU agriculture to societal demands on food and health, including high-quality, safe and nutritious food produced in a sustainable way, to reduce food waste, as well as to improve animal welfare and combat antimicrobial resistance.
x. Fostering knowledge and innovation: modernise agriculture and rural areas through fostering and sharing knowledge, innovation and digitalisation, and by encouraging their uptake by farmers through improved access *to research, innovation, knowledge exchange and training.*

At the time of writing (February 2024), the implementation of measures of the new CAP and in connected European laws that affect farmers' operation are being highly criticized by farmers across the EU. Ther claims that are being raised and the potential implications for FL and FW reduction are briefly analyzed in section 8.1 of chapter 8.

3.1.4 Common Fisheries Policy (CFP)

"The goal of the common fisheries policy (CFP) is to ensure long-term sustainability for fisheries and aquaculture, the availability of food supplies and a fair standard of living for fisheries and aquaculture communities. [...] By combining environmental, social and economic sustainability objectives, the CFP was a precursor of the European Green Deal and its related strategies. In turn, the European Green Deal strengthened the CFP approach, emphasizing the triple contribution of fisheries and aquaculture to the economy and employment of coastal regions, food security in the EU and the protection of the marine environment." (European Commission, 2023, p. 1).

Through the Landing Obligation that entered into force in 2019, the CFP aims to reduce and eliminate the amount of discarded fish as they represent a waste of resources that negatively affects the marine ecosystem (European Commission, 2023). At present, around 7 to 10 million tons of fish are discarded annually by commercial fisheries (European Commission, n.d. e). Discards may occur because of several reasons:

- the fish is smaller than the legal size
- the fisher does not have a quota for it
- the fish is of low market value
- the fish is sick or injured
- it is prohibited to catch that species

The Landing Obligation requires all catches to be landed and counted against the fisher's quota. It also aims to use the undersize caught in processed products such as pet food or pharmaceuticals. As a consequence, producers' organizations are now obliged to help their members to identify suitable outlets for the undersized catches.

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3.1.5 Circular Economy Action Plan (CEAP)

The new Circular Economy Action Plan (CEAP) was adopted by the European Commission in March 2020. CEAP is one of the main building blocks of the European Green Deal. The key aspects related to food waste highlighted in the CEAP relate to reduction and redistribution actions. They can be summarized as follows:

- Reducing organic waste cycles and development of the Integrated Nutrient Management Plan;
- Reducing packaging prescription;
- As part of the CEAP, in October 2017 the Commission adopted EU food donation guidelines to facilitate the recovery and redistribution of safe, edible food to those in need.
- Introduction of a food waste reduction target as part of the Farm to Fork Strategy (European Commission & Directorate General for Communication, 2020) (see section 3.1.1).

3.2 EU directives, regulations and guidelines

This section provides an overview of the current directives and regulations affecting the way FVC operators and EU citizens handle, process and relate to food items.

3.2.1 EU Waste Framework Directive

The Delegated Decision establishing a common EU methodology to measure food waste was published in the Official Journal of the European Union on 3 May 2019 and entered into force on 17 October 2019. It is an amendment of the 2008 EU Waste Framework Directive which prescribes the first ever data collection on food waste at European scale. The delegated decision requires Member States to collect data on food waste starting from the year 2020, in view of reporting on national FW figures due in June 2022. The EU reporting framework will help standardize reporting of food waste levels by business, and by other FVC actors, from production to consumption.

With reference to the 2008 Waste Directive:

Article 9 on Prevention of Waste addresses at clause 1.g the reduction of generation of food waste across the FVC stages, and at point 1.h the promotion of food donations and other redistribution actions for human consumption, prioritizing human use over animal feed and the processing into non-food products.

Article 9, clause 5 prescribes for Member States to “monitor and assess the implementation of their food waste prevention measures by measuring the levels of food waste on the basis of the methodology established by the delegated act referred to in paragraph 8, as from the first full calendar year after the adoption of that delegated act”.

Article 9, clause 6 reports: “By 31 December 2023, the Commission shall examine the data on food waste provided by Member States in accordance with Article 37(3) with a view to considering the feasibility of establishing a Union-wide food waste reduction target to be met by 2030 on the basis of the data reported by Member States …”

Article 9 clause 8: “8. By 31 March 2019, the Commission shall adopt, on the basis of the outcome of the work of the EU Platform on Food Losses and Food Waste, a delegated act in accordance with Article 38a to supplement this Directive by establishing a common methodology and minimum quality requirements for the uniform measurement of levels of food waste.”

With reference to the 2018 Revision of the 2008 Waste Directive:

Initial consideration n°31: Member States should take measures to promote prevention and reduction of food waste in line with the 2030 Agenda for Sustainable Development …. Those measures should aim to prevent and reduce food waste in primary production, in processing and manufacturing, in retail and other distribution

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of food, in restaurants and food services as well as in households. … Member States should aim to achieve an indicative Union-wide food waste reduction target of 30 % by 2025 and 50 % by 2030. … Member States should measure progress made in the reduction of food waste. To measure that progress and to facilitate the exchange of good practices across the Union both between Member States and between food business operators, a common methodology for such measurement should be established. Based on those methodologies, reporting on food waste levels should take place on an annual basis.

Initial consideration n°32: In order to prevent food waste, Member States should provide incentives for the collection of unsold food products at all stages of the food supply chain and for their safe redistribution, including to charitable organisations. Consumer awareness of the meaning of 'use-by' and 'best-before' dates should also be improved in order to reduce food waste.

Amendment to Article 29: '2a. Member States shall adopt specific food waste prevention programs within their waste prevention programs.

The revised Waste Framework Directive adopted on 30 May 2018 requires Member States to reduce food waste at each stage of the food supply chain, monitor food waste levels and report back regarding progress made[13]. Moreover, it lays down obligations for Member States to:

- prepare food waste prevention programs (specific and/or as a part of general waste prevention programs);
- encourage food donation and other redistribution for human consumption, prioritizing human use over animal feed and the reprocessing into non-food products as part of measures taken to prevent waste generation;
- provide incentives for the application of the waste hierarchy, such as facilitation of food donation (articles 4 and 9 of the revised Waste Framework Directive).

July 2023 EU food waste reduction targets legislative proposal

On July 5th, 2023, as part of the revision of the Waste Framework Directive, the European Commission presented a legislative proposal on food waste reduction targets for EU member States to be reached by 2030. The proposal is currently being negotiated with the European Parliament and the Council of the European Union. According to the proposal, EU Members States will be called upon to take the necessary measures to reduce food waste (by 2030) in the following measures:

- 10% for food processing and food manufacturing stages
- 30% (per capita) as a joint effort of the retail, HORECA and end-consumer stakeholders

The year 2020 is proposed as baseline reference year. These targets are much lower than the 50% reduction targets set in target T12.3 of the Sustainable Development Goals of the United Nations, which had 2015 as a baseline year.

3.2.2 EU Food Safety Regulation

European food safety regulations regarding Food Hygiene cover all the food value chain stages (European Commission, n.d. d). The two main regulations for food business operators are the Regulation (EC) 852/2004 and 853/2004 covering the Food Hygiene for foodstuffs and food of animal origins. Both regulations came into

[13] Source : *https://ec.europa.eu/food/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement_en*

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force in January 2006 and have been regularly updated since. Food waste is targeted as follows in the 852/2004 amended by the Commission Regulation (EU) 2021/382 of the 3rd of March 2021:

- The removal of food waste from rooms where food is present is to be done as soon as possible.
- The containers used for food waste disposal should be (among others) closable and easy to clean or disinfect.
- Food waste should be stored and disposed of adequately.
- All waste is to be eliminated in a hygienic and environmentally friendly way.

The focus in this regulation is therefore the handling of food waste, with no reference to waste prevention measures.

The Directive 853/2004 amended by the Commission Regulation (EU) 2022/2258 targets food waste as follows:

- Increase the allowed period between laying and delivery to consumers of eggs from 21 to 28 days in order to reduce food waste.

The Directive 853/2004 is currently under revision for some update. The proposed amendments that were set for adoption in Q4 2023 target the revision oof date marking, the slaughter on the farm of small ruminants, the transport of meat and aged meat, the stiffening of fishery products, milk and the unintended extraneous odor of eggs (European Commission, n.d. f). Some of the changes may impact food waste such as:

- Changes to Section III point 3 (h): “Slaughtered and bled animals are transported to the slaughterhouse or to a game-handling establishment hygienically and without undue delay; if transport takes more than two hours, the animals must be refrigerated; where climatic conditions so permit, active chilling is not necessary; evisceration may take place on the spot, under the supervision of the official veterinarian”.
- Changes to Section VIII, Chapter IV: “In the case that the temperature of fresh or processed fishery products needs to be temporarily decreased, or in the case that the temperature of frozen fishery products needs to be temporarily increased, to a temperature higher than -18°C to permit the use of machines that slice or cut fishery products, the change of temperature to reach that required for the cutting or slicing of fishery products, and the subsequent return to the storage temperature of the fishery products, shall be as short as possible. The total time of the operation of cutting or slicing at the technologically-required temperature shall not exceed 96 hours. Storage or transportation of fishery products at that temperature shall not be allowed”.

As a result of these two provisions, unforeseen delays in the cutting process may lead to fishery products to stay longer at the higher temperature and therefore, it may lead to food wastage.

3.2.3 EU Guidelines on Food Donation

The European Guidelines on Food Donation have been adopted by the European Commission on 25 October 2017. They have been established as part of the Circular Economy Action Plan (CEAP), and elaborated in consultation with the EU Platform on Food Losses and Food Waste. The guidelines encompass the recovery and redistribution of food by food business operators. They have been established to:

- Facilitate the compliance of food value chain actors with the EU requirements surrounding surplus food.
- Homogenize the understanding of the EU regulations regarding food surplus among the regulatory authorities of the Member States.

Therefore, the Guidelines provide clear information on:

- The definition of “food redistribution” and “food surplus”
- The roles and obligations of all actors active in the sector of food surplus redistribution

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- The liability system for food safety issues
- The hygiene standards for food surplus redistribution
- The regulations surrounding food information provided to consumers
- The fiscal rules (including fiscal incentives) applying to donated surplus food
- Examples of European projects working on the redistribution of food surplus

To promote food surplus redistribution and prevent food waste, fiscal incentives (such as corporate tax break or tax deduction) can be used. Each MS is responsible for implementing the European VAT (Value Added Tax) Directive 2006/112/EC into their national regulation. VAT can be an obstacle to food redistribution therefore leading to food waste. Hence, the Guidelines recommend to adapt the VAT rule for food items subject to donation. Articles 16 and 24 of the VAT Directive already facilitate the donation of food for charitable purposes (no VAT or food items' price equals the VAT). MS can therefore expand this example to other cases of food redistribution to avoid food waste.

Besides fiscal incentives, it is equally important to support the actors of the food surplus redistribution sector and to develop "information, communication and training activities to further support safe food redistribution practices on the ground" (European Commission & Directorate-General for Health and Food Safety, 2017, p. 3).

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4. National regulation on food loss and food waste

This chapter provides an overview of the national regulation on food losses and food waste existing, at the time of writing, in the FOODRUS pilot (Spain, Denmark, Slovakia) and Associated Regions (Austria, Bulgaria, Greece, Hungary, Romania). An additional overview is also provided for the region of Catalunya (Spain). Further reference on the specific legislation in the FOODRUS Associated Regions countries is available in *Annex A: Food regulation in the Associated Regions*, while a comparative analysis showing the degree of adoption of specific legislation on food losses and food waste prevention across European countries is provided in *Annex C: Comparative overview of adoption of food losses and food waste legislation in selected European countries*.

4.1 General overview

The degree of prescription, enforcement and adoption of food loss and food waste regulation in European Member States (MSs) is still highly heterogenous. The requirement to report on food waste generation at the level of the single MS entered into force only on 28 November 2019 through the Commission Implementing Decision (EU) 2019/2000 which defined the FW data reporting format. The decision followed the Commission Delegated decision (EU) 2019/1597 of 3 May 2019 which laid down the common methodology to follow for data collection. With the entering into force of the delegated act in May 2019, EU Member states have been called to *measure and report* on the amount of food waste generated in a full calendar year for any given stage of the food supply chain, using tons of fresh mass as the common unit of measure. The first mandatory reporting year was 2020, with EU MSs having about one year to deploy the methodology, while reporting to the Commission had to be finalized by June 2022. First data became available to Eurostat in June 2022. Updated data for the reporting year 2021 become available in the summer of 2023.

The mandatory EU requirement to report FLW data per stage of the food value change has positively brought some action at Members State level, who understood the need to improve the monitoring systems on food losses and food waste generation, and who are now requested to improve their monitoring and reporting capacity in this field. The first Eurostat data show indeed the low level of detail to which most European countries were able to report representative data on FLW

Table 4.1 below is an extract from the 2022 Eurostat data report. In yellow, we have highlighted the countries for which actual measuring data was not available, and for which only estimated data have been provided to the European Statistical Office by EU Member States. Further comments on the reliability of these data is commented n section 7.1 of this report. Overall, these figures show how still unstructured and approximate FW measurements, and their results are across the EU.

The suboptimal knowledge of FLW situation in a country is, to some extent, a reflection of the level of policy development on FLW. Based on the information collected through the FOODRUS project pilots and Associated regions, this chapter provides an overview of the current status of adoption of laws and regulations concerning FL and FW prevention and reduction at national level in the 8 countries where FOODRUS partners are present.

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Table 4-1 Food waste by sector of activity in the EU and Norway, 2020 (tons of fresh mass)

	Total food waste	Primary production	Processing and manufacturing	Retail and other distribution of food	Restaurants and food services	Households
EU (')	*56 986 019*	*6 194 107*	*10 148 682*	*4 117 511*	*5 292 718*	*31 233 000*
Belgium	:	:	:	:	:	:
Bulgaria	596 844	228 472	156 435	15 708	14 375	181 854
Czechia	*972 445*	27 022	100 339	*64 394*	*37 941*	*742 749*
Denmark	1 286 488	66 452	596 599	99 500	62 544	461 392
Germany	10 922 321	190 203	1 612 505	762 352	1 860 980	6 496 282
Estonia	166 513	23 612	31 622	19 976	10 739	80 564
Ireland	770 316	70 413	219 453	60 894	178 507	241 048
Greece (')	2 048 189	*372 204*	375 158	*150 472*	*220 032*	930 323
Spain (')	4 259 232	*845 620*	1 419 257	*348 219*	*211 410*	*1 434 726*
France	9 000 000	*1 059 000*	*1 926 000*	*800 000*	*1 096 000*	*4 119 000*
Croatia (')	286 379	*40 916*	9 866	4 180	15 072	216 345
Italy (')	8 650 456	*1 270 638*	510 018	343 535	*193 915*	*6 332 349*
Cyprus (')	*354 021*	*43 564*	*169 706*	*50 268*	*27 145*	*63 338*
Latvia	:	:	:	:	:	:
Lithuania	*382 665*	*81 202*	*28 057*	*27 342*	*4 495*	*241 570*
Luxembourg	92 580	7 384	10 692	8 525	8 739	57 240
Hungary	905 068	16 587	187 391	41 952	19 331	639 806
Malta	:	:	:	:	:	:
Netherlands	2 811 000	*463 045*	*1 031 407*	*209 805*	*83 035*	*1 023 708*
Austria	1 211 534	13 879	173 734	84 326	201 956	737 639
Poland	4 002 099	670 547	544 942	320 396	190 293	2 275 921
Portugal	*1 890 712*	*101 384*	*61 719*	*214 233*	*237 486*	*1 275 891*
Romania	:	:	:	:	:	:
Slovenia	143 570	93	10 757	15 290	42 666	74 764
Slovakia	455 587	71 889	4 113	15 825	7 110	*356 650*
Finland	641 258	48 011	162 278	57 555	77 914	295 500
Sweden	*905 000*	*22 000*	*53 000*	*97 000*	*98 000*	*635 000*
Norway	769 967	162 158	29 088	61 281	97 547	419 893

(:) not available
Figures in italic are estimates
(') Definition differs in some figures

Source: Eurostat (online data code: env_wasfw), Eurostat FW data report 2022

In the following sections, based on the data that we were able to collect, we present an overview of the legislation in force for the following 4 areas of work:

- Prevention and reduction of food losses
- Prevention and reduction of food waste
- Measuring and monitoring of food losses and food waste
- Food donations, and handling and management of food surplus

4.2 Food legislation in pilot countries

Section 5.2 presents the key aspects of the national legislation in the 3 FOODRUS pilot countries of Denmark, Slovakia and Spain. In addition to the 4 assessment categories mentioned above, for each pilot country, considerations on the legislative framework directly affecting the food category of focus in the pilot (bread in Slovakia, vegetables in Spain, fish and meat in Denmark) are also presented when available.

The FOODRUS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101000617.

4.2.1 Denmark

Background information

The Danish Environmental Protection Agency is in charge of measuring the amounts of food waste generated across the entire value chain. All measurements follow the common methodology set out in the Commission Delegated Decision (EU) 2019/1597. Danish food business operators along the entire food value chain commit themselves to monitor and reduce their food waste by 50 % by 2030 through the voluntary agreement Denmark against Food Waste.

Prevention and reduction of food waste

In Denmark, there is a strong government support in favor of separate collection of waste, and among these biowaste, to comply with the Waste Framework Directive of significantly reduce the amount of waste that end up in landfills. At the same time, food upcycling is considered a food waste prevention action. The current emphasis on the development of technologies for food upcycling creates a demand for food surplus redistribution and for food waste collection. While on the one hand it is positive that government authorities and food businesses aim at keeping food in the nutritional level sphere, on the other, with the development of new businesses, and the financial investments that derives from them, a demand for food waste is created, therefore hampering the effort in food waste prevention policies and actions whose aim is that to *eliminate* food waste at source, rather than *redistributing* it or *upcycling* it. Yet, novel technologies for food upcycling are still a fairly new development in the Danish business environment. As a consequence, companies that focus their business on food rescue for food or nutrients upcycling are not strictly bound to any sectoral regulation at the moment, as the regulation for this new type of business segment has not been developed yet.

Measuring and monitoring of food losses and food waste

The Danish government has approved a Food Waste Reporting Scheme which is set to start its operations in in 2024.At the time off publishing of this document, the reporting scheme had not been launched.

Food donations, and handling and management of food surplus

In 2016, the EU Fusion project reported that all Danish supermarket chains had developed a food waste reduction strategy[14]. The project also reported that many restaurants in Denmark have a REFOOD label against food waste. In Denmark there is a mandatory requirement disposing that food surplus has to be donated through aid organizations (i.e. food banks) to the homeless and socially disadvantaged.

4.2.2 Slovakia

Background information

In Slovakia, food waste management is a sector shared between two ministries: the Ministry of Agriculture and the Ministry of Environment. Their roles in this context are not clearly defined and as a consequence, different actions are taken in parallel without full coordination. This creates a certain level of confusion as to the responsibilities of the different ministries, sometimes leading to overlapping activities, or conversely, lacking accountability on responsibilities for food waste prevention and reduction action. Slovakia does not yet have a specific national law dedicated to Food Waste. The topic is covered mostly through EU laws, guidelines and recommendations as well as by Ministry decrees specifying the national Food Codex and the national food law.

Prevention and reduction of food waste

[14] Source: EU Fusion report, accessed on 04 September 2023

The FOODRUS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101000617.

Food waste prevention is currently not addressed separately by any document or strategy. The National platform for the prevention of food wastage and loss was established by the Ministry of Agriculture in 2016 as part of the National strategy for the food waste prevention for 2016-2020. The platform is active but meetings' proceedings are not accessible to the public. A new strategy covering the years following 2020 was not published. The current documents in place which address food waste prevention are following:

- Envirostrategy 2030
- Waste Prevention program 2020 - 2025
- Circular Economy Roadmap

Measuring and monitoring of food losses and food waste

Measuring of FLW is defined by the delegated decision. Municipalities have the obligation to ensure waste collection and valorization through either composting or anaerobic fermentation. (defined by the National Waste Law). The HORECA sector has the obligation to ensure waste collection by a certified company and report the numbers to the environmental department of the corresponding municipality, in compliance with the requirements of the national waste law.

Food donations, and handling and management of food surplus

In Slovakia the interpretation of legislation on food donations is not clear and many supermarkets prefer not to donate to avoid possible sanctions for wrong doing. This is because the rules on food donation cover only a group of foodstuffs with the best before date indication, but do not define how to proceed with other food categories..

Responsibility for the safety of donated food should be at the charity organization that is distributing it for human consumption and not at the level of the retailer, since they do not donate food directly to consumers. Furthermore, retail often does not have capacities to sort, especially larger quantities of food, e.g. bread and thus charities could do it instead, with the right to refuse to take the goods if the percentage of spoiled food is exceeding a certain level, e.g. 20%.

4.2.3 Spain

Background information

In June 2022, the Spanish Council of Ministers approved the draft Food Loss and Waste Prevention Law, the first regulation on this global issue to be enacted at the state level, making Spain the third EU country to legislate on food waste after France and Italy. The draft law is promoted by the Ministry of Agriculture, Fisheries and Food of the Government of Spain. The draft law has been approved by the Council of Ministers in January 2023.

Among its objectives, the law aims to prevent and reduce food losses and waste by all agents in the food chain; to establish a hierarchy of priorities; to facilitate food donation and contribute to meeting the food needs of the most vulnerable population; with the general aim of achieving more sustainable production and consumption; and to raise awareness, train and mobilize all agents in the chain in proper food management, without prejudice to the necessary guarantees of food safety.

This law will apply to the activities carried out in Spanish territory by the agents of the food chain, whether they are involved in the production, processing and distribution of food, as well as the hotel and catering industry, other entities and associations for the distribution of donated food and the public administration.

Likewise, Law 7/2022, of April 8, on waste and contaminated soils for a circular economy, establishes some measures for the reduction of food waste, taking into account for its application a priority hierarchy for the management of food waste.

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On the other hand, in both regions participating in the Spanish Pilot, Navarre and the Basque Country, there are different Autonomous Strategic Plans that include among their objectives the reduction of food waste.

In the Basque Country, for example, mention should be made of the Basque Green Deal, the Circular Economy and Bioeconomy Plan and the Basque Strategy against food waste.

In Navarre region the Agenda for the FW and FL reduction "Agenda para Reducir el Desperdicio Alimentario en Navarra 2022-2027" has been approved in October 2022, but the reduction strategies are also included as key aspects in the Regional Circular Economy Agenda, and its Action Plan. The Agenda is a novel and unprecedented strategy in the region for the next six years, an environmental, economic, ethical and social challenge. The main objective of the Agenda to Reduce Food Waste in Navarra 2022-2027 is to substantially reduce the generation of food waste in homes, but also in restaurants and food services and in the agri-food industry, transformation and manufacturing, retail and other types of food distribution.

Prevention and reduction of food losses and food waste

Under the new Food Loss and Waste Prevention Law, all actors in the food chain are obliged to have an implementation plan for the prevention of food losses and food waste.

In the Basque Country, and within the framework of the Basque Strategy against food wastage, since 2019, awareness and sensitization campaigns on food waste have been carried out with the main objective of preventing food waste.

In Navarre region, the agenda aims to be an effective instrument to reduce the generation of food waste in homes, as well as throughout production chains. Specifically, the main objective of the Navarrese Agenda is to reduce by 50% food waste per capita at the retail and consumer level, and to reduce food waste by 20% throughout the year for the primary production and wholesale sector by 2030 compared to the baseline year 2020.

Measuring and monitoring of food losses and food waste

At present, the draft of the new Spanish Law for FLW Prevention only establishes the obligation to collaborate with the public administrations for the quantification of food waste in order to comply with the obligation set forth in Article 65.5.b) of Law 7/2022, of April 8, derived from Article 9.5 of Directive 2008/98/EC of the European Parliament and of the Council, of November 19, 2008, on waste and repealing certain Directives.

In the Basque Country, and within the framework of the Basque Strategy against food wastage, in the year 2022 a Quantification and analysis of food waste in the food chain in the Basque Country has been carried out following the Methodology established by the European Delegated decision.

Navarre region includes specific actions for the measuring and monitoring of food losses and food waste. In order to manage the measuring and monitoring, a specific Working Group (WG) at regional level has been established with the participation of the whole food value chain. This WG will have the function of advising on aspects that may affect the development of the agenda, guiding the impact that the actions are having, proposing improvements, and seeking meeting points and synergies that promote the agenda and its planned actions. In establishing the annual work plan, the advisory body will contribute its vision on the need to advance in some actions before starting others, of the possibilities and opportunities that have arisen. With a view to the annual monitoring of the agenda, it will report on the status of the initiatives and projects already underway.

A key aspect is that during the application and monitoring of the agenda, it will be ensured that Navarra is consistent with the actions related to food waste that are included in the final text with the national laws.

Food donations, and handling and management of food surplus

The FOODRUS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101000617.

Under the new Spanish Law on FW prevention, all actors in the food chain are obliged to apply the hierarchy of priorities to food losses and food waste:

a. Donation of food and other types of redistribution for human consumption,
b. The transformation of products that have not been sold, but are still fit for human consumption, into other alternative products.
c. Animal feed and feed manufacturing within the corresponding regulatory framework and in particular the Ministerial Order APM 189/2018, of 20 February, which determines when production waste from the agri-food industry intended for animal feed, are by-products under Law 22/2011, of 28 July, on waste and contaminated soils.
d. Its use as by-products in another industry.
e. And ultimately, already as waste, to recycling and, in particular, to obtaining compost and digestate of the highest quality for use in soils with the aim of producing a benefit to them, and, when the above is not possible, for energy recovery by obtaining biogas or fuels.

This new Law, also establishes that the agents of the food chain that are catering companies and other food service providers will have the obligation to provide the consumer with the possibility of taking away, at no additional cost other than, the food that has not been consumed, except in the free buffet service formats or similar where the availability of food is not limited, as well as to inform of this possibility in a clear and visible manner in the establishment itself, preferably in the menu or menu.

In Navarre specific actions regarding food surplus are also established in the regional Agenda, such as Promoting the development of agreements between key agents of strategic sectors for the creation of stable channels for the use of food surpluses, The objective of this action would be to encourage collaboration between the agents that generate food surpluses (such as producers, food industries, processors, distributors...) with those who receive them (such as food banks, soup kitchens, NGOs...). For this, the search for agreements between the different agents would be facilitated, among which can be found: associations and social entities, city councils or other local entities (for example to enable public spaces for the distribution of food), regional government, business associations of the catering sector, agricultural and industrial unions, the CEN and other agents to develop actions aimed at preventing waste in the agro-industrial sector, and/or consumer associations.

Under the new Law, all agents in the food chain shall be obliged to reach agreements or arrangements to donate their food surpluses to companies, social initiative entities and other non-profit organizations or food banks, except in cases where it is unfeasible and duly justified and in food distribution activities carried out in establishments with a useful exhibition and retail sales area less than or equal to 1.300 m2.

In the Basque Country, as part of the Basque Strategy against food wastage, in 2020, a "Guideline for the donation of food surpluses in the Basque Country" was drawn up.

In the Navarre region food donations are promoted as interesting initiative or experiences as part of a prevention of food waste in addition to other responsible social actions of organisations, specifically with food banks and social organisations. In order to boost this type of actions a specific fiscal incentive for food donation will be implemented.

4.3 Food legislation in the Associated Regions

This section reflects the information collected from the FOODRUS partners representing the Associate Regions. It therefore covers the legislation of the following European countries: Austria, Bulgaria, Hungary, Greece and Romania. It also includes additional information from the region of Catalunya (Spain). The four categories of assessment used for the pilot countries are equally used here for the Associated Regions. Specific reference to the national laws on which the following overview is based is provided in Annex A in the Appendix.

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4.3.1 Austria

Prevention and reduction of food losses and waste

Establishment of a program for the prevention of food waste

1) In order to achieve the objectives of this Provincial Act (§ 1), the Provincial Government may draw up a program for the prevention of food waste, taking into account national waste prevention programs pursuant to § 9a AWG 2002 and the Federal Waste Management Plan. This may be part of the provincial waste management plan pursuant to § 19.
2) Insofar as environmentally relevant effects have not already been assessed within the framework of the provincial waste management plan, § 38d of the Upper Austrian Environmental Protection Act 1996 shall apply mutatis mutandis with regard to the environmental assessment of the program for the prevention of food waste pursuant to Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programs on the environment, OJ No. L 197, 21.7.2001, p. 30
3) The food waste prevention program shall be published on the website of the Province of Upper Austria.

Measuring and monitoring of food losses and food waste

The district waste association in its association area and the city with its own statute in its administrative area shall, taking into account the objectives and principles (§ 1) of this Act and of the provincial waste management plan (§ 19) record the quantities of waste accepted in the performance of his or her duties, differentiated by type of waste, origin, type of treatment and whereabouts, collect this data, check it for plausibility and report it to the state government by March 15 of the following year through the state waste association.

Food donations, and handling and management of food surplus

For the transfer of food to social institutions, all provisions of Austrian food law apply, in particular also "Low-threshold". A social facility that distributes food provided by companies to other social institutions or directly to socially needy persons, is a food business. This applies regardless of whether the products are distributed free of charge or against payment. It is merely an extension of the conventional value chain; therefore, all relevant legal regulations must be complied.

4.3.2 Bulgaria

Prevention and reduction of food losses

In the different food value chains, specific legislation and regulations have been introduced throughout the years. They aim to optimize the processes of harvesting, dairy farming, food hygiene, coffee production, fish farming and fishing, etc. The production quality and techniques are usually determined in them. The HACCP contamination prevention system is implemented in most of the food manufacturing and packaging plants in the country. The system provides for openness and accessibility of the production process, the related procedures and maintenance of good hygiene. It minimizes the food contamination and food loss during the production and manufacturing stage of the FVC. Thanks to the HACCP system the factors affecting the ingredients, the product and the process can be easily controlled, and the initial wastage of raw materials and food is minimized.

Generally, on a national level one of the necessary steps that should be taken is the improvement of the performed technological processes and introduction of new machinery and process units. Currently, these aspects are outdated and sometimes ineffective, thus leading to losses and low production efficiency.

An important development that should be considered is the exchange of know-how with other EU and UN countries which have established and well-working good practices and available techniques. An idea to be

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looked into and introduced is the concept of industrial symbiosis in the sphere of food loss reduction. In Bulgaria there are such ongoing projects in other industries and manufacturing sites, thus similar collaboration between producers of various food value chains could be highly beneficial.

Prevention and reduction of food waste

- National Strategic Plan for gradual reduction of the quantities of biodegradable waste intended for landfill 2010-2020, which envisages measures aimed at reducing the deposited biodegradable waste, incl. food waste and in particular to prevent the generation of food waste, such as home composting.

An official report on the achievement of the measures suggested in the National Strategic Plan 2010-2020 has not been published yet. A more current National Strategic Plan for gradual reduction of the quantities of biodegradable waste intended for landfill for the period 2020+ has not yet been published.

- National Waste Management Plan 2021-2028, which includes measures for both treatment of food waste and measures to prevent their generation, e.g. measure to the municipal administrations for inclusion in the municipal waste management programs of specific measures for prevention of the generation of waste (including food waste).

In the previously issued Plan (2014-2020) the up-to-that-moment achieved measures are analyzed and follow-up improvement precautions are suggested. One of these precautions is to introduce a better information and feedback collection system in order to provide more reliable and accurate statistical data. More specific measures and aims are listed in the National Program for Prevention and Reduction of Food Loss 2021-2026.

- National Program for Prevention and Reduction of Food Loss 2021 – 2026, according to Goal 12.3 of the UN Sustainable Development Goals by 2030

In this Program file major operation aims have been established:

1. Obtaining measurable and comparable information regarding the results of food waste – measures to achieve this aim are to collect data where, how much and at what stage of the food supply chain food is lost or wasted and to report the gathered data to the European Commission;
2. Supporting FVC members in implementing more sustainable and efficient FW and FL practices – measures to achieve this aim are to create voluntary collaboration platforms for the interested parties and for the producers, processors and distributors to exchange information on BAT and efficiency;
3. Alternation of the consumers' attitude towards food value and consumption – measures to achieve this aim are to organize awareness-raising campaigns on food wastage and to engage the customers in related discussions;
4. Application of measures to reduce FL and FW at all stages of the food supply chain - measures to achieve this aim are to encourage the business and food producers to correctly use the "use before" and "best before" marking, to educate the general public on the difference between the two terms and to popularize the consumption of fruits and vegetables with non-typical appearance like form, size and colour;

5. Redistribution of surplus food to people in need and socially disadvantaged people - measures to achieve this aim are to rationalize the national legislation in the sphere of food donation and to ease the procedures and lower the taxes for the companies willing to donate.

- Regulation on the specific requirements for carrying out food banking and the control of such activity

The targets set in these documents include increase in the food donations by business owners, harmonization of the national and EU legislation, collaboration between the UN and EU members for the adoption of good practices in regard to food losses, provision of food to socially disadvantaged and to those in need, sustainable production of food and many other aspects. The adoption of these has provided ground for wider discussions

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with the concerned parties such as producers, farmers, cattle owners, retailers, etc. in order to increase the efficiency of the mutual actions for the solving of common issues. An opportunity that the National Program is providing is shortening the food supply chain and engaging the business with the coping actions taken on local, national and European scale.

For both FL and FW it is a necessity for comply with the waste hierarchy. The first priority step is prevention of waste generation followed by reduction of waste generation.

According to the National program for waste management 2009-2013, 29% of the generated waste has originated from food and food scraps, not mentioned whether it was generated by industries or in the private sector. Moreover, the Executive environmental agency reports that in 2018, roughly 500,000 tons of FW has been generated, 57% of which originates from the households.

Additionally, all municipalities are obliged to create and put into force a Regulation on waste management and reduction (including food waste).

Measuring and monitoring of food losses and food waste

There is a lack of nationally issued handbook, which guides the processes of how to measure and monitor the FL and FW. The last measuring before the mandatory requirements of the EU has been executed over a decade ago. The obtained results are most likely to be non-applicable for the current situation.

Control and monitoring methodology is expected to be put into force in the near future. All strategic documents overviewed so far mark the lack of a concise and clear feedback and data collection system as a major drawback.

Food donations, and handling and management of food surplus

The handling of food surplus is still being researched and discussed in Bulgaria. As of now, there are four main destination streams for the surplus food – composting, treatment in biogas installation, donating it to food banks and landfilling. Currently, composting and biogas production are the two most widely used methods of handling excess food, both still edible and expired. At the same time, food donation is also becoming more and more widespread. A major drawback with food donations is that it is poorly economically justified for the donors, suggesting a lack of fiscal incentives that support such strategies.

Food donations principles, measures and regulations are outlined in the Food Law. Chapter Four "Food Banking" of the law defines the activities of food banking, the requirements for food producers and traders to the method of labeling food intended for donation, as well as requirements for the availability of a reporting system for food bank operators [3] .

Furthermore, food banking is tackled in many of the strategic documents mentioned above. Food donations can be done by producers, retailers or other members of the FVC. The food donations, however, can only be accepted by legally registered and operating food banks. The donated food is usually redistributed to disadvantaged people or entities providing social services. Donations to food banks in Bulgaria is not perceived as a FL and FW prevention mechanism but simply as a management of food surplus. Although this practice is becoming more widespread nowadays, the proportion it represents from the total amount of surplus food is minor, and further investments are required to increase the capture rate of food surplus by food banks. Moreover, one of the major disadvantages of food donations in Bulgaria is that the latter are taxed, with the donor having to pay. In Bulgaria, up until 2017, a 20% VAT was required for every kilogram of donated food. The paradox here was that if the food was scrapped – treated in biogas installation or landfilled, the producer would have been exempted from paying taxes. This made the whole idea of food banking unwelcoming and undesirable for the FVC members. Since 2017 some easing measures have been taken and 0% VAT has been

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introduced under the condition that the donation is less than 0.5% or the company's turnover. The business representatives are optimistic and demand increase in the 0% VAT threshold.

4.3.3 Greece

Prevention and reduction of food losses and waste

- National Law 4819/2021. Integrated waste management plan with reference to biodegradable waste, food waste and food surplus as distinctive categories. It incorporates the EU Directives 2018/851 and 2018/852 as well as the Directive 2008/98/EC of the European Parliament. Active since July 2021 the law consists one of the most recent legislative actions of the Greek state on food waste. The Greek national law 4819/2021 incorporates the EU Directive 2018/851 thus entering into force the measuring and reporting methodologies of food waste as mentioned in the delegated decision. Detailed information on the requirements of the decision form the Member Stated are stated in the section 4.2.1. of the present report. The target set in the law is to reduce food waste of the FVC by 30% by the year 2030 in comparison to the year 2022. Tangible target of reduction is set only on food waste with respect to the above three mentioned categories.
- National Strategic Plan for Waste Prevention in accordance with Article 29 of the Directive 2008/98/EC (Article 23 of Law 4042/2012). National Program for Prevention and Reduction of Food Loss by 50% by 2030 according to Goal 12.3 of the UN Sustainable Development Goals. Food loss and waste is one the streams that have been selected for determining qualitative targets. Active since May 2022.
- National Circular Economy Strategy 2021 incorporating the National Circular Economy Strategy of 2018. It incorporates the targets and directions of the national law 4819/2021 and includes guidelines of food packaging and its disposal according to the Directive 94/62/EC. For the scopes of preventing food loss and reducing food waste a n inter-ministerial Group for the prevention of food waste and the creation of waste from food residues was convened. (27.9.2017)

Measuring and monitoring of food losses and food waste and handling and management of food surplus

- National Law 4819/2021. Integrated waste management plan with reference to biodegradable waste, food waste and food surplus as distinctive categories. It incorporates the EU Directives 2018/851 and 2018/852 as well as the Directive 2008/98/EC of the European Parliament. Active since July 2021 the law consists one of the most recent legislative actions of the Greek state on food waste.
- National Strategic Plan for Waste Prevention in accordance with Article 29 of the Directive 2008/98/EC (Article 23 of Law 4042/2012). National Program for Prevention and Reduction of Food Loss by 50% by 2030 according to Goal 12.3 of the UN Sustainable Development Goals. Food loss and waste is one the streams that have been selected for determining qualitative targets. Active since May 2022

Food donations, and handling and management of food surplus

The National Waste Prevention Programme 2021-2030 aims to implement financial incentives such as tax reliefs and VAT exemption (The Council of Ministers, 2022). Food donations alongside with donations of other goods such as medicines, clothes (apart from those subject to specific VAT) are exempted from VAT when they are donated to public or non-profit legal entities. These latter need to prove to work towards charitable or public benefit to be distributed solely for the convenience or comfort of vulnerable social groups. In addition, article 19 of Law 4172/2013 provides guidelines for food donation: free redistribution of food is allowed when given for a charitable goal (EEA, 2021b). Such food donations may benefit from a 20% reduction of taxes according to the EU guideline 2018/851 on food donations.

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4.3.4 Hungary

Prevention and reduction of food losses

In 2016, the National Food Chain Safety Office of Hungary (hereinafter referred to as Nébih) launched project 'Wasteless' with the financial support of the European Union's LIFE programme, with the aim to decrease the amount of food waste in all food chain sectors. Project Wasteless was selected as the national level food waste prevention programme (as it has been put forward in the Waste Framework Directive (2008/98/EC) as an obligatory action to be taken by member states, and has been advocated in the Key recommendations for actions of the EU FLW Platform) by the Food is Value Forum.The Food is Value Forum was launched jointly by the Ministry of Agriculture and the Hungarian Food Bank Association in 2014, in order to reduce food losses and waste along the food supply chain. Members are required to sign a declaration through which they commit to a voluntary agreement to reduce food losses and food waste in their respective food chain sectors.

The forum aims to engage members to:

- actively reduce food loss and food waste;
- highlight the importance of the current issue and shape public opinions and attitudes in this regard;
- enhance knowledge management and the flow of information among all stakeholders concerned;
- identify issues and possible solutions along the whole supply chain from primary production to consumers;
- valorise unavoidable waste.

The forum elaborated guidelines for food donation in the food processing and food distribution, as well as in the food service sectors and for event organization. The most essential elements of the Good Practices for food waste reduction in the catering sector document have been adopted by the Good Hygiene Practice (GHP) recommendations for Food Services issued officially by the Ministry of Agriculture based on the regulation (EC) No 852/2004. The new edition of the GHP document is available here, since May 2018.

Food is Value Forum currently counts 56 members from different fields, such as food production and processing, retail, non-governmental sector, public administration, R&D and education.

The main priorities for food loss and waste prevention actions in Hungary are to:

- set a baseline for food waste levels for households and the food supply chain in Hungary;
- implement the food waste hierarchy;
- demonstrate the efficiency of the voluntary approach as regards the reduction of waste in the food supply chain;
- raise awareness of food waste issues and change consumers' attitudes;
- identify and address hotspots in retail supply chains to prevent food waste;
- work with the hospitality and tourism industry to improve practices and influence consumer behaviour to prevent food waste; and
- engage the entire food supply chain and recruit new members for the Food is Value Forum.

According to the governmental decision 1519/2017 (VIII. 14.): the Hungarian government considered the advancement and first results of the Wasteless project to be significant, and based on this consideration, a decision has been made about the extension of the project goals. Due to the additional funding provided by the government, we were able to hand over the students' book to all Hungarian children of the 5-7th grade.

Prevention and reduction of food waste

Food waste prevention is part of the following policies: the National Framework Strategy for Sustainable Development and the National Waste Management plan (2021-2027). The National Waste Management Plan

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2021-2027 serves the adoption of DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives and indicates that Hungary contributes to the Sustainable Development Goals (SDG) of the United Nations, including SDG 12.3. According to that, by 2030, Hungary aims to halve food waste at the retail and consumer levels and reduce food losses along production and supply chains.

A dedicated national food waste prevention programme called 'Wasteless' has been running since 2016 organized by Nébih. The main objectives of the project are to increase consumer awareness on food waste and to change current behavioural patterns that lead to food waste, with a special focus on primary school education, collecting good practices for food waste prevention and reduction and enhancing collaboration with other EU Member States.

Nébih started its project 'Wasteless' with the financial support of the European Union's LIFE programme, with the aim to decrease the amount food waste. Under the programme, several **awareness-raising actions** have been organised, including a consumer campaign, a school programme (development of educational materials for teachers and pupils, organising events, thematic summer camps, competitions and quizzes, interactive lessons), and an award for food waste prevention initiatives.

Project Wasteless has also set a number of indicators and targets for reducing consumer food waste:

- The programme conducted two household food waste surveys in 2016 and 2019 (involving 100 and 165 households respectively), which showed a 4% reduction over three years. In 2021 the third measurement was conducted with the involvement of 282 households, of which processing is in progress.
- More than 100 million people have been reached through awareness-raising and communication materials, and almost 500 *000 children have been reached through the school programme.*

Within the project a guideline for food waste reduction good practices for consumers have been elaborated.

Measuring and monitoring of food losses and food waste

In Hungary, the Ministry of Technology and Industry is responsible for conducting the mandatory reporting exercise on FW. In 2021, the ministry conducted the first voluntary reporting exercise, with the involvement of Nébih and the Hungarian Central Statistical Office. The data of primary production, processing and manufacturing, as well as that of retail and other distribution of food were based on reported waste by business operators in the National Environmental Information System (OKIR). The amount of food waste had been determined by extracting food-related waste data based on NACE Rev. 2. and waste codes, in accordance with the Commission Delegated Decision (EU) 2019/1597. In terms of restaurants and food services, and households, Nébih provided the ministry with relevant data.

For households, data was based on a survey conducted in 2019 by Nébih applying a methodological approach recommended by the FUSIONS project (later approved by the Commission Delegated Decision (EU) 2019/1597), with the involvement of 165 participating households.

For the restaurants and food services sector, data was obtained from the national Quality-controlled Catering Program of Nébih. The national Quality-controlled Catering Program of Nébih supervises Hungarian institutional food service facilities based on a multi-criteria evaluation system. In addition, Nébih experts collect data on the FW generated in the examined food service providers. In the first voluntary reporting exercise, Nébih provided the Ministry of Technology and Industry with these FW data. Nevertheless, these data are mainly resulting from institutional food service providers, with the exclusion of other catering actors (e.g. restaurants, hotel canteens).

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The results of the voluntary report in 2021 reflect the limitations arising from currently applied measurement methodologies. Thereby, it became evident the need to foster the production of high-quality data, that can only be achieved with operational capacity development, methodological development, and testing.

Based on the experience of the first voluntary food waste measurement exercise, data extracted from the National Environmental Information System based on waste codes do not prove to be sufficient for the following reasons:

- Overlaps of certain waste codes (20 01 08; 20 01 25; 20 03 01) in different food supply chain sectors bring about data management difficulties.
- Not all food business operators have to report their waste to the National Environmental Information System (under 2000 kg/year it is not mandatory to report to the national system).
- The accuracy of the reporting may also be influenced by the reliability and the willingness of FBOs obliged to report to the national system.
- Separate biowaste collection is not yet in practice in the household level in Hungary, thus, separation of the FW fraction from the reported municipal waste is hindered.
- Mixed municipal waste contains biowaste fractions collected from FBOs, that is not associated with any Nace Rev. 2. codes, therefore can only be identified as household FW.
- Pouring edible oils and fats, or other types of FW into the sewer seems to be a general practice in many households, although this practice is inappropriate. Measurement of this part has to be taken into consideration.

The first two household surveys carried out in Hungary with the FUSIONS methodological approach shed light on the limitations of the diary method – of which several had been justified by the results of Quested et al. (2020). Limitations can arise from personal factors of the participating individuals (e.g. social desirability to conform; higher consciousness as a result of behavioural reactivity; misreporting due to lack of awareness or forgetting), seasonal deviations that cannot be handled in a short-term survey, the lack of sufficient demographic coverage of the sample, or the improper usage of the user interfaces (e.g. diaries, online questionnaires) of the participants. These limitations could be eliminated up to a certain level with more financial resources, optimization, and more intensive communication with the households. In 2021 Nébih conducted the third national household survey, now with the involvement of nearly 300 households. Results will be published in the second half of 2022.

Food donations, and handling and management of food surplus

Regarding the food surplus topic for caterers and mass caterers got released a GHP document, where the food chain members can find solutions to reduce their surplus. This relevant guide has available since 2018. From year to year, the specialists follow the rules, which have been indicated in there.

The GHP summarizes the changes of the food industry and the guidelines in order to the best way of food surplus management. This includes details of the obligations in the following paragraph:

4.3.5 Further treatment of waste and by-products

The safe and regular removal of waste and by-products must be ensured.

Food waste according to Regulation 1069/2009/EC on the transport, handling, processing and disposal of animal by-products. It can be given to registered or licensed persons and businesses (for example, to recognized dog kennels, dog and cat shelters, circuses, zoos, wildlife parks).

For further information this document summarizes the main regulations.

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The professional guide to food surpluses in catering for charitable purposes is available for the members of the sector.

In the field of food donations, Hungary has a long-term tradition. The Hungarian Food Bank Association started its work in September 2005, and became a full-fledged member of the European Federation of Food Banks (FEBA) in 2006.

Their mission searching surplus food to pass it for the needy, saving food and reducing hunger at the same time. They strive to raise awareness among players of the food chain, who then -with or without the Food Bank- offer the surplus food for the needy instead of eliminating it.

Hungary produces 1.8 million tons of leftover food annually. If the amount were to be put on trucks, it would reach from Budapest to Paris. Meanwhile, thousands of people live in food insecurity all over the country with more than ten thousand children.

Apart from helping the needy, they also prevent the incarceration of the food and also save energy. Therefore, the Food Bank has social and environmental benefits by being an aid- and green association.

The Food Bank receives leftover food for free from food producers and retailers in all cases. The members also give it to our partners free, who then distribute on a non- profit basis.

On the other hand, the Hungarian Parliament has accepted the amendment of the Act No. XLVI of 2008 on food chain and its control for decreasing food waste in the retail sector and establishing the 'Food Rescue Centre' for better organisation and traceability of food donations of the most important retail chains. According to the amendment, food retailers will have to create annual plans for food waste reduction and should offer certain durable goods near to the expiry date for donation (in the last 48 hours). The Food Rescue Centre will operate an online system on which the offered batches would appear for all registered charity organisations.

Joining the new system will be compulsory for the largest actors of the food retail sector that accumulate an annual revenue of 100+ billion HUF from food sales, however other donating organisations (smaller retailers, food processors) are also encouraged to take part. Only durable food batches that are close to their ‘best before’ date have to be offered by law, but donating organisations may upload fresher products, as well. The Food Rescue Centre will provide support for charity organisations to broaden their capacities in delivering food for their clients. This helps to scale up food donations in the country, to fulfil new opportunities that the recent amendment of Regulation (EC) No 852/2004 on the hygiene of foodstuffs has opened. According to this, food stuffs after the ‘best before’ date should be made available for food donation by the Member States. Illegal trafficking and re-labelling of expired food (a problem the country formerly faced with) can be also effectively prevented with the online tracing of food donations.

Food is Value Forum, Hungary (co-hosted by the Ministry of Agriculture and the Hungarian Food Bank Association) published a Guide of Food Donation Guide for Food Processing and Distribution Companies in which guides produced within Project Wasteless have been incorporated.

Legislative background:

- Commission regulation (EU) 2021/382 of 3 March 2021 amending the annexes to regulation (EC) no 852/2004 of the European Parliament and of the Council on the hygiene of foodstuffs as regards food allergen management, redistribution of food and food safety culture.
- 2021 CLI. Act XLVI of 2008 on the food chain and its official supervision. Act and XLV of 2020 on retail tax. on amending the law
- 72/2022. (III. 2.) Government decree on food saving

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4.3.6 Romania

Prevention and reduction of food losses

Romania made the transposition of EU Directive 2018/851 by Government decision 92/2021 on the waste regime. The key articles of reference are the following:

- Art.1: The purpose is to ensure a high level of environment protection and population health by establishing measures: to prevent and reduce the generation of waste and its efficient management; to reduce the adverse effects caused by the generation and management of waste; to reduce the general effects determined by the use of resources and to increase the efficiency of their use.
- Art.13: The economic operators from the entire food chain take action for: the reduction by 50% of food waste (UN SDG target) and the reduction of food loss in the whole food production and distribution chain by 2030; encouraging food donations and other forms of redistribution for human consumption.
- Art.17: Municipal waste (includes HH waste, do not include waste from production, agriculture, etc.) has to reach a target for reuse and recycling: minimum 55% by 2025, minimum 60% by 2020 and minimum 65% by 2035. Also public authorities must implement the PAYT scheme and by 31.12.2023 they have to assure the separate collection and recycling of bio-waste at source or separate collection.

Prevention and reduction of food waste

In Romania, prevention of food waste generation is governed by the following legislation and articles:

Government decision on law enforcement no. 217/2016 on reducing food waste:

- Art.5: For each FVC stage the law provides examples of what operators can do, without mandatory requirements. Example: in the HORECA sector, economic operators **can:** a) plan measures and economic tools that promote the efficient use of resources; b) carry out at least one annual internal communication campaign with employees regarding the objective of reducing food waste; c) use FIFO monitoring system (First In First Out) of stocks of goods/raw materials; d) separate FW collection by categories.
- Art.11 prescribes that the economic operators **must:** a) elaborate the annual plan for FW reduction and they will present it to the competent authorities in the field of FW at their request; b) submit to the Ministry of Agriculture and Rural Development, by March 31 of each year, the annual reports for the period between January 1-December 31 of the previous year. Economic operators form the entire agri-food chain, regardless of the form of organization, in order to donate and sell agri-food products, take measures at all stages of production, processing, storage, distribution *and marketing of food, to comply with the provisions on food safety.*

With regards to Green Public Procurement (GPP), the Ministry of Environment together with the National Agency for Public Procurement in 2022 had planned to elaborate a guide for product and service groups and standard specifications, as well as quantitative and qualitative criteria for FW prevention. Moreover, Art. 1 of Law 69/2016 on GPP Sets the multiple purposes and benefits of adopting green public procurement measures, but the law in itself does not prescribe specific actions that actors need to adopt or comply with.

In Romania, the National Waste Prevention Program sets targets for the reduction of HH waste generated per capita in 2025 by at least 3% compared to the 2017 values, reducing the per capita generated waste by 5kg/year. The Program however does not provide specific indicators for food waste reduction but considers households waste in its whole.

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The functioning of the Timisoara food banks (Romania)

The operations of Food Banks in Romania are structured by a common methodology supervised by the Federation of Food Banks in Romania which include regional banks from Bucharest, Cluj, Roman, Brasov, Oradea, Constanta, Craiova, Galati and Timisoara. The banks are located in major urban areas and serve organizations in a proximal distance to ensure sustainability of operations.

From a legal point of view the banks handle the logistics for collecting the food waste from donating economic operators (mostly supermarkets), on the basis of donation contracts using the fleet of the Food Banks. The food items are then portioned based on the number of final beneficiaries in the care-taking of the social organizations, based on the expiration date of the products, and on the beneficiaries' age, nutrition restrictions, etc. In the afternoon the social organizations with which the Food banks have donation agreements, collect the food items allocated to them.

The Bank's day to day operations are managed by a small executive team and operate mostly on large voluntary networks. The Regional Bank in Timisoara is operated by 4 full time paid staff and over 40 volunteers.

From a logistic point of view the Banks have own vehicles for collection of food items and small warehouses from where thew food items are picked up.

The costs for these operations are covered from donation contracts, mostly from economic operators.

The Food Bank in Timisoara coordinates operations for all four counties of West Region (Timis, Arad, Caras-Severin and Hunedoara), working with 78 partner organizations and supporting 20,000 vulnerable people under the care of partner social associations

Measuring and monitoring of food losses and food waste

The National Waste Management Plan 2018-2025 includes waste management planning, instruments, waste policy tools and National Waste Generation Prevention Program.

Romania's Sustainable Development Strategy 2030 Targets:

- Halve per capita food waste at the level of retail and consumption and reduce food waste throughout the production and supply chain, including post-harvest losses;
- Recycle 55% of municipal waste by 2025 and 60% by 2030;
- Implement the separate collection of household hazardous waste by 2022, of biological waste by 2023;
- Implement sustainable green public procurement practices in conformity with national priorities and European policy.

Food donations, and handling and management of food surplus

According to the Government decision 92/2021 on the waste regime (transposition of EU Directive 2018/851):

- Art. 23: The original waste producer has the obligation to perform treatment operations by its own means or through an authorized economic operator.
- Art.60: For HH waste, public authorities' contracts authorized economic operators to implement the extended producer responsibility – the producers have the organizational and financial responsibility for the waste management from the life cycle of a product, including separate collection and sorting operations and this obligation may also include the possibility to contribute to the prevention of waste generation and to the products' reuse and recycling.

This decision includes financial penalties for each original waste producer.

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According to the legal requirements all companies are obliged to take measures to diminish food waste, including firms in the production, processing, storage, distribution, retail trade sectors, hospitality industry and food services. Food products that are close to expiry can't be destroyed anymore.

Thus, economic operators can donate / sell at reduces prices food with expiration date of 10 days or less. The donations must be made to non-governmental association which can ensure direct or upon processing access to donated food to final consumers within their own social care system. Retailers and producers will be able to sell the products that are close to expiry at 3% of their price plus VAT to social enterprises or foundations. These will be allowed to further sell them at 25% of the initial price plus VAT. Social economy retailers can then sell them to registered final consumers at lowest price that ensures sustainability of the social economy retailer, with thresholds for reasonable operating costs stipulated within the normative document.

The system provided a solution to supermarkets to valorize the food approaching the end of shelf life.

Regulation on food donation in Romania is governed by Government decision no.51/2019 for law enforcement no. 217/2016 on reducing food waste. According to this decision, the following food items are prohibited for donation:

- ✓ Unpasteurized vegetable and fruit juices
- ✓ Precooked vegetables and fruits
- ✓ Germinated seeds
- ✓ Fresh meat and organs
- ✓ Minced meat
- ✓ Prepared meat
- ✓ Fresh fish and fishery products
- ✓ Raw milk and raw milk products
- ✓ Raw eggs and raw egg products

Economic operators who donate food products in Romania benefit from fiscal incentives. Foods can be donated to social canteens or other public catering units to be transformed, without undue delay, into finished products for the final consumer. The law prescription is addressed to all food value chain actors, from primary producers to the HORECA sector. The economic operators may donate the products close to the expiration date of the minimum durability to the final consumer or to the receiving operator, based on a contract, at any time in the last 10 days until the date of minimum durability is reached. Associations and foundations, social enterprises operating in the agri-food sector can sell food to the final consumer, at a price that allows to cover the operating costs of that activity.

Further details on other Romanian law are provided in Annex A.

4.3.7 Catalunya (Spain)

Prevention and reduction of food losses

The regional Parliament of Catalonia approved in 2020 the Law 3/2020, of 11 March, on Food Loss and Wastage Prevention with the aim of establishing preventive actions for reducing food loss and wastage and promotional actions for increasing food utilisation and reuse throughout the food chain.

This law applies all the actors along de food value chain including primary sector. The main points regarding food losses prevention are:

- The requirement for food producers of having a food loss and wastage prevention plan and to implement it (microenterprises are exempt).

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- The requirement for food producers of reducing, measuring and annually reporting the quantity of food loss and of accounting the food products that are intended for free distribution or animal feed (microenterprises are exempt).
- Includes the regulation of gleaning practices.
- The Catalan Government is required of drawing up a Strategic Food Loss and Wastage Prevention Plan, which has to be updated at least every five years and of creating an information system for collecting and analysing data about food losses and waste.

This law must be deployed by a regulation that is currently being defined (2022).

Prevention and reduction of food waste

The regional Parliament of Catalonia approved in 2020 the Law 3/2020, of 11 March, on Food Loss and Wastage Prevention with the aim of establishing preventive actions for reducing food loss and wastage and promotional actions for increasing food utilisation and reuse throughout the food chain.

This law applies to all actors along de food value chain including transformation food sector, retail, hotel, restaurant and catering businesses, social entities, public authorities and consumers. The main points regarding food waste prevention are:

- The requirement for food business and social entities of having a food loss and wastage prevention plan and to implement it (microenterprises are exempt).
- The requirement for food business and social entities of reducing, measuring and annually reporting the quantity of food loss and of accounting the food products that are intended for free distribution or animal feed (microenterprises are exempt).
- The requirement for restaurant, hotel and catering companies of offering doggy bags to their customers.
- The requirement for schools of having educational programmes on food wastage reduction.
- The requirement for hospitals and geriatric residences of having food wastage reduction programmes.
- The Catalan Government is required of drawing up a Strategic Food Loss and Wastage Prevention Plan, which has to be updated at least every five years and of creating an information system for collecting and analysing data about food losses and waste.

Measuring and monitoring of food losses and food waste

The Catalan Law 3/2020, of 11 March, on Food Loss and Wastage Prevention requires all agents along de food value chain and social entities the measuring, monitoring and report of both food losses and food waste.

This information system is currently being defined. Some challenges have been identified to do so like the high number of companies with this obligation or the absence of records of existing companies in the retail or restaurant sector. On the contrary, it seems more affordable to obtain these data from the primary sector or the food industry since they already report other data to the public administration.

In the meanwhile, the Catalan Government has published different guidelines to help companies and entities to assess food losses and waste and to draw up the prevention plans.

Food donations, and handling and management of food surplus

In Catalonia, there has been a growing awareness in recent years regarding the prevention of food loss and waste. Also in the business field, where the food value chain and social entities have articulated many circuits to take advantage of leftover food.

The Catalan Law 3/2020, of 11 March, on Food Loss and Wastage Prevention includes, within the measures to support and promote the prevention of food loss and wastage, incentives for adopting collaboration agreements

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between food chain stakeholders and social entities. The aim is to increase the use of surpluses as a donation for human use.

The option chosen is to promote voluntary agreements and not make them mandatory, thus gathering the opinion of social entities that claim not to be the end of the food management chain.

The Catalan Law 3/2020, of 11 March, on Food Loss and Wastage Prevention defines a stakeholders' hierarchy of priorities for food management. After the food loss and waste prevention, use for human consumption (including food donation) is the second option.

The main points in the law regarding food donations are:

- It asks the food value chain the accounting the food products that are intended for free distribution.
- Social entities have the right to receive food originating from donations and gleaning for redistribution
- Social entities have the right to receive advice and information from public authorities, third-sector social organisations or private food-sector companies.
- Social entities have the right to receive financial support from the public authorities.

The Catalan Government has published different guidelines to help companies and entities to do a good food donation process.

Social entities have shown interest in creating businesses models based on selling the products and/or selling the products beyond the best before date. Their aims are the transformation of the donation system and to achieve more economic sustainability. At the moment, selling products beyond the best before date is prohibited by consumer code law and the sale of a given product is not well regarded by the food value chain.

4.4 Final considerations

Data collected from the FOODRUS associated regions and pilot countries shows how there exist a considerable degree of heterogeneity of approaches and regulations in addressing food waste reduction not only across European Union countries, but within the same countries where regional and municipal legislation is, at times, more stringent than national regulation. This is the case for example of Romania where while national regulation does not set mandatory requirements for food waste reduction by FVC operator, regional regulations does so. In this case, the municipal waste prevention measures set out in West Region Romania (the Timis County Waste Management Plan) sets out food waste reduction targets (-50% compared to reference year 2018) for the distribution and end-consumes to be achieved by 2025, while the national regulation only prescribes the definition of FW reduction plans without setting specific reduction target. This is the case as the national government has prescribed the different counties in the country to draft their own County Waste Management Plan, leaving flexibility on how to set targets and how to define laws at regional level. The case of the Timisoara county however is not unique, and other examples of such a differentiated implementation process are present across Europe.

Overall, the flexibility offered by instruments as EU Directives has to be counterbalance with situations like the Romanian case where too much flexibility in the transposition of EU laws produces heterogeneity in the setting up of FLW reduction targets, and FLW action plans. This divergence in the use of regulation creates a misalignment of food waste reduction action within a country, and confusion among businesses and citizens that, depending on where they operate and live, will have to abide to different regulations. This approach also create delays in the achievement of food waste reduction targets at national level as FVC actors will work at different priority levels and abide to different legal constraints, depending where they are based. In these cases, monitoring of progress towards set targets could also become complex, when reduction targets are not homogeneously defined across regions.

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5. Stage-specific legal and economic barriers to food losses and food waste prevention

In chapter 4 and chapter 5 we provided an overview of the legal landscape around food losses and food waste management in Europe, looking at the laws and regulation currently in place at the level of the European Union legislation (chapter 4), and at the level of the single European member states (chapter 5). In this and in in the following chapters we zoom in into the legal and economic barriers that during the FOODRUS project we have identified through the literature review, the consultation with FOODRUS pilots and Associated Regions, the EU survey on legal and economic barriers we run throughout 2022 and 2023, and the 2 policy workshops held in November 2023 and January 2024.

Throughout these sources and interactions with different FVC stakeholders, the FOODRUS project has identified a total of 40 key barriers to food losses and food waste prevention and reduction. While a list of these barriers is presented at the beginning of each chapter sub-section, several of them are connected among each other, and could be grouped in a single broader barrier. As a result of this, in chapter 6 and Chapter 7 we have focused on the in-depth description of about 15 of the identified barriers, accounting that what we described there does include, at least partially, considerations also for the barriers not directly analyzed in detail.

It is important to notice that, while initially we primarily focused on the identification of legal barriers, while carrying out the research we realized that causes of food losses and food waste generation in Europe did not have only a legal nature. The relevance and interlinkages between laws and regulations on the one hand, and the economic system that governs food production and consumption on the other, emerged quite evident from the very beginning. The legal and economic elements are in fact very well interlinked, and one could suggest that nowadays it is the economic model that dictates the legal framework defining the patterns of functioning of our food systems.

It is for this reason that, deviating from the initial intention, we decided to expand our analysis of the barriers to FLW prevention and reduction also to the economic aspects that determine specific corporate behaviors and practices that generate food losses and food waste.

As the economic system per se, and the food system in particular, are a network of highly interlinked agents and processes each influencing the other to variable extents, the identified legal and economic barriers and their solutions described below are characterized by a high level of interdependency. As a matter of fact, the selected cases could potentially be approached systemically all together leading to a redefinition of the policy landscape that would positively affect the functioning of food systems through a holistic approach. This would mean rethinking and reshaping the way the current profit-driven drivers behind our food supply systems work. Such a re-evaluation process would account for different aspects of food production and consumption, rebalancing the value of the different elements (i.e. nutrition and health aspects, fair farmers' wages, youth employment in agriculture, social and environmental impacts, ethics) in the overall system functioning. In turn, such a shift would directly contribute to the food system transformation needed to achieve the sustainability targets of the European Green Deal and of the UN Sustainable Development Goals. Addressing holistically the below identified challenges would lead to a significant reduction of the carbon footprint of our European food systems, primarily via a reduction of food waste generation and an improvement of the way FVC actors utilize production factors such as water, soils, fertilizers and energy resources.

Yet, given their widespread presence across EU MSs, even by acting independently on the single identified barriers, positive domino effects will be produced on the other barriers as well, leading to an intrinsic demand for change across the interlinked elements and processes that regulate the daily functioning of food systems in Europe.

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To allow the reader to contextualize the identified barrier and to grasp the key implications of keeping the barrier in the system or, reversely, remove it through corrective actions, we decided to make use of a pre-defined descriptive table where – for ach identified barrier - we describe a number of key aspects that characterize it. These elements are presented in Table 5-1.

Table 5-1 Description of elements used in the definition of the barriers to FLW prevention and reduction

FVC stage	This element describes the food value chain stage affected by the barrier.
Barrier short name	Name of the barrier identified
Type of barrier	The barrier type can be: - "legal" when the barrier refers primarily to a flaw in the legislation; - "economic" when the barrier refers to the patterns of the economic system that governs the way a FVC actor works and behaves within the food system; - "structural" when it relates more closely to the functioning of the overall system and where sub-optimal mechanisms are well-established and changing them would require a revision of a large part of processes of the current food systems
Barrier description	Here we provide a description of the key aspects of the barrier.
Current negative externalities	Here we described what are the negative effects that the barrier currently produces (externalities)
Existing examples	Whenever identified, we provide reference to empirical examples where the barriers manifests
Proposed corrective action	Here we enumerate a number of concrete propositions on what practices and adjustments could be set in place to overcome the barrier and limit its negative effects
Expected benefits	Here we provide a description of the positive transformations that overcoming the barrier through the suggested corrective action would produce
Suggested administrative level of adoption	In this section we provide a suggestion of the level of jurisdiction where the change in the legal or economic barrier should be formulated and guided. In selecting the level, we considered what would be the most effective and timely option
Existing examples of corrected externality	Wherever available, here we provide examples of countries, regional authorities or FVC actors that have already identified the obstacle as a barrier to FLW prevention and that, as a consequence, have already formulated corrective actions.
Areas that remain to be investigated	In this section we list the aspects of the barrier which we believe need further investigation to determine the dimension of the barrier, its implications for the food systems and its prevalence and interlinkages with other aspects
Further references and suggested readings	In this section we provide reference to the literature we have identified during the research and that specifically refers to the barrier described in the table. This allows the reader to have a first stepping stone to dive deeper into the literature and cases that have already been studied.

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While identifying barriers to FLW prevention and reduction, our approach has been that of focusing primarily on the top priority level of the Waste Hierarchy (Figure 5-1): prevention. In doing so, we adopted an approach where we gave higher importance to the identification of corrective measures that could significantly support the principle of waste generation avoidance before all, hence prevention. Secondly, we have identified barriers to re-use, where food items could actually be redistributed for human consumption, without a loss of nutritional and economic value. For this reason, in this exercise we have given less attention to pure FLW *reduction* initiatives as reduction would only partially mitigate the identified externalities, but not remove them. Reduction measures indeed have a limited potential in changing – rather than eradicating - system dynamics that are producing FL and FW at source.

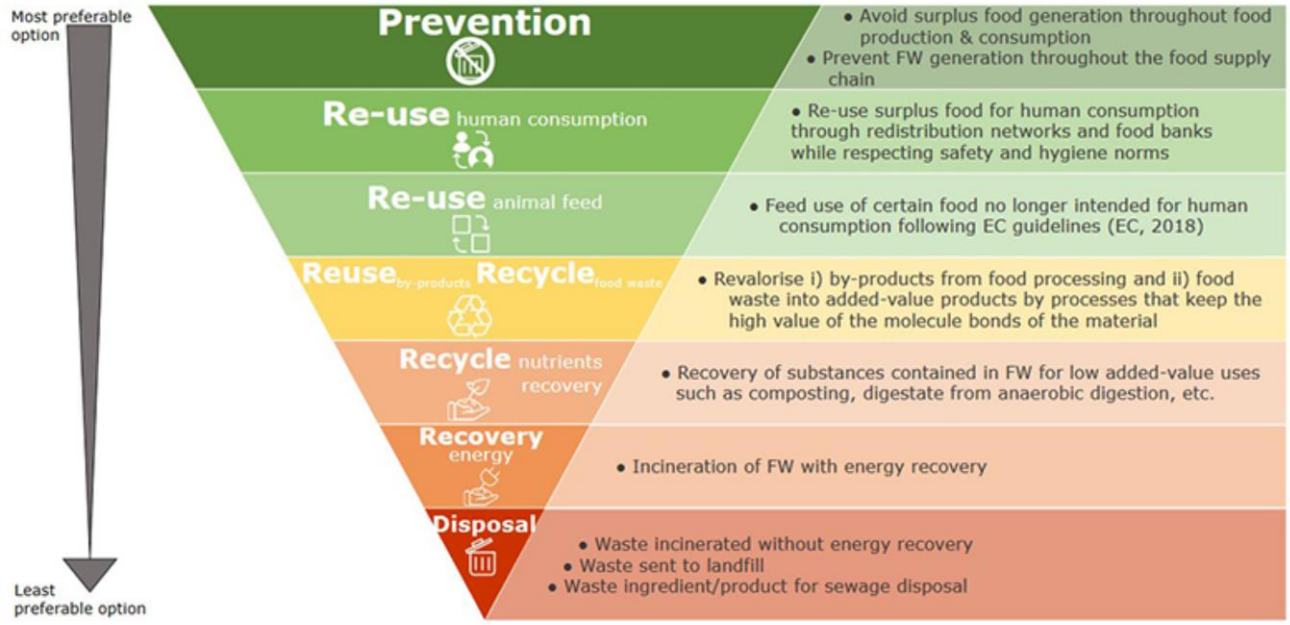

Figure 5-1 The waste hierarchy applied to food (Source: European Commission, Food Safety and food waste measurement)

Considering the diversity of actors and legislation that affects each stage of the FVC, in Chapter 6 we have analyzed barriers present at the single stage of the food value chain. These barriers are FVC stage specific. This clearer and targeted overview allows to analyze the barriers and to formulate proposition on potential corrective measures that could be set in place for specific actors of the value chain, and not for all.

On the other hand, in chapter 7 we describe the inter-sectorial barriers that are more widespread across stages, and that affect multiple actors of the food system at the same time. In fact, some of the identified barriers do affect multiple, if not all, stages of the food value chain. In this case, we enlisted them in the cross-cutting barriers, where we also provide recommendations for corrective action.

A final remark is also made with reference to existing knowledge available in literature. The EU Platform on Food Losses and Food Waste published in 2019 a report on recommended actions for the reduction of FLW. The Platform also provided advise for the different stages of the FVC. We would like to make reference to this publication as well to complement the barriers we have identified in the FOODRUS project, and/or to reinforce the urgency to act on specific drivers when the barriers identified in this report and in the one of the EU Platform on Food Losses and Food Waste are similar. The report of the platform can be accessed at this link.

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5.1 Barriers at primary production

At primary production level we do not talk about food waste, but we refer to the concept of Food Losses (FL). At this stage, for plant-based food, FL are generated either during harvesting (harvesting losses) or during post-harvest storage and distribution (post-harvest losses). A harvesting food loss would for example be a crop ready to be eaten but left on the field. A post-harvest loss would be a crop that gets damaged or rotten during storage or transportation. With reference to animal-derived, food losses at this stage may result in the loss of the entire animal during farming, or in losses of edible meat parts during in-house animal processing and butchering. This can be the result of specific pre-slaughtering processes, slaughtering techniques and/or market-driven meat selection choices. In most cases however, butchery practices are carried out in food processing establishment, in which case we already start to talk about food waste.

Figure 5-2 An intensive pig farm in Italy, source

Sources of animal food losses in primary production are diverse, covering for situations like illnesses of animals, large diseases outbreaks, premature deaths, animal mistreatment and sub-optimal living conditions in farms, low level of biosecurity in farms, commercial policies and market drivers.

In this section we discuss only a few of the legal and economic barriers that affect the primary production stage. While the information here presented is therefore not exhaustive, the aim is to shed some light on often underdiscussed structural externalities of the economic system on which a large part of European farming practices are currently based.

According to the latest food loss and food waste data collected by *Eurostat*, in 2021 primary production stage accounted for about 8.4% of food waste (food loss) generation across the entire food value chain.

The FOODRUS project has identified 7 key barriers at the level of primary production. These barriers are listed in Table 5-2.

Table 5-2 Identified barriers at primary production stage

#	Identified barriers at primary production stage
1	Legislation on infectious diseases outbreaks prevention (Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases)
2	Weak animal welfare legislation (e.g. male calves are either killed on-farm or sent to bio-gas plants when farmers are unable to place them on the meat market)
3	Use of animals for the production of animal-derived products (e.g.hens are sent to biogas plant after concluding their egg-laying cycle (industrial production)
4	Lack of primary producers influence on market price: Food price at farmgate is set by the middle-man. With no market value for the produce, products are either left on the field, or harvested and then processed into compost
5	Sub-optimal storage and cooling conditions reduces the lifetime of fruits and vegetables.
6	TBAs: Take-Back Agreements (discussed in the cross-sectoral section)
7	No common definition of food losses, difficulty in measurement of food losses

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For the primary production stage in this section, we discuss the challenges and proposed solutions for the following identified legal and economic barriers:

1. Legislation on transmissible animal diseases (Animal Health Law);
2. Animal welfare practices in commercial farming

Although relevant, there has been no time to further investigate other subjects, such for example:

a. the role played by CAP subsidies on incentivizing farmers to cultivate land without the obligation to commercialize the crops being cultivated;
b. Market power control of the wholesale and retail sector and/or intermediaries in the FVC in defining market prices at farmgate, and hence affecting the decision of the farmer weather or not to harvest specific crops for the given market price offered to them;
c. Sub-optimal storage and cooling conditions that reduce the lifetime of perishable goods like fruits and vegetables

Lastly, the topic of Take Back Agreements (TBAs) which do affects food losses in primary production (especially for specific categories of food items) but that do not regard the primary sector alone are discussed in this chapter in section 6.6 where transversal barriers that affect actors in all or multiple stages of the food supply chain are presented.

5.1.1 Legislation on Transmissible Animal Diseases

The frequency and incidence of animal diseases in Europe is on the rise. Posing a threat for transmission of the disease to humans, the affected animals are culled based on the prescriptions of EU legislation. The 2016 EU regulation on Transmissible Animal Diseases regulates – among others - the measures that Member States should take to limit the risk of spreading of animal diseases of high risk of transmission. The limits of the regulation and its negative impact on food losses at primary production are highlighted in Table 5-3 below.

Figure 5-3 Protests on preventive culling of bufala campana in Italy

Table 5-3 Eu legislation on infectious diseases outbreak

FVC stage	PRIMARY PRODUCTION	
Barrier short name	EU Legislation on infectious diseases outbreak	
Type of barrier	Legal	
BARRIER DESCRIPTION		CURRENT NEGATIVE EXTERNALITIES
Article 61 of Regulation (EU) 2016/429 on Transmissible Animal Diseases (Animal Health Law) provides for the application of disease control measures in establishments and other locations upon confirmation of category A diseases. One of those measures is the culling of animals that may be contaminated or may contribute to the spread of the disease.		With the application of this preventive measure for animal diseases outbreaks, the total number of healthy animals killed (livestock, poultry) far exceeds the number of animals actually infected. Ratio of infected-healthy animals can reach the value of 1-10, with 10 heads of livestock being killed out of only 1 infected.
Existing examples	• Brucellosis outbreaks in Bufala campana cows in Campania and Sicily (Italy): 98% of the culled buffalos cows were not infected with the disease • Swine fever in pigs (several countries across Europe)	

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	• Chicken avian influenza (bird flu) (several countries across Europe) • BTV 3 (blue tongue) diseases

PROPOSED CORRECTIVE ACTION	EXPECTED BENEFITS
➢ Reintroduce mandatory preventive vaccination programs especially when incidence of diseases or its risk is high[15]; ➢ Revise existing legislation on preventive outbreak measures to limit the culling only to sick animals. Extend quarantine and preventive health monitoring activities; ➢ Set a limit on the allowed animal density within farms (max number of animals per unit building) such that – when the law is applied – it affects a lower number of animals (the smaller the animal density, the higher the management of quarantine and the control on diseases outbreak) ➢ Set-up a more capillary system of biosecurity controls in farms and promote the use of minimum standards and good practice protocols for animal husbandry across farms	➢ Animals are more protected from diseases since an early age ➢ The size of the herd exposed to the preventive measure is reduced. Less healthy animals are culled, Farmers' income is safeguarded, especially that of small farmers ➢ Animals leave in healthier conditions, risk of cross-contamination is reduced

Suggested administrative level of adoption	EU level, revision of the Animal Health Law Regulation
Areas that remain to be investigated	1. Links between animal vaccination and degree of antibiotic resistance (in animals and humans) 2. Trade-offs of preventive vaccination programs 3. Use of phytopharmaceuticals as alternatives to vaccines (seem to be more effective and be healthier for consumers)

Further references and suggested readings

- EU legislation:
  - EU Regulation on Animal Health law, 2016 link
  - Commission Delegated Regulation (EU) 2020/687 of 17 December 2019 supplementing Regulation (EU) 2016/429 of the European Parliament and the Council, as regards rules for the prevention and control of certain listed diseases (Text with EEA relevance) (comma 35 page 5/76 referencing Article 61 of Regulation 2016/429 on preventive culling. Link
- Brucellosis outbreaks and impact on livestock and farmers' income and existence of farming business in Italy:
  - 13,000 Bufala cows culled in 2022, Italy link and link
  - Brucellosis is a public health problem in Southern Italy
- Bird flu outbreaks and culling of flocks (examples):
  - Friesland region, Netherlands, 2021: link
- On link between industrial production processes and diseases outbreaks:

[15] In the case of Bufala campana Brucellosis outbreaks, vaccination was compulsory only for buffalos younger than 9 months. The associations of local producers called for a reintroduction of vaccination schemes up to 3 years of age of the cows

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- Factory farms of disease: how industrial chicken production is breeding the next pandemic. The Guardian, 18 Oct 2021
- On animal diseases prevention and vaccination programs
  - Animal Health Europe. The need for animal diseases prevention
  - Anima Health Europe welcomes recognition of essential role of vaccination in prevention, control and eradication of animal diseases (link)
  - Animal Health Europe, FECAVA, FVE. Animal vaccines protect our shared One Health (link)

With regards to this barrier, we recommend further cross-country comparative studies in Europe to bring-up scientific evidence on the following areas of investigation:

1. In what type of farming systems the incidence of diseases outbreaks is the higher and why;
2. If there exist a statistically significant relation between the size of the farm (small-scale, large-scale) and the farming model (i.e. conventional, organic) on the one hand, and the size of avoidable food losses generated by culling on the other. This will provide insights on the relation between diseases incidence, farming practices and animal FL due to infections' spreading;
3. What is the ratio between heads of livestock/poultry being killed because of preventive culling versus the actual number of heads infected;
4. What post-mortem treatment is made of the culled animals, how are they disposed of, and if there is a financial incentive not to prevent massive culling (i.e. emergency response compensation to farmers, animal waste used for bioenergy production, etc.)?
5. What is the economic loss for farmers produced by these type of practices, and how likely these practices affect the existence of the farmers' business in the medium-run?

We believe that answering these questions will help future project research and policy makers at all levels (regional, national, European) to better understand what the real combined impact of legislation, heath living conditions, and farming practices is with specific reference to the challenge of managing animal diseases outbreaks according to current standards and procedures.

5.1.2 Animal welfare practices and commercial farming

According to Eurostat, "there were 9.1 million agricultural holdings in the EU in 2020, of which about 64% were less than 5 hectares in size" ... however …" the number of farms in the EU has been in steep decline, while the amount of land used for production has remained steady[16]." This situation is well represented in Figure 5-4 where from the last right-hand bars representing farms larger than 100 hectares, we see an increase in the number of holdings. This trend shows how Europe is rapidly losing its share of small-scale family farming to the advantages of more large-scale commercial holding. In the period 2005-2020, the loss of small-scale farms amounted to a 37% decline, equivalent to "5.3 million farms across the MSs, the vast majority of which, (about 87%) were small farms of 5 hectares or less"[17].

[16] Farms and farmland in the European Union – statistics, Nov 2022 source
[17] idem

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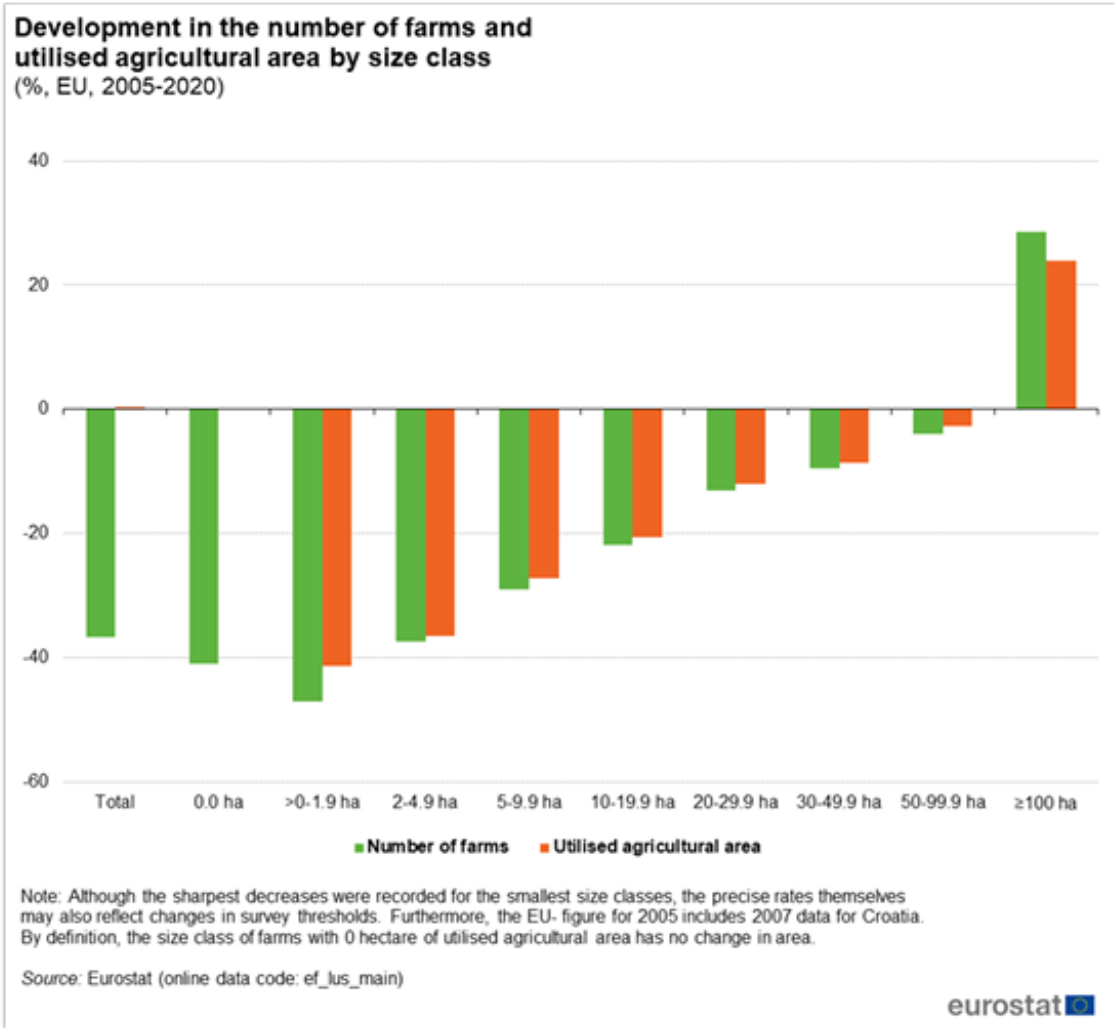

Figure 5-4 Number of farms and utilized agricultural area in Europe 2005-2020 (Source: https://ec.europa.eu/eurostat/statistics-explained/SEPDF/cache/73319.pdf)

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In the last 2 decades, we have therefore witnessed all across Europe a loss of granularity in small-scale farming with a concentration of land in the hands of larger farm holding. According to FEFAC[18], the average size of livestock farming in the EU is 34 hectares, with an average herd size of 47 livestock units. A change in the farming size (from small-scale family-run business to large-scale commercial holding) brings with it a change in farming practice, with larger infrastructural investment needing more solid financial returns from the production activities. Although a direct correlation between livestock farm size and adoption of intensive farming practices needs to be further strengthen by statistical evidence, collected evidence from multiple countries across the EU shows that animal welfare conditions and, more in general, breeding and treatment practices of animals used for meat and animal-derived products in commercial farming is, in many cases, not aligned with sustainable farming practices from an animal health perspective. In this dis-alignment, killing of healthy animals that do not have a productive role or a commercial outcome in the food supply chain results in food losses. Further description of the barrier encountered in this respect is provided in Table 5-4.

> "For the first couple of days, the calf receives its mother's colostrum, her first milk. Colostrum is rich in antibodies that are essential for the calf to develop immunity. In nature, calves drink milk from their mothers until they are 6 to 10 months old, but in the dairy industry it is normal to start feeding calves milk substitutes already when they are two days old. After all, the motivation for allowing the cow to give birth to a calf is to get her milk production going and to sell the milk."
>
> "Such low prices are the result of oversupply. Sometimes farmers are unable to find a buyer for a calf, especially if the animal is a bit lighter than average at birth or if he has been ill during the first weeks of his life. If the sale does not succeed, the calf is euthanized. A few years ago, TV program *Rambam* showed that the cadavers are then burned in a waste incineration plant and end up as 'green energy'."
>
> Extract from "The by-products of the dairy industry: three calves slaughtered every minute", by Ties Joosten

Table 5-4 Animal welfare practices in commercial farming

FVC stage	PRIMARY PRODUCTION	
Barrier short name	Animal welfare practices in commercial farming	
Type of barrier	Economic (economic model)	
BARRIER DESCRIPTION		CURRENT NEGATIVE EXTERNALITIES
In intensive farming, cases are reported where animals are used simply as productive units where productivity has to be guaranteed above certain thresholds. When this is not the case (i.e. hens for eggs production), the animal is physically removed from the systems although its health conditions would still allow him/her to, either be productive at lower productivity levels, or be used for other food production purposes.		Thousands of animals are being killed every year among calves, chickens, and other animals either because the market price offered for the meat is too low for farmers to have an incentive to rear livestock (i.e. male calves), or because productivity of the animal (i.e. egg-laying hens) is too low.
Existing examples	• Industrial egg production (DK, …): hens being sent to biogas plant after concluding their egg-laying cycle (80-100 weeks)	

[18] Source: link

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	• Dairy industry - Intensive milk production (IRL, UK, DK, NL, …): (male) calves considered as by-products of dairy industry, they are either killed on farm or sent to bio-gas plants as their meat has either too low market price, or because the calves are not fitting the market requirements of the meat industry

PROPOSED CORRECTIVE ACTION	EXPECTED BENEFITS
➢ Thoroughly review animal welfare legislation to protect the wellbeing of animals even in industrial production processes, and enforce a tight control at MS level of unethical practices at farm level ➢ Rase the existing F2F 25% target of organic farming to promote more sustainable animal husbandry practices across farmers, ensuring that organic farming does comply with ethical measures on animal husbandry ➢ Regulate the market through price control of agricultural goods to provide farmers with sufficient farm-income not to embrace price-based economies of scale production practices ○ Regulate oversupply and limit import of meat from outside the EU to provide value to domestic production ○ Reduce the power of the retail and wholesale sector in setting prices at farm-gate	➢ Farmers are no longer provided by the market negative incentives to dispose off of animals who are still productive. Animals used for human consumption receive better treatment and are not killed or incinerated when still suitable to live or to be used for the production of meat or animal-derived products. Food losses are reduced ➢ More sustainable animal husbandry practices where the animal has a value for the farmer help reduce the amount of animals lost in primary production, hence reducing food losses ➢ Farmers have a stronger role in determining market prices for their products.

Suggested administrative level of adoption	EU level, revision of exiting regulation on animal welfare (animals and animal-derived products intended for human consumption). Inclusion of better animal clauses within the existing Farm to Fork strategy. Ensure that such changes are accounted for in the upcoming Sustainable Food Systems legislative framework.
Areas that remain to be investigated	1. The extent of the identified phenomena: a. How recurrent is the practice of killing male calves in milk production farms across the EU member states? b. How recurrent is the practice of killing egg-laying hens after 100 week of life? 2. The existence of other phenomena which have not been identified in this study *3.* In general, an assessment of food losses in primary production of most commonly commercialized animals for meat production and animals-derived products

Further references and suggested readings

- Size of livestock farms in Europe
  - The actual size of European livestock farms, FEFAC
  - A collective scientific assessment of the roles, impacts, and services associated with livestock production systems in Europe (Dumont et al, 2017)
- On slaughtering of male calves in dairy industry in the Netherlands, and on price per liter of milk paid to farmers
  - Ties Joosten, 24 Sept 2022 The by-products of the dairy industry
- On slaughtering of dairy calf in Ireland:
  - Byrne et all, 2023. Trends and factors associated with dairy calf early slaughter in Ireland, 2018-2022
  - Utterly unacceptable and unlawful": Ireland's mistreatment of male calves
  - Almost 30,000 male calves slaughtered at 10 days old last year
- On animal welfare and revision of EU legislation
  - Animal Welfare: will the EU revise legislation as promised?

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5.2 Barriers at food processing and food distribution

In 2016, the EU Fusion project report *Estimates of European food waste levels* (Stenmarck A., 2016), estimated that about 19% of food waste generated in Europe in 2012 could be attributed to wastage produced during the processing of food. More recent data from Eurostat, reporting the food waste situation in 2021 across Europe, show a level of 21.4% (equivalent to 28kg/person/year) for the manufacturing of food products (and beverages), confirming the role of the sector as an important generator of food waste. Moreover, some wastage also occurs during transport and distribution, either because food gets spoiled due to bumps, or as a result of significant temperature variations during the cold chain process. These wastage results in food waste at transportation and distribution level.

During the research period of the FOODRUS project, the following 11 barriers have been identified at the level of food processing and food distribution (Table 5-5).

Table 5-5 Identified barriers at food processing and food distribution stage

#	Identified barriers at food processing and food distribution level
1	Food Safety regulation on unsafe food (if parts of the batch are defected, all batch is discarded)
2	Overproduction of bread and bakery product driven by marketing standards of the retail sector°
3	High food discard levels from industrial food processing (related to usable parts of the animal, and in terms of appearance standards)
4	Lack of market opportunities for food from upcycling technologies
5	Lack of business know-how on food upcycling technologies and options
6	Low financial support to businesses for investment in food upcycling technologies
7	Insufficient availability of qualified staff for the use of new technologies
8	Short time for the logistics related to food donation (unpack, sort, store and redistribute)*
9	Breakdown of machine lead to food being discarded (bread & bakery products, fruits & vegetables)
10	Damaged products during handling are discarded (bread & bakery products, fruits & vegetables)
11	Damaged or wrongly labelled products are discarded (all food categories)*

* These barriers are shared with the wholesale and retail sector

° This barrier is discussed in the cross-cutting barriers section 6.6

In the following section we focus on only two of the identified barriers, namely: the handling of food in contaminated batches, and the handling of wrongly labelled and damaged food items. In the case of the latter, the barrier is faced also at retail level.

Barriers 4 to 7 in Table 13 refer to the challenges faced by start-up and new businesses working in the area of food upcycling. As the analysis of business innovation models is dealt with in more details in deliverable *D4.1 Innovation catalogue of food loss and food waste valorization opportunities*, we make reference to that deliverable for the challenges and opportunities related to innovative food upcycling processes. Nonetheless, we recall here and in the conclusions chapter the very fundamental challenge that capital investment in food upcycling from the private sector should be carefully balanced with investments in food waste prevention and

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reduction, and that food waste and food surplus *should not* become a new input source for food upcycling technologies where food waste and food surplus generation can be avoided in the first place.

5.2.1 Handling of damaged and wrongly labelled food items

At food processing level, a share of food waste is produced during food labelling and the handling of damaged or wrongly labelled food items. In several cases, due to productivity constraints, business operators do not have the time to relabel or unpack wrongly labelled food items, nor to separate damaged or wrongly labelled products for other destinations. This challenge is also shared with the wholesale and retail sectors where handling of damaged and wrongly labelled food items occurs in their storage houses. Table 5-6 provides further explanation of this barrier.

Figure 5-5 Use of the "use-by" date for milk

Table 5-6 Use of labelling, handling of damaged and wrongly labelled food items

FVC stage	FOOD PROCESSING (also present in FOOD WHOLESALE and RETAIL)
Barrier short name	Use of labelling, handling of damaged and wrongly labelled food items
Type of barrier	Technical, economic, legal
BARRIER DESCRIPTION	CURRENT NEGATIVE EXTERNALITIES
➢ *Producers and food processors use a precautionary principle when labelling food items with Best Before (BB) date and Use-By date to limit their liability in case of food safety concerns raised by consumers. To avoid deterioration of company image and liability for food items that might become unsafe from a food safety viewpoint, producers prefer to set a shorter "BB" or "Use by" date than the actual one.* ➢ *Damaged products during handling are discarded (bread & bakery products, fruits & vegetables)* ➢ *Damaged or wrongly labelled products are discarded (all food categories)* ➢ *Short time for the logistics related to food donation (unpack, sort, store, redistribute)*	➢ *In several cases (i.e. eggs, dairy products), food items are labelled with BBD and UBD that are shorter than the actual applicable dates according to food safety standards. In those cases where the consumer is not educated to evaluate the food safety of a food item using other means of evaluation, safe and edible food is discarded leading to food waste.* ➢ *Damage products with altered aesthetic appearance are discarded as not compliant with shelf display policy on supermarkets. This generates food waste* ➢ *Due to time and logistics constraints, it is easier and less costly to discard wrongly labelled products rather than relabel them or redistribute them towards other actors*
PROPOSED CORRECTIVE ACTION	EXPECTED BENEFITS
➢ *Develop training and informative sessions for food operators and food producers to know how to correctly label the expiration date of food items* ➢ *Introduce the use of smart labelling systems where «BB» or «use by» dates are linked with freshness indicators* ➢ *Require W&R businesses to develop information campaigns for customers on the interpretation of date marking* ➢ *Integrate in primary and secondary schools curricula modules on Nutrition which include the understanding of how to interpret date marking*	➢ *Food producers and food operators are better informed on how to use labelling and place on the market their products with a more realistic expiration date. When coupling this action with the application of smart labelling, the combined measures will be more effective, allowing consumers to better interpret the food safety conditions of the food items.* ➢ *The combined use of smart labelling schemes would also reduce the liability burden of food processing operators, wholesale, and retailers when donating food as the food safety indicator resulting from the smart labelling would allow for more direct evaluation of the conditions of the traded items;*

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➢ *Make it mandatory for businesses in food processing to quantify, qualify (reason for dumping) and report FW figures on a daily basis (automized weight-based reporting per food category) + monitor compliance + fine non-compliance* ➢ *Require businesses to identify food donation or redistribution paths for damaged/mis-labeled food* ➢ *Introduce a scale of progressive fiscal incentives (i.e. PAYT) with higher benefits for zero-food-waste businesses* ➢ *Introduce mandatory open-access and transparent FW reporting by the food production industry, and certify businesses by performance*	➢ *The costs related to consumers' interpretation of the labels is shared with the producer. This should act as an incentive for the producer to promote a proper and safe consumption of thee item (s)he's selling* ➢ *Businesses and regulators have better information on the reason why FW is generated at this stage of the FVC, and can adopt adjustment measures to reduce FW at business and sector level;* ➢ *Business clusters can offer support to companies that face the same challenges in FW reduction/avoidance due to the same cause. This includes in-house reduction and avoidance measures on the one hand, and food redistribution options on the other.* ➢ *The use of fiscal incentives for businesses that perform well in FW avoidance should provide examples of sectoral leadership serving as best practices for other companies. With a reduction in waste taxes for businesses, companies should be incentive to invest in FW avoidance measures* ➢ *More transparent information systems towards consumers and public authorities should stimulate businesses to perform well in terms of FW avoidance to preserve their business public image*
Suggested administrative level of adoption	Regional and national level. By public administrations and by industrial clusters, via Guideline documents, Responsible Code of Conducts and similar instruments.
Existing examples of corrected externality	Having identified the difficulty of food processors and food producers in identifying the correct labelling for food items, the region of Catalunya (Spain) has included training sessions for producers to inform and teach them how to correctly label food items for consumers. This is part of the new Food Losses and Wastage Prevention Law (Lax 3/2020) that the region has adopted in March 2020.
Areas that remain to be investigated	1. *The quantification of food items discarded because of wrong labelling, wrong packaging, damages as a percentage of the overall food waste generated by the company at that level of the food value chain (food processing)* 2. *Existing company practices that addressed FW generation due to these causes and found alternatives management tools for handling of these food items* 3. *How to internalize costs of business-level FW measuring, especially for small businesses* 4. *How to make the labelling system informative and effective (In Portugal, there is a nutritional information system represented by a 3-color code (similar to a traffic light) integrated into product packaging. However, the feedback received on the tool is that people either do not look at it, do not value it, or do not understand it)*
Further references and suggested readings	
On use and application of date marking and date labelling across Europe • *ICF, 2018. Market study on date marking and other information provided on food labels and food waste prevention (link)* • *Vince S., 2014. Date labelling. Diluting Food safety indicators (link)* • *Interpretation of labelling in food items* • *EUFIC, Best before, use by and sell by dates explained, link* • *EU Regulation on the provision of food information to consumers, link*	

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The use of smart labelling system such as TTI (Time-Temperature Indicators) couples with Freshness Indicators are promising innovation technologies that can help food producers and food processors be more precise on the use of BB and use-by dates, while providing consumers more information on the status of safety of the food items they are about to purchase or consume. An example of the combined use of the use-by ate coupled with a TTI indicator is provided in Figure 7 below, based on a research study conducted by Karanth et al..

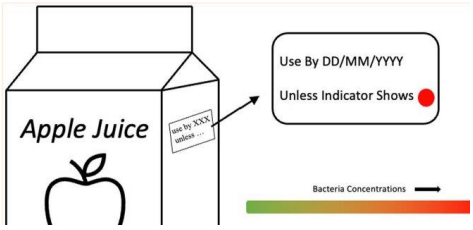

Figure 5-6 Example of TTI smart indicator (Source: Karanth et al., 2023)

5.2.2 Handling of food items in contaminated batches

Fruits and vegetables are nowadays present on supermarket shelves during all seasons of the year. When local climate conditions do not allow it, fruits and vegetables are produced in greenhouses and then transported across Europe to reach supermarkets. During packaging and transportation processes, food items can get damaged, or their quality can perish due to suboptimal storage conditions or to an alteration of the cold chain conditions during transport. As a result, food gets spoiled and can not be commercialized.

Figure 5-7 Fruit products collected in batches

Another source of food waste at processing level is the practice of discarding entire batches of food when inspections reveal some sort of contamination or deteriorated product conditions in the batch. As in the previous case, this practice also affects to some extent the wholesale and retail sector. Further description of the barrier is provided in Table 5-7.

Table 5-7 Handling of food items in contaminated butches

FVC stage	FOOD PROCESSING (also present in FOOD WHOLESALE and RETAIL)
Barrier short name	Handling of food items in contaminated batches
Type of barrier	Legal, technical, economic
BARRIER DESCRIPTION	CURRENT NEGATIVE EXTERNALITIES
Food safety regulation on contaminated food requires that if parts of the batch are contaminated, all food in the batch must be discarded	Food waste is generated from the discarding of items from contaminated butches when not all the butch contains food unsuitable for human consumption
PROPOSED CORRECTIVE ACTION	EXPECTED BENEFITS
➢ *Divert contaminated batches towards redistribution actors for further screening, selection and use of safe food shares in the batch*	➢ *Larger shares of food items are saved through the selection and separation of contaminated and non-contaminated parts of the batch. More food is available for re-use or re-processing or redistribution purposes.*

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➢ *Support the use of track and tracing technologies to apply selective selection of damaged or defected product from batches*[19] ➢ *Support the development of smart food sensing technologies to improve food safety monitoring system also for non packaged food* ○ *Financially invest in scale-testing of freshness indicators for batch items*	➢ *Smart labelling technologies help adjusting BB date and use-by date based on real product storage conditions. Retailers can take earlier action on food items that show deteriorating status, consumer benefit from more information during their purchase and consumption at home*
Suggested administrative level of adoption	Eu level for regulation on food waste avoidance (possible as part of the upcoming SFS legislative framework) Business level for the adoption of the measures
Existing examples of corrected externality	TTI (Time-Temperature Indicator) and Freshness Indicators are currently used for packaged food to detect the risk of possible food contaminations using temperature and chemical changes monitoring
Areas that remain to be investigated	1. *The application of TTI and Freshness indicators on un-packed food items* 2. *The most frequent types of contamination in specific food categories (i.e. vegetable and fruits) and the food safety risk related to these contaminants* 3. *The cost of further inspection for food safety based on the type of contaminant and the cost-benefit ratio related to the practice* 4. *Trade-offs between single packaging and plastic waste on the one hand, and prevention of contamination in food items on the other* 5. *Cost of the smart sensors technologies and benefits-cost ratio for the final price of the product and the gain in FW prevention*
Further references	
Smart food technologies for microbial detection of contaminants in food • *Karanth S. et al., 2023. Linking microbial contamination to food spoilage and food waste: the role of smart packaging, spoilage risk assessments, and date labeling (*link*)* Food Safety regulation in the EU • *Food Safety Authority of Ireland. Specific Hygiene Rules for Food of Animal Origin (comprehensive overview of EU food safety legislation per food category)* link	

5.3 Barriers at wholesale and retail level

According to the EC Fusion project report *Estimates of European food waste levels* (Stenmarck A., 2016), food waste generation at wholesale and retail level accounted for only 5% of the total FW generated in the EU-28 area in 2012. New Eurostat results confirmed that these 2 stages of the FVC accounted for nearly 7% of the total food waste generation also in 2021.

Wholesale and retail manage large volumes of food items on a daily basis. Given these large volumes, their storage and distribution systems are often very efficient. Yet, in this efficiency equation, time of delivery to a client, along with quality and price, are the most important elements of the formula. Especially in large food distribution centers, there is a tendency to reduce to the minimum any inefficiency that delays the duration of

[19] This is recommendation produced by the Dutch Association Samen Tegen Voedselverspilling in an analysis the carried out on measures for food waste prevention in the Netherlands. STV has collaborated with the FOODRUS project as a non-partner Associated Region. Full STV report is available here.

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the time factor. As presented in the previous section, time spent on pre-selection and differentiation of food items in batches with defected products is one of these externalities that currently most businesses are not able to overcome. This negatively affects the redistribution capacity of these businesses, leading to food waste generation rather than to food redistribution action. Given its widespread presence across the different stages of the food supply chain, this challenge is addressed in section 6.6.

During the FOODRUS project, 6 key barriers have been identified for the wholesale and retail sector. They are presented in Table 5-8.

Table 5-8 Identified barrier at wholesale and retail level

#	Identified barrier at wholesale and retail level
1	Date marking: use of "Best Before" date and "Use by": use of shorter expiration period to avoid liability/image deterioration in case of food safety concern
2	Little financial support for businesses donating food, so that they have to bear all costs of redistribution
3	The VAT refund on damaged food items creates a disincentive for businesses to donate food (in this case businesses cannot claim a VAT refund)
4	Unpacking food items is time consuming and costly. It is faster to dispose of the items in the residual waste containers
5	Business-led marketing standards and practices (shape, appearance, shelf 24/7 availability)
6	Insufficient logistics capacity for food donation

Barrier 1 has already been dealt with in section 6.2.1. Barriers 2, 4 and 6 relating to the support to redistribution networks and the sector of food donations will be discussed in the cross-cutting section 6.6. Barrier 5 is a well-known barrier that relates to marketing standards and on which several recommendations have already been formulated in other studies.

In this section we will focus on the fiscal incentives and disincentives related to food donations, where several examples of cases across Europe are available.

5.3.1 VAT regimes on food donations

Evidence shows that food donations are not regulated on the same level across the EU member states, and actions by FVC actors differ from country to country based on national legislation. In some countries food donations are exempt from VAT (Value Added Tax), in other countries this is not the case. Moreover, other fiscal arrangements that actually allow to recover VAT from damaged items do represent a disincentive for food donations as businesses prefer to declare the items damaged and recover the VAT, rather than donating the food items and having to pay VAT on the donated food.

Table 5-9 provides an overview of the current barriers and proposed solutions that related to the use of the VAT instrument to facilitate food donations. The barrier is presented in this section as it considerably affects the potential of food waste prevention and redistribution in retail and wholesale give the large volumes of food items traded. Nonetheless, it equally applies to the lower and upper levels of the food supply chain, namely to primary producers and to the

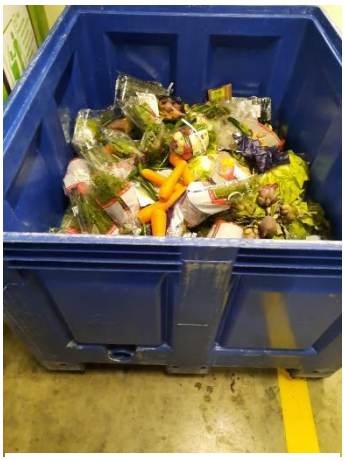

Figure 5-8 Food items dumped at a wholesale business

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HORECA sector where donations of food can also take place although in smaller volumes.

Table 5-9 VAT regimes on food donations

<table>
<tr><td>FVC stage</td><td colspan="2">WHOLESALE and RETAIL
(equally applicable to primary production and HORECA)</td></tr>
<tr><td>Barrier short name</td><td colspan="2">VAT regimes for food donations across Europe, & requirements on food donation</td></tr>
<tr><td>Type of barrier</td><td colspan="2">Legal</td></tr>
<tr><td colspan="2">BARRIER DESCRIPTION</td><td>CURRENT NEGATIVE EXTERNALITIES</td></tr>
<tr><td colspan="2">Not all EU Member States have a 0% VAT policy on food donations. In some countries, business operators still need to pay VAT on the donated food. This hampers food redistribution and puts a financial , and operational burden on businesses that are willing to donate food (e.g. Denmark)

In some other countries (i.e. Netherlands), there is a VAT refund on damaged items that can not be commercialized. Being food items one of the categories where this principle applies, the latter creates a disincentive for businesses to donate food as they would forgo the opportunity to recover the VAT according to the damaged goods policy in force in the country.

Depending on the country, different categories of food are allowed/not allowed to be donated.</td><td>In countries where VAT regimes on food donations still persist, businesses do not have an incentive to donate food.

In countries where the refund of VAT on damaged food items is allowed, businesses do not have the financial incentive to redistribute food to other organizations.

The financial burden to run operations for Food Banks that collect food surplus at local and regional level is very high. When volumes become large, the logistic effort is also high. These organizations run on donations from citizens and/or private organizations. Moreover, by collecting the food surplus from businesses in wholesale and retail, food banks help operators in this sector pay less waste taxes to the municipalities as the volume of the generated waste from the business is low. It also help them decrease their environmental footprint, reducing the amount of CO2 emissions resulting from waste, as well as their water footprint.</td></tr>
<tr><td>Existing examples</td><td colspan="2">In Denmark, when wholesale and retails donate food to the food bank, the latter pays the VAT on the items it receives. Otherwise, donating entities are not able to recover the VAT on the donated food. To overcome this barrier, when wholesale donates directly to other entities, rather than fully donating, they sell the items at lower prices to pay less VAT.

In Spain, the 167 volunteers of the Food Bank (FB) of Navarra (Navarra region) manage a volume of 4,500 tons of food items that satisfied the food needs of more than 25,500 beneficiaries in 2023. They work through a network of 188 charitable organizations (and 600 volunteers). Fix costs for the operations of the FB is around 480,000 EUR/year (70% covered through private financing, 30% through donations). Public financing for the operations of the bank is very limited.[20]</td></tr>
<tr><td colspan="2">PROPOSED CORRECTIVE ACTION</td><td>EXPECTED BENEFITS</td></tr>
<tr><td colspan="2">Enforce European/national legislation that incentivizes food donations of food surplus with full VAT recovery on donated items (applicable to</td><td>Larger volumes of food surplus are saved from dumping. More food is</td></tr>
</table>

[20] Source: FOODRUS national replication workshop proceeding, link

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all FVC operators). When food surplus is generated at the business level, diversion towards food banks should be made compulsory. A penalty (tax) for dumping food should be paid otherwise, with the tax being higher than the costs of redistribution. Review the list of food categories that can be donated and harmonize legislation throughout Europe in this respect, Develop financial schemes where operational costs of food banks (or similar entities) collecting and redistributing surplus food are covered - partially or in full – by taxes levied on businesses by public authorities (i.e. PAYT).	redistributed to people in need. Carbon and water footprint of food waste is reduced. Food Banks and similar entities have the financial means to meet their operational fixed costs, and they can broaden their operation according to the needs of the sector.
Suggested administrative level of adoption	National level for the adoption of food donation legislation. Regional level for the development of the financing scheme, based on national guidelines.

Existing examples of corrected externality	• French 2016 Garot Law against food waste in supermarkets
	  ○ Supermarkets in France are forbidden to dump food surplus and are obliged to connect with charities for food donations
	• Italian Food Donation law (Gadda Law 2016):
	  ○ Donation legislation applicable to all FVC actors, and addressing damaged and wrongly-labeled food;
	  ○ Simplification of donation procedures for donations of perishable food items with value <15k
	  ○ Possibility to donate food beyond BB and Use by dates
	  ○ It includes gleaning option
	  ○ VAT exemption from donation + full recovery of VAT from donated items
	  ○ Reduction of company taxable income (donations are not considered as a source of income)
	  ○ Coupled with educational programs in schools
	  ○ Incentivise doggy bag/family bag option at HORECA level
	  ○ (optional) reduction of waste tax for donating companies (PAYT system)
	• The Netherlands
	  ○ Corporate tax on dumped food by retailers and wholesalers

Areas that remain to be investigated	None. There is enough evidence on the action to be taken.
Further references and suggested readings	
Italian legislation on food donations: - Rossi Laura, The Italian Food Waste Policy: data and perspectives. CREA Food and Nutrition - Arianna Pia Santoro, 2020. La legge Gadda come strumento di contrasto allo spreco alimentare. Adoption of the Gadda law in the city of Turin, comparative study with other 6 Italian cities (in Italian): link French legislation on food donation: - Zero waste Europe Factsheet, France's law for fighting food waste - The Guardian, France to force big supermarkets to give unsold food to charities Challenges of food donation in Spain - Example from the Food Bank of Navarra and from the charity association Tudela Comparte: workshop presentations (in Spanish)	

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Examples of how this barrier has been already overcome come from the adoption of the 2016 Gadda Law in Italy, which builds on the Good Samaritan Law of 2003 created to facilitate food donations from the HORECA sector to Onlus associations (not-for-profit organizations) which, in turn, are considered as end-consumer. Based on this principle, the Good Samaritan Law implies the operating principle of "self-accountability" of operating bodies. The Good Samaritan law still applies in the moment that food is donated. A similar situation is detected in France, where the law promoting food donations and forbidding supermarkets to dump food was also adopted in 2016.

5.4 Barriers at HORECA level

The HORECA sector embraces all those services that offer food and meals at hotels, restaurants and canteens. This includes both private holdings like hotels and restaurants in the commercial and tourism sector, as well as all those catering services that offer public services in schools, hospitals, daycare home for the elderly and public offices' canteens.

Figure 5-9 A one-person serving portion at a restaurant in Austria

According to the latest Eustostat data, the HORECA sector in Europe was responsible for 9% of all food waste (and food losses) generated in Europe in 2021. This equates to about 12kg/person/year. Data however differ from country to country. Evidence collected through the FOODRUS project partner Biz-Up shows for example how food waste generation at HORECA level in Austria is higher than the European average. According to national statistics, in Austria around 280,000 tons of avoidable food waste are produced in large kitchens, hotels and catering businesses every year. This equates to 31.4 kg/person/year of food waste generated at HORECA level only, which is nearly 3 times the average level estimated by Eurostat for Europe. The reason for this food waste is excessive production of food serving and too large portions. This will be discussed in the next sections.

HANDLING OF UNFIT-FOR-MARKET FOOD ITEMS AT WHOLESALE LLEVEL – A CASE FROM DENMARK

In late 2015, Folkekirkens Nødhjælp established "WeFood," which is Denmark's first surplus food store. The organization's purpose for this store is to prevent food waste in Denmark and generate surplus funds for its humanitarian work.

The surplus food items will be sold by the organization at prices that, on average, represent approximately 50-70 percent of the price of regular food items in the retail sector. The surplus food items are provided to the organization by food producers, wholesales, supermarkets, and others. These are items that, for the producers and others, constitute "surplus goods," meaning items that the company would typically have to dispose of, thus representing a negative value for the company. According to the Danish tax authority's (SKAT) interpretation, food producers, food wholesalers, supermarkets, and others can sell their surplus food items to Folkekirkens Nødhjælp at a symbolic unit price per kg/ton of food and pay sales tax (VAT) based on the actual selling price of the items.

Source: collected information from Danish pilot partner Torvekoekken, September 2023

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Overall, the FOODRUS project has identified 6 key food waste prevention barriers for operators active in the HORECA sector. The barriers are listed in Table 5-10.

Table 5-10 Identified barriers at HORECA level

#	Identified barriers at HORECA level
1	Regulation for food donation is not legally binding and it is less costly to throw food away than donating it (dealt with in wholesale and retail section)
2	Food Donations: insufficient logistics infrastructure to timely capture and redistribute all food surplus (dealt with in the cross-sectoral section)
3	Government obligation to divert food waste to compost or biogas plants (dealt with in the cross-sectoral section)
4	Food Safety regulation on food donation procedures: the window for donating cooked, defrost or unpacked food is very small
5	Too large food portions in restaurants
6	Too many food items and full offer policy at hotels' canteens' buffets

Barrier 4 refers to the fact that, in most cases, based on the current food safety regulations, there is a maximum time for restaurants and HORECA operators to keep food at their once the food is defrosted or cooked. In the case of defrosting, the food can be kept and used in the kitchen for a maximum of 24 hours. After this period, the food needs to be disposed of and cannot be donated. This often poses an unnecessary limitation on the use of food products that are still apt for consumption from a food safety and food quality point of view. Similar practices are observed for cooked food of for food that has been removed from its original package and that is therefore exposed to oxidation.

In this section we discuss barriers 5 and 6 on too large portions offered at restaurants, and the management of the food offer at buffets at restaurants and canteens.

5.4.1 Excessive plate portions and food offer at buffets

One of the most frequent barriers detected at HORECA level is the oversupply of food items to clients. This can occur in different forms, either via the offer of too large one-person servings in restaurants and bars, or through an oversupply of food items in restaurants' buffets. In the former case, the food left on the dish leads to direct food waste when the food is not packed in doggy bags and brought home. In the latter case, food not consumed by customers can still be refrigerated but needs to be used or consumed within specific and strict time frames (usually 24 hours). A third source of food waste is the food surplus that does not reach the shelves of the restaurants but that remains unused in the restaurants' kitchens. This food surplus offers higher opportunities for handling and reuse, hence avoiding food waste generation. The recommendations formulated to address these sources of food waste are described in Table 5-11.

Figure 5-10 A restaurant buffet

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Within FOODRUS the Danish pilot has worked on the reduction of food waste at HORECA level with its dietary shift and nudging activities at university canteens. For a detailed description of the work carried out in Denmark, we remind to the deliverables D1.4 *Full test report* (reporting of activities in the project pilots), D1.5 *The Future of Circular Food report*, D5.4 *Guidelines on FOODRUS replication* and D5.5 *Report on replication events and replication roadmaps*.

Table 5-11 Excessive plate portions and food offer at buffets

FVC stage	HORECA	
Barrier short name	Excessive plate portions and food offer at buffets	
Type of barrier	Cultural & market-driven	
BARRIER DESCRIPTION		CURRENT NEGATIVE EXTERNALITIES
Too large food portions in restaurants Too many food items and foll-offer policy at canteens' and hotels' buffets		Served food remains on the dish and it is thrown away, generating food waste Food from buffet which is not consumed is disposed off, generating food waste Situation at restaurants of public canteens is also similar.
Existing examples	- Sweden. Studies at public canteens show how the amount of FW generation can reach up to 75g of food per serving (Eriksson M. e. a., 2017). Wasted food consisted of 64% serving waste and 33% plate waste - Many other examples available through literature and empirical studies	
PROPOSED CORRECTIVE ACTION		EXPECTED BENEFITS
Introduce the option to choose the size of the dish (with connected information on average portion weight and calories intake) for restaurant and canteens' customers. Adjust buffet offer based on monitoring of FW generation based on food categories. Associated a PAYT (Pay as you Throw) taxing scheme applicable to organic waste across HORECA sector operators, coupled with practical tools for FW prevention in restaurants, hotels and canteens.		The amount of FW per serving can be decreased by letting customers choose the size of the dish they want to buy. Food items that are most often left on the buffet are monitored and offer is adjusted accordingly. FW is avoided. An adjustable weight-based tax on organic waste production should produce a fiscal incentive for HORECA sector operators to produce less organic waste.
Suggested administrative level of adoption	Business-unit level first (for portion size and adjustment at buffets) Municipal and regional level for implementation of the PAYT system	
Existing examples of corrected externality	➢ IT: Gadda Law, 2016 incentivizing the use of doggy bags ➢ PT: Porto experience of «dose certa» (right portion) promoted by the local Waste Agency + incentives for doggy bag promotion in restaurants «embrulha». The strategy also includes tool for estimation of financial benefits generated through food waste avoidance. More info here ➢ SP: Catalunya Food Loss and Food Waste Prevention Plan: awareness raising and practice change through protocol procedures on plate portions, canteens' buffets, etc.	

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	➢ FR: Garot Law, 2016: HORECA sector operators are obliged to offer doggy bags if customers ask for it
Areas that remain to be investigated	None. There is enough evidence on the action to be taken.
Further references and suggested readings	
• EU Food Law Regulation - General Food Law Regulation EU, link • On Food Waste generation in the HORECA sector: - Matzembacher et al., 2020. Consumer's food waste in different restaurants configuration: A comparison between different levels of incentive and interaction, link - Germany: Leverenz et al., 2020. What influences buffet leftovers at event caterings? A German case study, link - Sweden: Eriksson et al., 2017. Quantification of food waste in public catering services – A case study from a Swedish municipality, link - Finland: Juvan E., et al, 2021. Drivers of plate waste at buffets: A comprehensive conceptual model based on observational data and staff insights. link - Denmark : Shrestha P., 2016 Food Waste in Danish Restaurants. Aalborg University link • On Prevention of Food waste in the hospitality sector - Spanish practical guide to reduce food waste in the catering sector, link - WRAP, Preventing food waste – Key legislation in the hospitality and food service sector, link	

For further reference to the functioning of the Pay as You Throw (PAYT) scheme, reference is made to the FOODRUS Briefing on Fiscal Instruments available in Annex B of this report.

5.5 Barriers at end-consumer level

Based on the latest 2022 reporting data, Eurostat estimates that about 53% of the overall food waste (and food losses) generated across the whole food value chain in the EU are produced by consumers. This equates to an estimated share of 70kg per person per year of food that European citizens – on average – throw away at home. On a daily basis, this translates in 192 g of food thrown away every single day.

These data are based on best estimates of European Union Member States, but it needs to be recalled that there is still a wide range of uncertainty on the database with countries not able to report data on time, and estimates on small samples being extrapolated to national level. Therefore, while considering these data as provisionary, the shar of food waste produced at household level is still considerable.

A multitude of studies and reports have analyzed the challenge of food waste generation at end-consumer level while FW figures remain unfortunately high. For this reason, we decided not to investigate this field further, but rather focus on the drivers of food losses and food waste generation across the other stages of the food value chain. This to provide a balance in the focus of policy makers towards addressing the FW challenge at sectorial level, and to provide decision makers with a wider base of information on the various drivers at play that currently generate food losses and food waste.

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6. Cross-sectoral legal and economic barriers to food losses and food waste prevention

This section collects all the food losses and food waste prevention challenges that the current set-up of the food value chain across Europe is causing on multiple levels of the food value chain. We report here challenges that have been identified across multiple FVC stages, and that in most cases affect multiple food categories. While being unable to verify if these challenges are present in each European member state to the same level of depth, we found evidence of the existence of these barriers in multiple countries across Europe. This is for us a large enough evidence that the challenges identified are representative of general trends across food sector actors in Europe.

As in the previous sections, we recall that the list of identified cross-sectoral barriers is not exhaustive. Table 6-1 provides an overview of the challenges at stake.

Table 6-1 Cross-sectoral barriers to food losses and food waste prevention and reduction

#	Identified cross-sectoral barriers to food losses and waste prevention
1	Food waste collected with its packaging is not considered food waste, and therefore it does not need to be measured (1501 European Waste Code)
2	Lack of a mandatory, well-established and harmonized FW quantification and reporting system which FVC operators at all levels of the FVC are obliged to comply with
3	Lack of inspections and fining system on FW generation by FVC operator
4	Oversupply of bread and bakery products, and fruits and vegetables at retail level. Take Back Agreements (fruits & vegetables, bread, milk)
5	No mandatory regulation on food surplus management to avoid food dumping[21]
6	Lack of investment, human and technical capacity for food surplus redistribution logistics (food donations management)
7	Conflicting food waste prevention and green energy policies. Government subsidies to green energy/biogas plants, and government obligation to supply food waste to composting or biogas plants
8	Lack of general knowledge by FVC operators regarding the impact of food waste
9	Weak transparency and control over food prices across the food value chain
10	Complex & long food value chains, industrial food processing and strict marketing standards

[21] Some exemptions apply, i.e. France

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6.2 Weak mandatory, well-established and harmonized FLW quantification and reporting system for all FVC operators

The Food2030 Pathways for action report already highlighted the importance of supporting a EU-wide measurement and reporting obligations both at the level of individual business and organization across the food value chain, as well as at the industrial sector level across countries and regions, and across different waste streams[22]. This to be able to better identify the sources and types of food waste, to act upon it in a tailored way.

EU-level transitioning towards a wider and tailored monitoring of food waste is, however, in the making. This came with the adoption of the EU Delegated Decision 2019/1597 and the subsequent Commission implementing decision (EU) 2019/2000 of 28 November 2019 laying down a format for reporting of data on food waste and for submission of the quality check report in accordance with Directive 2008/98/EC of the European Parliament and of the Council. As we describe in Table 6-2 below, current measurement and reporting requirements do not allow yet to gain a comprehensive and representative picture of the FL and FW situation in Europe. This is further explained in the table.

To testify the level of uncertainty that still characterizes our understanding of the dimension of FLW generation in Europe, across the FVC stages, and across the member countries, we report below a snapshot of the results of the data collection from the first mandatory reporting exercise on Food Waste generation in Europe (Figure 6-1). In this case, data refer to the 2020 situation, for which MSs had time to report till June 2022. The report on the 2020 data is available here, and the metadata are accessible via the links provided on the webpage. To access the latest food waste monitoring data, the latest inventory referring to the year 2021 is available at this link.

[22] Source: Food2030 Pathways for Action, October 2020

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Table 1: Food waste by sector of activities, 2020
(tonnes of fresh mass)

	Total food waste	Primary production	Processing and manufacturing	Retail and other distribution of food	Restaurants and food services	Households
EU (¹)	*56 986 019*	*6 194 107*	*10 148 682*	*4 117 511*	*5 292 718*	*31 233 000*
Belgium	:	:	:	:	:	:
Bulgaria	596 844	228 472	156 435	15 708	14 375	181 854
Czechia	*972 445*	27 022	100 339	*64 394*	*37 941*	*742 749*
Denmark	1 286 488	66 452	596 599	99 500	62 544	461 392
Germany	10 922 321	190 203	1 612 505	762 352	1 860 980	6 496 282
Estonia	166 513	23 612	31 622	19 976	10 739	80 564
Ireland	770 316	70 413	219 453	60 894	178 507	241 048
Greece (¹)	2 048 189	*372 204*	375 158	*150 472*	*220 032*	930 323
Spain (¹)	4 259 232	*845 620*	1 419 257	*348 219*	*211 410*	*1 434 726*
France	9 000 000	*1 059 000*	*1 926 000*	*800 000*	*1 096 000*	*4 119 000*
Croatia (¹)	286 379	*40 916*	9 866	4 180	15 072	216 345
Italy (¹)	8 650 456	*1 270 638*	510 018	343 535	*193 915*	*6 332 349*
Cyprus (¹)	*354 021*	*43 564*	*169 706*	*50 268*	*27 145*	*63 338*
Latvia	:	:	:	:	:	:
Lithuania	*382 665*	*81 202*	*28 057*	*27 342*	*4 495*	*241 570*
Luxembourg	92 580	7 384	10 692	8 525	8 739	57 240
Hungary	905 068	16 587	187 391	41 952	19 331	639 806
Malta	:	:	:	:	:	:
Netherlands	2 811 000	*463 045*	*1 031 407*	*209 805*	*83 035*	*1 023 708*
Austria	1 211 534	13 879	173 734	84 326	201 956	737 639
Poland	4 002 099	670 547	544 942	320 396	190 293	2 275 921
Portugal	*1 890 712*	*101 384*	*61 719*	*214 233*	*237 486*	*1 275 891*
Romania	:	:	:	:	:	:
Slovenia	143 570	93	10 757	15 290	42 666	74 764
Slovakia	455 587	71 889	4 113	15 825	7 110	*356 650*
Finland	641 258	48 011	162 278	57 555	77 914	295 500
Sweden	*905 000*	*22 000*	*53 000*	*97 000*	*98 000*	*635 000*
Norway	769 967	162 158	29 088	61 281	97 547	419 893

(:) not available
Figures in italic are estimates
(¹) Definition differs in some figures

Figure 6-1 EU-level food waste data reported for 2020 in Europe (Source: Eurostat , 2022)

For the 2020 data, we have analyzed the statistics contained in the table and we have identified 3 main causes of uncertainty in the reported data. These are highlighted with three different colors as follows:

I. yellow highlight: 10 out of the 27 EU member states reported estimated data. In terms of population, these 10 countries accounted in 2020 for 54% (or 240 million inhabitants) of the EU total population;
II. pink highlight: 5 countries (113 million inhabitants) applied different boundary conditions and food losses and food waste definitions to provide the estimated data;
III. green highlight: 4 member states (33 million people, equivalent to 7% of the Eu total population), provided no data or were in the impossibility to report

We believe this provides sufficient empirical ground to justify the barriers and the suggested steps for improvement of legislation described in Table 6-2. The reflections on the unreliability and non-representativeness of data collected through the current methods is also relevant for the considerations made

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in Table 6-3 in the next section where we reflect about animals mortality rates and therefore food losses at primary production related to intensive farming systems.

Table 6-2 Weak comprehensive and harmonized monitoring framework for food losses and food waste quantification

FVC stage	ALL FOOD VALUE CHAIN STAGES
Barrier short name	Weak comprehensive, harmonized, capillary monitoring framework on food losses and food waste
Type of barrier	Legal and structural barrier
Reference legislation	The above mentioned barriers are referring to the following Guiding document of the European Commission: Eurostat, Guidelines on reporting of data on food waste and food waste prevention (version June 2022). These guidelines in turn refer to related Commission decision, namely: Commission delegated decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste; Commission implementing decision (EU) 2019/2000 of 28 November 2019 laying down a format for reporting of data on food waste and for submission of the quality check report in accordance with Directive 2008/98/EC of the European Parliament and of the Council

BARRIER DESCRIPTION (each barrier is described in a separate row)	CURRENT NEGATIVE EXTERNALITIES (externalities are presented for each barrier separately)
Definitions: a. Misleading use of terminology: alternative use of the term "food waste in primary production" when actually referring to "food losses in primary production"	*a.* The use of the term "food waste" while referring to food losses in primary production is misleading. In current efforts to distinguish and determine a boundary condition between food losses (FL) and food waste (FW) the current terminological framing used by Eurostat produced confusion for FVC operators who are asked to quantify the two elements.
b. In relation to the definition of "food" to determine what is the food waste to be quantified, Eurostat provides the following clarification: *"food must not include … live animals not placed on the market for human consumption, plants prior to harvesting (also for the case of plants not harvested for economic reasons), …" (General Food Law Regulation (regulation (EC) 178/2002, namely GFLR) (Eurostat, June 2022) (p 7 of 45)* c. Food waste measurement does not include losses at stages of the food supply chain where certain products have not yet become food (for instance, not harvested crops or animals killed due to zoonosis) (idem, p8 of 45)	a. Referring back to the barriers identified in section 6.1 in the primary production level, use of the definition as reported in paragraph b on the left excludes animals meant to be placed on the market, but not yet placed on the market, from entering the quantification assessment for food waste (food losses). Taking the example of the bufala campana reported in section 6.1, this is an important flaw in the guideline document and in the legislation to which the guidelines refer to as the farmer was raising the cattle for uses of animal by-products intended for human consumption (preparation of "mozzarella di bufala"). The loss of the animal because of zoonotic disease is for the farmer an economic loss represented by the forgone opportunity to have the cow producing milk for cheese production. In a similar way, "plants not harvested for economic reasons" excludes crops (i.e. salads) left on the ground from being quantified as food losses in the case of i.e. change in contractual terms or market prices when the salad has been cultivated by the farmer with the scope to be placed on the market. As in the case above, we reckon this definition erroneous as it excludes from the food waste (food losses)

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	quantification methodology animals or crops that were meant for human consumption and that would have entered the market and became marketable products should health or market conditions have been different.
d. Food waste measurement does not include: … food waste residues collected within packaging (code '15 01 — Packaging including separately collected municipal packaging waste) (idem, p8 of 45)	Also in this case, the limitation of not considering food waste a food that is discarded with its own packaging limits a fair quantification of food waste. The fact that the food was meant for human consumption and has not been used for this purpose should suffice to include discarded packaged food in the food waste quantification.
e. The objective of the data collection is to identify the sole component of food waste related to the products that entered the human food supply chain. Products usually traded as food but that never entered the human food chain, such as: – products that did not meet the requirements for becoming food e.g.: food losses resulting from plants affected by mycosis, animals affected by zoonosis or epizootic diseases, whose final destiny is usually incineration (excluded from WFD) – animals treated with specific medicaments and not anymore admitted for human consumption (idem, p8 of 45) are excluded from food waste reporting or food waste prevention reporting.	As in the previous cases, we defend the opinion that whenever food is cultivated for human consumption and meant to be placed on the market, or usually placed on the market as animal or animal-derived product it should be considered food waste (or food loss) when it eventually is not placed on the market or consumed for this scope, whatever the technical, commercial or legal reason behind the un-accomplishment of its destination is.
f. As a general principle, Commission Implementing Decision (EU) 2019/2000 excludes from the definition of food (and therefore the accounting as food waste generation), any amount arising from products excluded by the precautionary principles stated in the laws concerned on human health and consumers' interest in relation to food. Those amounts must never be reported as food waste (idem, p9 of 45)	Please see considerations made at point a. and point d. above
Methodology and representativeness: g. The Eurostat Guidelines require MS to report FW for each stage of the FVC according to measurement method described in Annex III (direct measurement)	The current requirement for reporting of waste data at FVC stage level requires MSs to observe minimum quality requirements (p. 13 of 45) as e.g. the requirement on a representative sample. It is however at the discretion of the single MSs to apply the statistical metrics defining what the size of a representative sample should be in their own situation, leading to a high degree of heterogeneity in the collection of presentative data, not only at FVC stage level (i.e. primary production), but also at stage sub-level (i.e. horticultural products). "Dimension of the economic activity": (p 13 of 45) this is another descriptive requirements that leads room to interpretation. "Dimension" here could be interpreted in terms

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	of revenue generated by the sector (which depends on the value intrinsic to the food items, and which is subject to price fluctuations in time determined by market forces) or could be interpreted in terms of employed workforce. It could also be interpreted in termsn of "resources consumption" in terms of input use or in terms of its environmental footprint. More clarification on
Accountability: h. while prescribing a monitoring framework, at present there are no stringent prescription on accountability for the data being reported, with no supra-national control system on the reliability and accuracy of the reported data	Without a supranational system of control on compliance with the reporting requirements and the quality requirements on data collection and reporting, the current level of quality of data reported to Eurostat is of low quality

PROPOSED CORRECTIVE ACTION	EXPECTED BENEFITS
1. review the definition of food waste and make clear the distinction with food losses; 2. include in the definition of food (and food losses, and food waste) all the categories of food currently excluded (i.e. animals and plants that did not enter the market of food for human consumption, packaged food, animals affected by zoonotic diseases, etc.). Revise definition of food, food losses and food waste according to the considerations made above on the current externalities. 3. Provide more detailed guidelines in relation to the sampling methodology and the minimum sampling size quantifying the minimum threshold requirements for direct data measurements to be collected. 4. Make data collection and reporting method compulsory for each actor of the FVC, with minimum requirement on data reporting on a rotating basis (i.e. while MS reporting to Eurostat is mandatory at least every 4 years, a FVC operator should be obliged to measure and report on its FL/FW data every other year, or every 3 years, on a rotating basis). 5. Developed easy to use digital reporting methods for FVC operators, where reporting is standardized across the EU MSs and where data are collected first at regional level, and then aggregated at national level. Define this reporting system in such a way to allow to differentiate and analyze FL and FW data for sub-categories within the same stage of the FVC (i.e. hotels separate from public service canteens, or tomato growers separately from peach growers). 6. In order to understand possible drivers and interlinkages with other sectors, it is fundamental to understand what the current final destination and treatment of the food waste is. On the one hand, this helps to understand how much of the FW generated actually contributes to composting and is directed to organic waste treatment. On the other, such data will help to shed light of what shares of FW are used for green energy production, and which other uses are currently not accounted for. This exercise will also help to understand what are the shares of food waste that could potentially be exploited for food upcycling technologies, and monitor the FL and FW flows across time. We therefore suggest to make the filling of the questionnaire formulated by Eurostat compulsory to all FVC operators, and to include in the questionnaire questions on the final treatment and destination oof the FW. 7. Develop a supra-national control mechanism on the data being reported by member States to ensure compliance with reporting standards, and harmonization of data, while providing MSs the needed support in capacity	Generalized improvement on food losses and food waste quantification methods; Identification of sector-specific or country-specific hotspots or good practices. Facility in identifying inter-sectoral collaborations for reduction of FL and FW. Better allocation of funds for FL and FW reduction to sectors that need it. Better understanding of the drivers of FL and FW.

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building for data collection, analysis, monitoring and reporting where capacity from the MSs is not adequate or insufficient	
Suggested administrative level of adoption	EU level – revise and correct regulations and directives where: - a provision of the "food" term is provided - a definition of what "food waste" is - the use of the term "food waste" is used in place of the term "food losses"
Existing examples of corrected externality	There has been no time to analyze cases in this respect, but we report the following regional and national initiatives where some of the points highlighted above have been partially address through legislation: - Regional government of Catalunya: Action Plan for the Prevention of Food Waste in Catalonia - France, Loi Garot, 2021. Proposition of law text
Areas that remain to be investigated	n.a.
Further references and suggested readings	
- European Commission, 2020. Brief on food waste in the European Union, link - European Parliament Briefing. Reducing food waste in the European Union, link - European Court of Auditors. Report on Food Waste Prevention 2016, link - JRC, 2019. Assessment of food waste prevention actions - Regional government of Catalunya: Action Plan for the Prevention of Food Waste in Catalonia - France, Loi Garot, 2021. Proposition of law text	

Improving current legislation on the level of detail described in Table 6-2 above would help the EC and national government dealing with food waste prevention to identify more targeted action on which categories of food, and for which operators it is more urgent to intervene. Availability of data at EU level , using the same methodology, would also mean allowing a cross-country comparison both at the level of the specific food value chain (i.e. salmon), and at the level of operators within that food value chain. This has the potential to considerably increase the effectiveness of reporting by developing more targeted intervention action, and also by identifying and replicating best practices.

Such a mandatory quantification and reporting system AT FVC OPERATOR level will allow for:

1. Better understanding of how much it is being wasted
2. Where to intervene
3. Develop cooperation action across FVC operators in the same FVC stage across regions and countries
4. Develop more targeted instruments and tools to help reduce/eliminate food waste

6.3 Complex and long food value chains, industrial food production and strict marketing standards

In this section we decided to couple under a single barrier three coexisting and tightly interlinked elements, namely:

- The existence and widespread diffusion of complex and long food value chains;
- The presence of diffused, resources-intensive, high-productivity type of food systems;
- The use of strict marketing standards in large distribution chains and retailers

Both individually and taken together, these 3 practices generate food losses and food waste across different stages of the food value chain. These 3 elements, the challenges they pose and the alternative practices that offer more sustainable solutions against food waste are described in more detail in Table 6-3.

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Table 6-3 Complex and long food value chains, industrial food processing and strict marketing standards

FVC stage	ALL FOOD VALUE CHAIN STAGES
Barrier short name	Complex and long food value chains, industrial food production and strict marketing standards
Type of barrier	Economic (market model driven)

BARRIER DESCRIPTION	CURRENT NEGATIVE EXTERNALITIES
Long food value chains allow consumers to find products of different seasons all year round on offer in supermarkets. They use intensive production systems that rely on economies of scale for production and commercialization of their product. This economic model calls for high crop yields, and high intensity fish or meat production, relying on large scale resources-intensive production systems. In these models revenues are made primarily on the quantities and volumes being trade rather than the quality of the product being commercialized. Long value chains are governed by a multitude of actors, from producers, to traders, middleman, wholesale, distributors and retailers. Throughout the move of food items from one actor to the other, the price of the good sold at farm-gate is progressively incremented. Intensive farming systems in Europe supply a large share of the meat, fish, vegetables and fruits that we can find today in large supermarkets. When specific to animal farming, intensive farming can also be termed as *factory farming.* These products are often subject to high marketing standards set by retailers which have the right to refuse supplies when the food items do not reach a specific weight, size, shape, consistency or color of the product. Lastly, given the many actors involved in the process, it is more complex to monitor variation in the quality of food and to quantify FW over long haul as compared to short hauls.	For the specific farming practices they operate, intensive farming systems are characterized by considerable volumes of food losses and food waste. For animal-based farming (i.e. salmon, broilers, pigs) mortality of the animals is on the rise owing to rapid diffusion of parasites, and diseases on the one hand, and on poor health conditions during rearing. Stocking density (density of animals per square meter) and overcrowding (are among the key drivers at the heart of the diffusion of diseases, parasites but also one of the main causes of injuries and attacks of animals among each other. In these cases, food losses and death of the animals result from the farming practices that are adopted by farmers in their production systems. Moreover, in food system that are characterized by long food value chains relying on intensive farming, end-consumers pay high prices, primary producers are paid low prices, and actors in-between make most of the gains. Long-haul food supply chain also have a high environmental footprint, for the soil and water resources they use, for the fertilizers and pesticides that are applied, for the environmental pollution and environmental degradation they cause, and for the high costs of transportation, both in terms of energy use and in terms of carbon emission footprint. Food losses and food waste also occur during transportation, with animals suffering stress and injuries during the long transits, or with fruits and vegetables deteriorating or getting damaged as a result of variations in the cold chain during transport, or for damages due to bumps.

Existing examples	High mortality rates in Salmon Farming in Europe (see references below) Mortality of broilers in intensive farming (see references below) Mortality of piglets in Europe in the range of 15-25% (see reference below) Austria: failure to meet marketing standards in Austria is estimated to produce more than 50% of overall food losses at primary production level[23]

[23] Information collected through Biz-Up, the FOODRUS partner Associated Region in Austria

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<table>
<tr><td>PROPOSED CORRECTIVE ACTION</td><td>EXPECTED BENEFITS</td></tr>
<tr><td>1. Limit the expansion of intensive-farming system
2. Set in place a capillary system of animal welfare controls and fining systems across the EU MSs
3. Introduce a mandatory system of food losses quantification at primary production stage (including distribution). Such a system should result from a combination of self-declarations and external independent controls (this action links to the aspects discussed in Table 6-2).
3. Promote consumers' reliance on short value chains and promote the diffusion of Alternative Food networks (AFNs)
4. Include in food public procurement requirements the priority rule on sources of food where animal welfare practices are respected, social and ethical criteria about labor practices (fair wages, regular employment) are guaranteed. PP rules should be set in such a way that they promote the purchase of food from those farmers or farmers' association where there is proof of actions being taken against FLW generation.</td><td>Food losses at primary production stage are limited by acting on the farming practice that produces these food losses.
Food losses at production stage, and food waste are avoided by relying on a different production system where there is a closer producer-end-consumer relationship based on the quality of the product, on social values related to the social component of famers' fair income and employment opportunities and, above all, on farming principles where animals are not solely considered as productivity machines, but are reared for human consumption in the respect of animal welfare norms.
In AFNs, the value of the food is placed on its quality and nutritional properties. Aesthetics and appearance market standards are not the primary criteria for selection and purchase of food items by consumers (especially applicable to fruits and vegetables).
AFNs also have a lower carbon footprint as they rely on local commercialization routes, and on a more direct producer-consumer relations.</td></tr>
<tr><td>Suggested administrative level of adoption</td><td colspan="2">National level (if having a faster legislative approval procedure) or European level through aa regulation.
Single businesses have the option to shift their production system towards more sustainable farming practices regardless of the prescriptions provided at national or European level</td></tr>
<tr><td>Existing examples of corrected externality</td><td colspan="2">Development of Alternative Food Networks which rely on more sustainable farming principles and practices. These AFNs often promote short food supply chains.</td></tr>
<tr><td>Areas that remain to be investigated</td><td colspan="2">- Comparative studies across Europe on the generation of animal food losses in primary production based on the type of the farming systems adopted
- Capillary quantification of the animal and plant-based food losses and waste (per food category, and per source of waste) that are diverted towards bio-gas and bio-energy plants. Total volumes per month.</td></tr>
<tr><td colspan="3">Further references and suggested readings</td></tr>
<tr><td colspan="3">On broilers farming and statistics:
- The Better Chicken Commitment EU Broiler Chicken Welfare
- Van Limbergen et al., 2020. Risk factors for poor health and performance in European broiler production systems, link
- Chauvin et al., 2011. Factors associated with mortality of broilers during transport to slaughterhouse. Link
High mortality rates in Salmon Farming in Europe:
- Higher salmon mortality in Scotland in 2022 link
- Mortality in Norwegian Atlantic salmon farming in 2019, link</td></tr>
</table>

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- 15% mortality rate in Norwegian fish farming in 2022, link

On pigs mortality and statistics in Europe:
- EU PiG, EU Pig Innovation Group TEchnical Report Precision Production, link

On Alternative Food Networks :
- Goodman et al., 2012. Alternative Food Networks Knowledge, Practice, and Politics, link
- Barbera and Dagnes, 2016. Building Alternatives from the Bottom-up: The Case of Alternative Food Networks. Link
- Laginova et al, 2023. Organizational Models of Alternative Food Networks within the Rural–Urban Interface. Link
- Open Food Networks. Link

Looking at the challenges posed by long haul food supply chains from a sustainable food systems perspective that goes beyond the sole quantification and reduction of food waste and food losses, some of the most critical points of the economic model described in Table 6-3 can be enumerated as follows:

a. it takes longer time for the product to reach the table of the final consumer from the production site, due to the time requirements for transportation. During this period, products have higher probability to deteriorate and/or contaminate other products in the same butch as compared to systems where the supply of the product to the end consumer is swifter and occurs within a shorter period of time;
b. the final price of the product accounts – among other factors - for the transportation costs, and for the profit that the wholesale and retails earn. In these models, the price that the farmer is paid for his/her product is lower than the price that the farmer would be paid had he/she sold directly to the consumer through short food supply chains. Nevertheless, the general lack of transparency in price composition of food products offered to retailers does not allow the end consumer to evaluate these differences;
c. driven by the will to increase his/her income based on the volumes of food that he/she can sell, the farmer is encouraged to stimulate crop productivity or the productivity of animal rearing. For plant-based food, this is often associated with an increase use of pesticides and fertilizers which on the one hand affect the quality of soils and water systems, on the other affect the healthiness of the product being farmed. For animal-based products, higher farm size often associates with higher animal concentration (for both fish and meat products), with higher exposure of animals to diseases, lower animal welfare conditions, and therefore higher food losses at primary production.

The new EU regulation on food waste prevention and monitoring, the increasing consumers awareness on the importance of healthy and sustainable food, and the growing efforts of some public authorities to reduce food waste generation are giving rise to a wave on new social innovation models that often incorporate circular economy principles in developing solution for a food waste-free economy. The growing relevance that alternative food commercialization channels like Alternative Food Networks gained in recent years is helping to change the relation of consumers and sensible food businesses with food, its commercialization and its production and purchasing patterns. The concept of alternative food networks "*emerged in the 1990s, as a reaction against the standardization, globalization and unethical nature off the industrial food system. Common examples include community supported agriculture (CSA), farmers' markets, fair trade, urban agriculture, specialized forms of organic agriculture, direct farm retail, and the slow food movement. AFNs seek to diversify and transform modern food provisioning by connecting ethical producers and consumers in more local, direct ways. They build on an ethics of environmental sustainability, social justice, and animal welfare*" (Edwards, 2016). Alternative food networks are commonly defined by attributes such as the spatial proximity between farmers and consumers, the existence of retail venues in the form of, e.g. farmers markets and community supported agriculture and a commitment to sustainable food production and consumption (Jarosz, 2008).

The public support and empowerment of such systems, promote a shift towards more localized production and consumption circuits, investing in the quality and nutrition properties of the product, along the social and

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economic values attached to this form of production. As a result, a closer bond between consumers and producers is formed and, households at the same level as producers, recognize the value of food and, as a consequence, avoid patterns that lead to the production of food losses and food waste. Thanks to the closer connection between demand and supply, farmers that sell their products on short circuits are able to tailor their offer based on consumers' requests, and this reduces the amount of surplus food that remain unsold.

At the same time, the increasing focus on reinforcing short food supply chains has also helped to re-assess the relevance of food marketing standards used in traditional food distribution systems. This reassessment allowed fully edible products that did not fulfill large retailers aesthetic appearance criteria to find a new market via short food supply chain where other purchasing criteria are more valued.

6.4 Take Back Agreements and retailers market power

Take Back Agreements (TBAs) are legal deeds between a buyer and a supplier where products are sent back to the suppliers in a number of given conditions set in the agreement. These legally binding clauses refer to the handling of unsold items at retail level and their management. Based on the TBAs, retailers are entitled to send back the surplus food to the producer, either in relation to their approaching expiring date, or for causes that relate to the quality of the products. Once the products are returned to the suppliers, these are left with surplus food which, in most cases, are unable to place back to the market. As a consequence, this practice generates considerable amounts of food waste.

> Take Back Agreements
>
> "A food supply chain system where the direct costs of waste management or incentives for waste reduction are separated from the organization responsible for generating the waste poses a significant risk factor in food waste generation and is therefore a potential hotspot for waste-reducing measures"
>
> Ericksson M. et al., 2017

A study conducted by Ericksson and colleagues in 2017 analyzed the influence of Take Back Agreements on food waste generation between food suppliers and the retail sector in Sweden. In their article they analyze TBAs for the milk, bread and fruits and vegetables sectors. The study concluded that the bread sector is the one where most waste is produced as "the retailer only pays for bread that is sold and any bread left unsold three days before the best-before date is returned to the supplier. For fresh fruit and vegetables, only goods of 'inadequate' quality are returned, but supermarkets have sole rights of determination on quality, posing a risk of" freely and univocally "categorizing unsold fruit and vegetables as inadequate quality and returning them to suppliers. In the case of milk, suppliers take back unsold items, but only for waste management" (Eriksson M., July 2017). In the author's word, "the trend found in this study was that bread had the highest waste, and the most extensive take-back policy. Fresh fruit and vegetables had medium levels of waste, partly due to unverified rejections, while milk had a very low level of waste combined with an even lower level of rejections" (idem). In the study oof Ericksson and colleagues, researchers concluded that "a food supply chain system where the direct costs of waste management or incentives for waste reduction are separated from the organization responsible for generating the waste poses a significant risk factor in food waste generation and is therefore a potential hotspot for waste-reducing measures" (idem).

Table 6-4 shows in more details the challenges posed by TBAs while enumerating a number of proposed actions to overcome this barrier.

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Table 6-4 Tack Back Agreements and retailers market power

FVC stage	ALL FOOD VALUE CHAIN STAGES	
Barrier short name	Take Back Agreements (TBAs) and retailers market power	
Type of barrier	Legal (TBAs) and economic (retailers' market power)	
BARRIER DESCRIPTION		CURRENT NEGATIVE EXTERNALITIES
Take Back Agreements are contractual agreements between buyers and suppliers where products are sent back to the suppliers in a number of given conditions set in the agreement. These conditions are often unfavorable to the suppliers who have to bear the financial burden of receiving back the surplus or discarded food, and manage its treatment and disposal even if the product they supplied in the first place was requested by the buyer, was of good quality and was complying with food safety standards. Marketing and competition policies of large retailers ask for full-shelf supply of food products in supermarkets. Among these products we find bread and bakery products, fruits and vegetables. When the products are not sold, or do not comply with the clauses of the TBA, these products are sent back to the supplier who is left to deal with its final management. This generates food waste. For packaged products, TBA application intrinsically related also to the use of "best before" and "use by" dates.		TBAs allow retailers to apply a "full shelf" policy at stores which generated food surplus and food waste at retail level. The excess offer at retail level links with a higher than needed demand for products which produces an over-production and oversupply of food at primary production. This over-supply does not always meet the real demand at retail level. Current TBAs separate the FVC actor responsible for FW production from its responsibility to deal and manage the produced waste. This inexistent linkage between the 2 factors creates an hotspot for food waste prevention and reduction at retail and primary production level. As a result of the application oof TBAs where such agreements still persist, large shared of bread, milk, fruits and vegetables turn into food surplus, food losses and food waste.
Existing examples	Sweden, Norway, Denmark: in these countries TBAs are in place for different food categories, among which bread and bakery products, milk, and fruits and vegetables. In Portugal it's not the supermarket responsibility to manage excess food. For fruits and vegetables, the retailer sends back the products to the producer, while milk and dairy products are sent back to the intermediaries[24]. In Greece, who bears the responsibility to dispose of surplus food depends on the type of the product. For dairy products, any excess at retail goes back to the producers. In the case of fruits, vegetables and meat, any unsold product is the responsibility of the retailer. Retailers decide to either throw it or redistribute through donation[25]. In Austria, legislation allows for retailers to send back to producers the unsold food items that were not sold in the shop. This is the case for bread and bakery products which, in a 2017 study run by the Austrian Ecology Institute, has been identified as the mostly common wastes food item, equivalent to 65% of the total avoidable food waste identified in the study.	

[24] Info acquired during the FOODRUS Policy Recommendations workshop of January 2024
[25] Idem

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PROPOSED CORRECTIVE ACTION	EXPECTED BENEFITS
Systematically remove any formal and informal type of Take Back Agreements from commercial practices across the EU. Limit TBAs only to those cases where food products are not complying with *food safety* requirements *at the time* of exchange of products (transactions) between FVC actors, or to those cases where products are severely damaged and can not be sold. In the latter case the retailer needs to be able to prove that the damage did not occur in its premises. Blockchain technology could be of help here in certifying transactions of food items that comply with defined food safety and quality standards. Quality in this case can only be evaluated against the status of the food item which impedes its sale at retail level. The use of blockchain and track and trace technologies can support the inspection of the batches and can allow to wave liability of the supplier once the transaction to the next FVC operator has been approved and processes. The application of these technologies can support the adoption of fairer agreements among retailers and suppliers, providing those quality guarantees that safeguard suppliers and limit the application of TBAs. Moreover, IT technologies can be used for better demand forecasting. This allows retailers to better know the volumes oof products they should request to suppliers, based on seasonality, days of the week and other criteria. Rebalance and correct the market power of retails versus producers and suppliers, by: - Disaggregate supply streams such that the retail sector does not set the rules of the game, and in such a way that producers have a negotiating power against large retailer corporations and their intermediaries; - Re-invest in the small scale, incentivize direct producer-consumer channels through short FVC, and provide farmers alternative options for the commercialization of their products (e.g. AFNs discussed in section 7.2) Revise the EU Code of Conduct on Responsible Food Business and marketing Practices to include the removal of TBAs from businesses' modus operandi.	a. Overproduction at earlier stages of the FVC is avoided by limiting the responsibility of food surplus and food waste management to the actor having physical possession of the food items. b. The removal of TBAs in Slovakia provides an empirical evidence of the positive self-adjustment of the retail sector to optimize their purchasing practices towards suppliers through a better demand forecasting of bakery products to be offered in stores. c. Retailers develop and adopt better demand-forecasting tools for leaner management of stocks. d. By removing TBAs, a positive influence on the deviating externality of VAT recovery for "damaged or unfit items" (see section 6.3) can also be positively overcome. e. Market power and control over prices is less biased towards retailers. Power dynamics between producers and retailers are more balanced. *f.* Food surplus at supermarkets' level is reduced.

Suggested administrative level of adoption	National or EU level legislation, whichever level allows for the fastest adoption of the measure
Existing examples of corrected externality	Slovakia, review of national legislation on Unfair Trading Practices and removal of TBA from specific food categories, link
Areas that remain to be investigated	- Thorough assessment of where (countries) and for which food categories TBAs are still in place in Europe. Study the supplier-buyer agreements they are based on, and determine the relative market power of the actors involved in the transaction. - Analyze the prevalence of this practice and what the economic (cost of production) and waste management implications this generates;

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	- Analyze the main forms of TBAs and what is the fate of the food surplus returned to the suppliers - Analyze who bears the costs of waste management in TBAs - Study the effect of the removal of TBAs on the volumes of food surplus redistribution that is sent to food banks and charities
Further references and suggested readings	
EU Code of Conduct on Responsible Food Business and Marketing Practices: - *EU Code of Conduct on Responsible Food Business and Marketing Practices, link* Analysis of Take Back Agreements in Scandinavian countries: - *Ericksson M. et al., 2017. Take-back agreements in the perspective of food waste generation at the supplier-retailer interface, link* - *Balasooriya I. D., 2022. Food losses and waste at Bakery, Retail and HH level, a case from Sweden. SLU, Swedish University of Agricultural Sciences, link* Slovak act removing TBA as part of the Act on Unfair Trading Practices: - *Act effective January 2023, link* - *Update and explanation of the Act from 2019: link and link*	

The existence of this legal barrier for the bread and bakery sector has also been detected in the FOODRUS Slovak pilot, where until recently, TBAs between bakeries and retailers were in place, generating large amounts of food waste at retail level which however had to be disposed of only by suppliers. Moreover, it remains to be investigated whether the bakeries were paid for the unsold bread products, or if, on top of having to deal with the surplus waste, they also had to internalize the costs of production for the unsold products.

Bread is renowned to be one of the top 3 most wasted food products in Europe. [Kumar et al., 2017] report that

"in Sweden, 29,870 tons/year of bread is wasted in domestic households, and 80,410 tons are wasted yearly in the whole suppy chain (Brancoli et al., 2019). Furthermore, Stensgård and Hanssen (2016) identified bread as the product group with the highest waste levels in Norwegian retailers, similar to the results found by Lebersorger and Schneider, 2014, Brancoli et al., 2017, van Dooren et al., 2019, and Katajajuuri et al. (2014) in Austria, Sweden, Netherlands, and Finland, respectively" (Kumar, 2023)

Actors from the FOODRUS Slovak pilot however, reported that in 2022, a review of the national legislation on Unfair Trading Practices[26] led to the removal of TBAs for specific food categories as of 01 January 2023. Among the categories, bread and bakery products were also included. Thanks to this new arrangement, retailers set in place purchasing monitoring systems for better demand forecasting of bread and bakery products. As a result, the volumes of bread surplus at supermarket level have been reduced and the demand of bread towards producers improved.

As a result of the adoption of this national law, the Slovakian large industrial bakery Senecké Pekárne reports little to no waste from bakery production since the bakeries produce the precise bread quantities requested by the supermarkets, which are their main customers. The change in legislation has therefore resulted in an optimization of bread production processes for bakeries supplying bread to supermarkets, which led to the reduction of bread waste at retail level. This is an example of how – thanks to a revision of the national legislation – operators of the retail sector have revised their marketing policies (i.e. full-shelf policy) towards more sustainable and fare practices.

[26] Act on Unfair Trading Practices: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2012/362/20130101

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6.5 Unstructured and weak food redistribution networks

The current status of food redistribution networks is weak and unstructured for a number of different reasons that relate to the limited logistic capacity to collect food surplus from donors, the financial burden that food banks and social enterprises have to face to run their operations, the limitations deriving from stringent food safety regulation and liability of the donating actors. In general terms, the infrastructural network related to food redistribution systems is scattered, fragmented, with little to no public support and investment in organization that operate in the area of food surplus redistribution. Also the few for-profit businesses that operate in this field report facing difficulties to place the recovered products back to the market. This as a consequence of a generalized absence of awareness that such redistribution businesses exist and that offer solutions for reliable food supply to retailers and HORECA sector operators.

Table 6-5 reports the main findings and suggested actions for this barrier.

Table 6-5 Unstructured and weak food redistribution networks

<table>
<tr><td>FVC stage</td><td colspan="2">ALL FOOD VALUE CHAIN STAGES</td></tr>
<tr><td>Barrier full name</td><td colspan="2">Lack of an organized logistics infrastructure for food donations that is able to timely capture and redistribute food surplus</td></tr>
<tr><td>Type of barrier</td><td colspan="2">Structural barrier, economic and legal</td></tr>
<tr><td colspan="2">BARRIER DESCRIPTION</td><td>CURRENT NEGATIVE EXTERNALITIES</td></tr>
<tr><td colspan="2">The current status of food redistribution networks is weak and unstructured for the following reasons:
Generalized lack of mandatory requirements for businesses to redistribute food surpluses to food banks or similar entities. Current action is based on voluntary action;
Lack of financial resources and public support to actors active in food redistribution activities (i.e. food banks, social enterprises) to run the daily operations (collect food from donors, inspect it, sort it, relabel it when necessary, and redistributing it to connected entities)
Absence of a structured and capillary system of food redistribution logistics:
Uncertainty for businesses who to donate to;
Unavailability of dedicated storage/facilities for businesses to temporarily store food to be redistributed;
Unavailability of staff taking care of food redistribution within businesses, and/or unwillingness to deal with food surplus management
In some countries, liability related to food safety requirements is preventing businesses to donate food to third parties (see also section 6.3)
Moreover, little to no financial support for businesses collecting food (charities, food banks) is available. These organizations rely on volunteer work and have to bear the costs of collection, storage, sorting and redistribution (e.g. Spain)</td><td>Most food banks and social enterprises currently run on a voluntary basis and private sector donations to run their operations. Despite the large volumes of food they are able to collect and redistribute, and the multiple social, economic and environmental benefits that they produce for society, public support to their existence in terms of financing is limited.

Due to the restrained capacity, these entities are not able to collect all the food surplus generated by businesses and primary producers, therefore a considerable share of food surplus goes lost and becomes food waste.</td></tr>
<tr><td>Existing examples</td><td colspan="2">In Spain, the 167 volunteers of the Food Bank (FB) of Navarra (Navarra region) manage a volume of 4,500 tons of food items that satisfied the food needs of more</td></tr>
</table>

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	than 25,500 beneficiaries in 2023. They work through a network of 188 charitable organizations (and 600 volunteers). Fix costs for the operations of the FB is around 480,000 EUR/year. About 70% of these costs are covered through private financing (charitable financial donations by philanthropic entities, private banks or businesses), 30% through donations from individuals. Public financing for the operations of the bank is very limited. Similarly, on the more local scale, social enterprises like Tudela Comparte are faced with high managerial costs and low human capacity to deal with the enterprise's operations. A generalized lack of financial and technical support to these entities put at risk the existence oof these entities and the support activities they perform for social purposes (poverty alleviation, food security and nutritional diets, social inclusion, employment opportunities, etc. [27] Bulgaria: too stringent regulation on food donation hampers the redistribution of food to social entities and food banks

PROPOSED CORRECTIVE ACTION	EXPECTED BENEFITS
The following corrective actions are proposed in chronological order (actions on top of the list are pre-requisites for adoption/implementation of actions down the list) 1. Make food redistribution of food surplus mandatory for all businesses of the food value chain, from primary production to the HORECA sector, through regional, national and/or EU legislation. Harmonize food donation practices across the EU by: a. free liability on food donations for donating actors and eliminate too stringent regulation on food safety that limits the options for donating food b. Make sure that businesses are incentives to donate food and that a full VAT refund is guaranteed to donating businesses. c. Once redistribution efforts cover 100% of the social needs of food security and poverty alleviation in a given region, allow for green public procurement tenders for food to source input from food surplus generated at primary production, wholesale and retail level; d. Ensure that food surplus for redistribution is given priority over food surplus reuse for upcycling technologies to safeguard sustainability and ethical principles of social equity, poverty alleviation and food security e. include fiscal instruments such as the PAYT (Pay As You Throw) in the legislation where the tax to be paid on discarded food is significantly higher than the costs of redistributing the surplus 2. Public authorities need to coordinate and support the development of functional, well-established, and capillary regional level food redistribution schemes/hubs, easing the redistribution capacity of food banks and connected entities in terms of: a. logistics (collection, selection, storage, redistribution); b. human capacity and labor force;	The share of food surplus currently going to food waste is captured by the system. Food waste and food losses are reduced to a minimum. Food redistribution networks become an integral element of sustainable food systems and sustainable food value chains. Food waste is avoided and food is redistributed to people and families in need. Employment opportunities are created for food redistribution networks and social enterprises. A lower environmental footprint is achieved by reducing the amount of food that goes to waste. Lower volumes of food waste have to be managed by waste operators. Businesses gain by reducing the volumes of (food) waste they confer to waste treatment plants. Society as a whole gains by redistributing value among its citizens and alleviating situations of poverty and food insecurity.

[27] Source: FOODRUS national replication workshop proceeding, link

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c. finances for running the redistribution activities; d. engagement of businesses to be active players in the redistribution network, also through financial instruments as PAYT[28] 3. Require businesses to draft food surplus redistribution strategies in order to be able to comply with the requirement prescribed by law 4. Monitor and quantify the change in collected food surplus volumes in the baseline first, and with the adoption of the measures afterwards *5.* Develop correction strategies on food surplus management based on empirical data	
Suggested administrative level of adoption	Regional and national levels first in terms of change in practice and legislation. European level for the drafting oof guiding documents or Directive.

Existing examples of corrected externality	We did not find examples of legislation that comprehensively addresses the establishment of food redistribution networks as suggested above. Nonetheless, certain MSs and regional authorities have developed actions and legislation addressing, partially or fully, the recommended corrective action of point 1 above. These identified examples are:
	• Region of Catalunya (Spain): Law 3/2020 on Food Losses and Wastage Prevention
	• French 2016 Garot Law against food waste in supermarkets
	  ○ Supermarkets in France are forbidden to dump food surplus and are obliged to connect with charities for food donations
	• Italian Food Donation law (Gadda Law 2016):
	  ○ Donation legislation applicable to all FVC actors, and addressing damaged and wrongly-labeled food;
	  ○ Simplification of donation procedures for donations of perishable food items with value <15k
	  ○ Possibility to donate food beyond BB and Use by dates
	  ○ VAT exemption from donation + full recovery of VAT from donated items
	  ○ Reduction of company taxable income (donations are not considered as a source of income)
	• The Netherlands
	  ○ Corporate tax on dumped food by retailers and wholesalers
	• Slovakia
	  ○ In Slovakia the grocery store Tesco uses the “Food Cloud” app to redistribute food to charities.
	• Romania
	  ○ According to the legal requirements all companies are obliged to take measures to diminish food waste, including firms in the production, processing, storage, distribution, retail trade sectors, hospitality industry and food services. Food products that are close to expiry can’t be destroyed anymore.

Areas that remain to be investigated	- Current sources of financing of food redistribution actors like food banks and other voluntary organizations

[28] In the Annex section of this deliverable, a briefing on financial instruments for FW reduction is available

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	- Financing gap of food banks and other food redistribution entities to run and/or expand operations based on demand and internal capacity - Comparative assessment of MS regulation on food donation across the EU, and assessment of the legal clauses existing in the different Eu member states. Assessment of how these clauses negatively impact on the capacity to redistribute surplus food
Further references and suggested readings	
EU Guidelines on Food Donations and related information: - *EU, Food donations general info,* link *and EU Guidelines on food donation,* link Examples of food redistribution systems and initatives: - Redistribution of fruits and vegetables from municipal markets in Milan (Italy): TEACHING GUIDE: Finding the Bread and Butter in Milan's Circular Food Waste Solution. Reflow project case study, link - Lombardi M. and Costantino M., 2020. A Social Innovation Model for Reducing Food Waste: The Case Study of an Italian Non-Profit Organization, link - Horkram web-shop (Denmark)[29]: an example of management of food surplus at wholesale level, link - Instock market, Food redistribution business, Netherlands, link Links to existing legislation partially regulating food redistribution practices and requirements: - Region of Catalunya (Spain): Law 3/2020 on Food Losses and Wastage Prevention - EY on behalf of the French Ministry oof Agriculture and Food, 2019. Evaluation of the application of the provisions of the law of 11 February 2016 on the fight against food waste, and the implementing decree of 28 December 2016. Synthesis of the final report. link	

To address the barrier of unstructured redistribution networks, the tool of fiscal instruments such as the PAYT or the fining for non-compliance with waste regulation is believed to be one of the key elements driving change towards more food waste-free food systems.

On the side of food redistribution at HORECA level addressed to the end-consumer, a positive note is made here as to the growth of food redistribution platforms, both online and community-based that focus on the creation of a last-mile solution for unsold food items. In the case of the online platforms, the food redistribution still occurs through profit-generating financial transactions. In the case of community-based redistribution systems, the case is more that of bartering and free exchange of products among neighbors and community members.

6.5.1 7.4.1. An overview of web-based food redistribution channels

In recent years, online food redistributions channels have emerged through the combined use of IT technology and consumers' engagement. When we look at food redistribution applications (food apps) used at HORECA level we see an expansion and replication of initiatives in various countries. Some of the most known apps used by consumers are: Too Good To Go, Phoenix, Munch (Slovakia, Hungary), Soy Comida Perfecta (Spain). In Italy, besides the most common food apps mentioned above, a number of community-based food exchange apps have also been developed. Some examples are: Bring the Food; Last Minute sotto casa; MyFoody, Ubo, Eco dal Frigo, PucciFrigo; Think About, Bring the Food, Spesa in Tempo.

[29] Further reference on the Horkram webshop tool is available through deliverable D5.5 Report on FOODRUS replication roadmaps

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At the same time, a similar phenomenon is developing in recent years at the level of food wholesale in those European countries that are most advanced in food waste reduction policies. In this case, online secondary food redistribution channels are developed for businesses rather than consumers, and food that has not reached the due date but that is closed to, is put on the market - via these online platforms - at discounted rates. This is for example the case of the *Fight Food Waste web-shop* developed by the FOODRUS partners Hørkram Foodservice A/S, a wholesale distributor to the Danish Foodservice market. The Hørkram web-shop started its operations in December 2021 and it is now being used at the national scale, also for green public procurement of food items for schools and public offices.

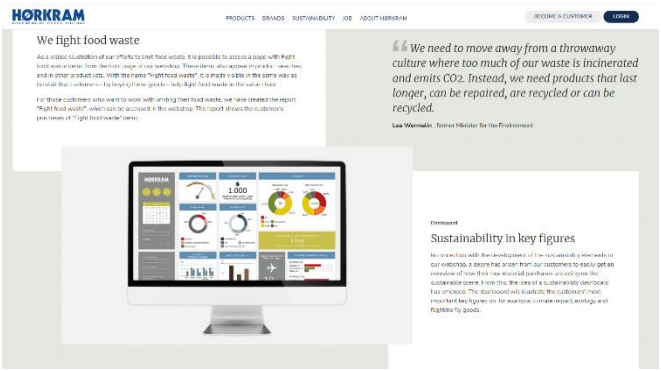

Figure 6-2: Information about the webshop on Hørkram's website

6.6 Conflicting interests for green energy production and food losses and food waste prevention

When we talk about food losses and food waste prevention policies on the one hand, and investments in renewable energies on the other, there is an evident conflict of interest.

The conflicting interests are evident when looking at the figures reported in the latest European Commission *Union Bioenergy Sustainability Report* of October 2023, according to which – at EU level - organic waste and agricultural biomass account respectively for 26% and 8% of solid biomass supply for *green* energy production. Countries where these contributions were the highest were Germany (accounting for about 75% of the overall biomass from organic waste), Sweden and Finland for agricultural biomass. The single contributions per EU MS are shown in Figure 6-4.

Figure 6-3 A biogas plant facility in Europe

While making a note that there is a need to investigate deeper into the components of both agricultural biomass and organic waste (as both do include biomass from non-food items), it is important to consider that food items - both of animal and plant origin, at food losses and food waste level - are part of these figures. In this respect, the EC report also highlights the following:

"Overall, primary supply of solid biomass in the EU has increased from 3,336,811 TJ in 2008 to 4,454,768 TJ in 2021, an increase of 33.5%. The largest growth of indigenous production of solid biomass in this period has been for wood pellets use (413%) and animal waste (351.9%)". (Commission, 2023)"

The 3.5-fold increase in the category "animal waste" demands further investigation of its building components. It is likely that categories of food losses identified in section 6.1 (food losses in primary production), and food waste identified in section 6.2.2 (Contaminated food batches), section 7.2 (industrial food production processes) and section 7.3 (Take Back Agreements) do contribute a share of feedstock for bioenergy production in modern bioenergy plants.

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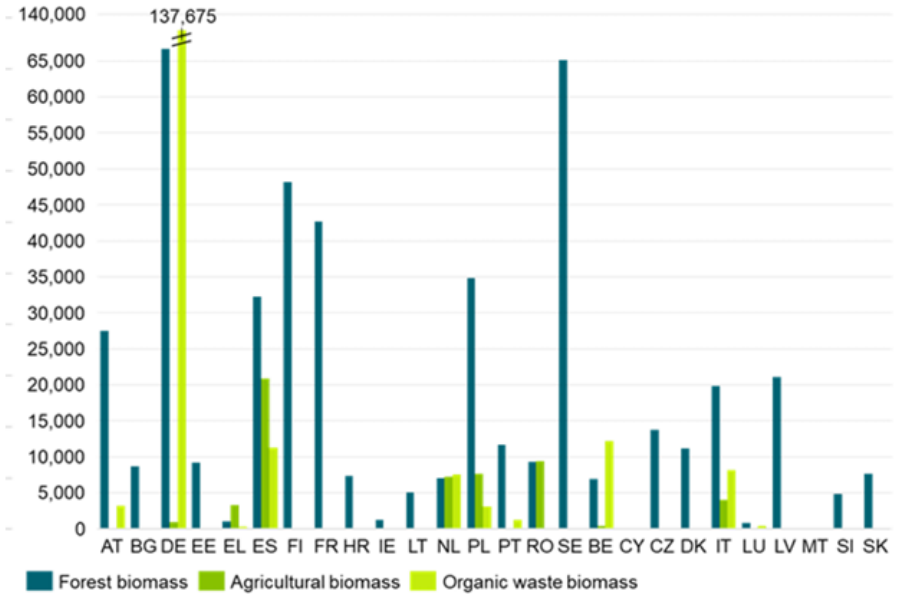
"Twenty-six Member States have reported their data on biomass supply. In the EU, woody biomass is the main feedstock reported for solid biomass production (labelled as "forest biomass" in the figure below), accounting for 66% of the total and followed by biomass from organic waste (26%) and agricultural biomass (8%). Germany records a significant production of organic waste biomass (137,675 thousand m3).



Primary supply of solid biomass in 1000 m3 for energy production, indigenous production in 2021[4] grouped by feedstock origin

Source: European Commission *Union Bioenergy Sustainability Report*, October 2023

On a second analytical level, it is also important to reflect on the incremental use of food crops for energy feedstock, the so-called energy crops. They are seeded and cultivated with the sole intent of producing biomass for energy production whereas traditionally, crops as maize, sugar beet, sweet sorghum, oats, barley, and rye were cultivated for human consumption. The other side of the coin here is that while incrementing the share of agricultural land used for the cultivation of energy crops, we also increase the share of agricultural imports from outside the EU, leading to a higher carbon an environmental footprint. These are considerations that partly

Figure 6-4 Sources of primary supply of solid biomass in Europe used for energy production

relate with food security in the EU, and the sustainability of our food systems. Further considerations oof the pros and cos related to this practice should be analyzed from a sustainable food systems perspective.

Through

Table 6-6 below we highlight what are the key challenges faced by these conflicting interests on biowaste, and what measures could be taken to mitigate the negative effects of the barrier. The key message is that the current investments in increasing the share of renewable energies in Europe should not generate a new demand for food losses and waste to be used as feedstock in biogas plants. Recognizing the relevance oof this conflict and regulating this aspect at EU level is of utmost importance if a concrete reduction in FLW across the food supply chain is to be achieved.

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Table 6-6 Conflicting interests for green energy production and food waste prevention

FVC stage	ALL FOOD VALUE CHAIN STAGES	
Barrier name	Conflicting interests for green energy production and food losses and food waste prevention	
Type of barrier	Legal, economic, structural	
BARRIER DESCRIPTION		CURRENT NEGATIVE EXTERNALITIES
The current EU investments in green energy production are pushing for more biowaste to enter bio-energy plants. Food losses and food waste constitute source of bio-waste. As such a demand for biowaste from Fl and FW is created, which conflicts with current efforts for Fl and FW prevention and reduction. The recent Nov. 2023 revision of the Renewable Energy Directive (2009/28/EC) set 42.5% as the new binding renewable energy target for 2030 (it was 23% in 2022) (Revised Directive EU/2023/2413). This creates a high demand for feedstock sources, among which food waste and food losses are part of the biowaste stream of organic waste, and agriculture sector biomass.		Primary sector producers that besides cultivating crops or rearing animals have also invested in bio-energy production have no incentive in reducing their shares of FW and FL as this would entail a fall in the feedstock that is used for energy production. Other FVC actors that currently supply biowaste from FL and FW to bioenergy plants might not have the incentive to reduce their supply if their supply is paid.
Existing examples	Denmark has a high investment in green energy production. The country has set some legal obligations for collection of biowaste from FVC actors, especially HORECA operators. The collected biowaste is then diverted from the municipality either for the production of compost or for the production of bio-gas in energy recovery plants. Other similar cases might exist in countries with high public and private investments in green energy production.	
PROPOSED CORRECTIVE ACTION		EXPECTED BENEFITS
Revise regulation on allowed feedstock for green/renewable energy production to prohibit the use of (edible) food-derived biowaste (from food losses and/or food waste) for energy production A stringent control system should be put in place to limit supply of food losses and food waste for energy production only to non-edible parts of the food, and to food that is no longer apt for human consumption. Authorities at national and regional level, supported by regulator control authorities at EU level should frame a system of controls ensuring that the waste hierarchy priorities are observed, and that prevention of FL and FW generation is the top priority for FVC actors. Recommendations provided in section 7.1 should also be taken into account in this respect.		The use of biowaste from FLW is limited only to the share of waste that can not be used for other higher forms of value generation. Green energy production does not reply on FLW as a major feedstock for energy production.
Suggested administrative level of adoption	EU level (policy and strategy review)	

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Existing examples of corrected externality	None identified
Areas that remain to be investigated	- *Assess what is the share of feedstock to biogas and energy-recovery plants that is sourced from food waste. Run a comparative analysis across EU countries* - *Analyze what is the potentially negative influence of subsidies for bio-energy on food losses and food waste avoidance* - *Assess if actors providing FW as feedstock for energy plants are paid for the feedstock they supply;* - *Investigate in more detail all conflicting interest among food losses and food waste prevention and green energy production*
Further references and suggested readings	
- *European Commission, 2023. Union Bioenergy Sustainability Report (in the report figures are provided for the share of agricultural waste, animal waste and organic waste that are used for renewable energy production)* link - *Joint Research Center, 2019. Brief on biomass for energy in the European Union,* link - *Interreg Europe project NEWbiogasDIMENSION: utilization of food organic waste in a highly efficient biogas plant, link* - *Guidehouse, 2022. Biomethane production potentials in the EU. Feasibility of REPowerEU 2030 targets, production potentials in the Member States and outlook to 2050 (The article lists the sources of feedstock for bio methane production, mentioning agricultural residues, manure and sequential cropping as top 3 sources of feedstock by 2050) link* - *European Commission, October 2023. Bioenergy report outlines progress being made across the EU, link* - *FERN, bioenergy and its challenges, link*	

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7. Final recommendations

In its first part, this deliverable has analyzed the status of food waste generation in Europe (chapter 3) and the policy landscape set in place to address the challenge of reducing and preventing food losses and food waste (chapter 4). In so doing, we looked at the key EU guiding instruments in the field, by referencing to the policies, directives, regulations and guidelines currently tacking the FLW burden. In chapter 5 we then took a closer look at the adoption and transposition of these EU regulations and directives at the national and regional level, trying to understand the degree of homogeneity in approaches towards FLW reduction and prevention formulated by EU Member States. Through this process we could better grasp to what extent EU MSs have been able to transpose and take action to address FLW generation. At a second stage, based on the collected information from the literature, from the FOODRUS pilots and associated regions, and the wider FVC actors engaged in the consultation process, we identified the key economic and legal barriers to food losses and waste prevention that today - despite the strategies, policies, regulations and directives set in place in the last decade - are still persistently in place.

These barriers are significantly hampering the achievement of the 2030 FLW reduction and prevention targets originally agreed upon with the EU signing of the SDG target 12.3. Similarly, they also pose challenges to the achievement of the new EU-level targets on FW reduction set in 2023 by the European Commission. Yet, regardless of the specific reduction targets they link to, the identified challenges represent a generalized burden that impinges on the capacity of national and European policy-makers to implement effective legislation and national policies for the eradication of food losses and waste in Europe. In turn, this translates into a dispersion of financial resources and human capacity that strains efforts towards the achievement of the objective.

This conclusive chapter thus aims to sum up the key recommendations that policy makers should firmly account for to be able to induce the needed system change for a fairer transition towards more sustainable food systems in Europe. Adopting and working towards these recommendations would create a new European context where FLW are reduced to the minimum, when not fully removed from the system, where food gains back its value as source of health and nutrition for the people, and where farmers are recognized for their role and have a better bargaining power vis a vis the other players of the food system.

Reflecting and elaborating upon all the proposed corrective actions set forth in Chapter 6 and Chapter 7 for the identified barriers, in the following sections we present our key messages.

7.1 An overview on the 2023-2024 protests of EU farmers

Farmers' protest across the EU have been on the rise since 2023 when Dutch farmers started protests against the national government decisions to curb nitrogen pollution by drastically reducing livestock farming in the country. Since then, several organized protests have taken place in France, Germany, Italy and many other countries where farmers' interests have been threatened by governments' decisions to significantly reduce the environmental footprint and carbon emission of the agricultural sector. More recently, the early months of 2024 have seen continuous farmers' protests throughout Europe. From Spain to Belgium, and from France to Poland, farmers manifest a general lack of recognition of their fundamental role in the economy, claiming that the recent EU policies connected with the Green Deal - the reformed CAP, the Nitrogen Directive and the Nature Restoration Law among other – and the political decisions on the prices of imported goods threaten the existence of the EU farming system. Yet, while farmers' protests are addressed towards EU institutions, their grievance is mainly a protest towards the economic system and the rules governing agricultural inputs and goods prices, which are factors largely controlled by the private sector.

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Figure 7-1 Photo of the farmers protest taking place in November 2023[30]

French and Italian farmers are advocating for an increase of their income, as they claim that "out of 100 euros of food items sold, only 10 euros is received by farmers" (Isnard-Dupuy & Micallef, 2024; Le Monde avec AFP, 2024). Another request by many European farmers (from, e.g., France, Italy, Belgium, Romania, Poland) is to ban importing non-EU products, including agriculture products from Ukraine (Belga, 2024; Boutelet, Bran, Girard, Morel, & Stroobants, 2024; Dennison, 2024; Le Monde avec AFP, 2024). The current and increasing administrative burden faced by farmers is also an object of their protest in France (Le Monde avec AFP, 2024; Isnard-Dupuy & Micallef, 2024). Finally, the "watering down" of the environmental closes of the European Green Deal impacting the agriculture also sits high on the agenda of the European farmers as seen by revendications in Belgium, France and Italy (Belga, 2024; Boutelet, Bran, Girard, Morel, & Stroobants, 2024; Isnard-Dupuy & Micallef, 2024).

Some farmers are also protesting because of decisions taken at national level. For instance, German farmers are fighting against the suppression of national financial support of agricultural fuel while Dutch farmers show their discontent with the cap imposed on nitrogen emissions (Boutelet, Bran, Girard, Morel, & Stroobants, 2024; Taylor, 2024).

All in all, "farmers are being burdened by debt, squeezed by powerful retailers and agrochemical companies, battered by extreme weather, and undercut by cheap foreign imports, for years now — all while relying on a subsidy system that favours the big players" (Politico, 2024).

In the light of these protests, both European and national politicians are looking to appease the situation by proposing some concessions to the European environmental laws and by advancing funds for additional financial supports (Le Monde avec AFP, 2024; The Associated Press, 2024). During the special European Council that took place in early February 2024, the Commission mentioned its intention to withdraw its proposal on pesticides reduction, a component of the Green Deal (News European Parliament, 2024). In addition, Von der Leyen vouched to protect farmers from cheaper Ukrainian agricultural products and to wave on the requirement asked to farmers to respect fallow rotation of cultivated parcels (The Associated Press, 2024).

In this generalized farmers' uprising context throughout Europe - while the Commission is showing to be open to revise some of the clauses posed by the policies of the Green Deal - the core of the matter remains the strong persistency of a free-market economy and the very limited role that governments in Europe currently exercise to regulate prices of agricultural goods, and the unbalanced market power of FVC players.

[30] Source of Image: The Guardian, Nov. 2023

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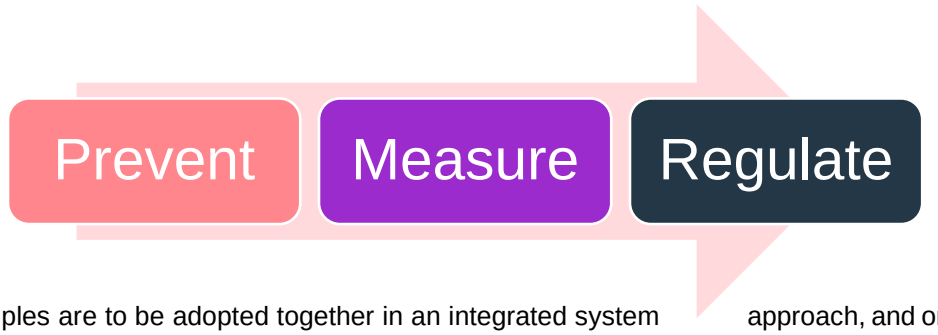
Many of the barriers we have identified in Chapter 6 and chapter 7 are of an economic nature. They are a reflection of this unbalance of power across the food value chain. The most obvious example is the barrier identified in section 7.3 where Take Back Agreements significantly strengthen to position of retailers towards producers. For primary producers this situation not only means managing food surplus that in most cases will become food waste, but it also means being subject to trade practices that are unfair and create unbalance among food value chain actors. Moreover, it has to be highlighted that, should the European Commission decided to further subsidize the European agriculture farming system with additional financial measures, the financial burden on the CAP would only partially benefit farmers, but the unbalance in market power would not be solved unless structural reforms are taken to revise and improve the regulatory role of national governments and of the European Union for both agricultural products prices and FVC actors' power relationships.

7.2 Key messages on the barriers' correction approach

Reflecting on the results of the research, the FOODRUS project brings in 3 key messages to policy makers at EU and national level: prevent, measure and regulate.



These 3 key principles are to be adopted together in an integrated system approach, and one would not work without the support of the other. Our explanation on the interlinkages between these three elements is provided in the sections below.

7.2.1 Prevent

The food waste hierarchy (Figure 7-2) well presents that *prevention* (of food losses and food waste generation) should be the most preferred option when having to take decision about food surplus management. Yet, the snapshot that we get from the analysis of several European context tells us that, at present, effort is distributed unevenly among several levels of the food waste hierarchy. Current actions are indeed skewed towards recovery (organic bio-waste for energy production – barrier described in section 7.5), recycle (biowaste used for composting, see section 7.5), re-use for human consumption (i.e. food donations and food redistribution networks) and re-use of animal feed. Moreover, increasingly, new innovations on food upcycling are feeding into the reuse category through so-called revalorization processes.

Prevention in waste generation is also one of the guiding principles of the circular economy where the elimination of waste and pollution is a fundamental pillar of the whole circular economy concept.

Although it is more difficult to measure prevention actions vis a vis other management options, evidence shows that currently there is no absolute predominance of prevention strategies in the food supply chain in Europe. Indeed, this would entail a thorough review of our production systems - from primary production to food processing - which simply would entail producing less quantities of goods at all levels of the food supply chain from primary production to food processing. This principle is in obvious conflict with the profit-driven free market economic model where profit maximization is one of its leading principles.

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The shift towards less consumptive production systems can be achieved only when farmers are paid the right prices for their products, and when intensive commercial farming is significantly regulated towards more sustainable production models removing the high rates of food losses intrinsic to the production practices currently in use. At the same time, this re-adjustment of the first stages of the FSC will determine lower profit margins for the wholesale and retail sectors. This is where policy makers need to intervene on regulating the market and the distribution of profit margins among FVC actors.

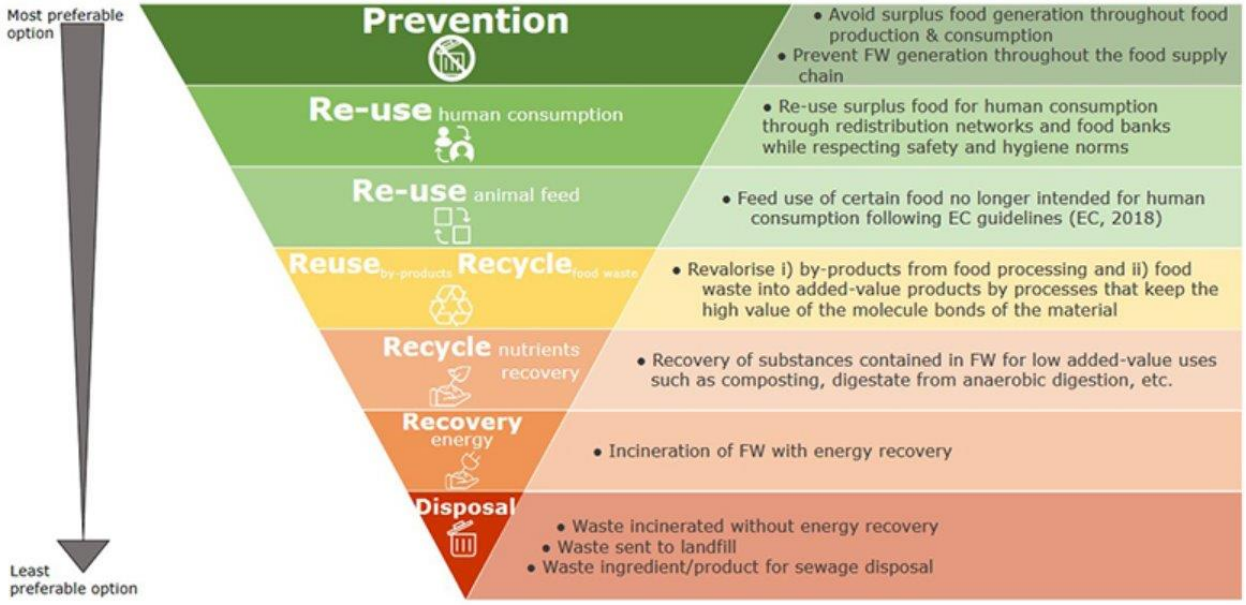

Figure 7-2 The waste hierarchy applied to food

This rebalancing pattern would create positive outcomes on several levels.

First, it would significantly contribute to curb the current rate of 30% food waste generation across the FVC, acting not only at increasing consumers' awareness on the importance to reduce FW at the household end (where most of the awareness raising efforts are currently focusing on), but actually addressing the challenge at its key source: the overproduction and oversupply of goods before they reach consumers. It is important here to note that this change does not necessarily mean that less food will be available to consumers. Reversely, consumers will be offered the same diversity of food options, but the offer itself would be better calibrated to the real demand, reducing food surplus throughout the FVC.

Secondly, prevention actions working towards lower quantities of food being produced would have a positive environmental and carbon footprint as on the one hand, fewer resources like water, fertilizers, crop-control agents and fuel would be needed for production, and on the other, less FW would be generated with needs to be disposed of. Further reference on the quantification of the environmental impact of food waste reduction is provided in deliverable D4.3 Process-based life cycle assessment of FOODRUS food production and supply systems

How then to enact FLW *prevention* processes at the full FVC scale?

To answer this question, we report below the key challenges to be overcome in terms of preventing the generation of food surplus, and the recommendations on corrective actions formulated in chapter 6 and 7. Although not exhaustive, starting to address the challenges at these identified levels of externalities will produce significantly positive impacts in the fight against food losses and food waste.

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Reference is made via hyperlinks to sections in Chapter 6 and Chapter 7, allowing to directly access the information provided in the respective tables.

Prevention level	Identified barriers and recommended corrective action
Prevention of food losses at primary production	Section 6.1.1 Legislation on Transmissible Animal Diseases
	Section 6.1.2 Animal welfare practices and commercial farming
Prevention of food waste at food processing and food distribution	Section 6.2.1 Handling of damaged and wrongly labelled food items
	Section 6.2.2 Handling of food items in contaminated batches
Prevention of food waste at HORECA level	Section 6.4.1 Excessive plate portions and food offer at buffets
Prevention of FLW at system level	Section 7.2 Complex and long food value chains, industrial food production and strict marketing standards
	Section 7.3 Take Back Agreements and retailers market power

7.2.2 Measure

The second fundamental pillar that will support the *prevention* effort is *measuring*. As presented in section 7.1, evidence shows how the level of detailed and reliable knowledge that we have today on hotspots for FL and FW generation, across FVC stages, across operators and across food categories is simply insufficient. Most of current data are based on estimates or extrapolation processes, and no structured and capillary quantification and reporting system is in place across Europe. Moreover, some categories of food are excluded from current quantification requirements in primary production, food processing and retail level, which further distorts actual figures of FLW production.

This weak context on the quantification of the real FLW picture represents a major drawback when tailored policies and interventions to respond to the challenge need to be formulated.

The key recommendation for the measuring pillar is the one we formulated in Section 7.1, where we advocate for the following corrective actions:

- review the definition of food waste and make clear the distinction with food losses;
- include in the definition of food (and food losses, and food waste) all the categories of food currently excluded (i.e. animals and plants that did not enter the market of food for human consumption, packaged food, animals affected by zoonotic diseases, etc.). Revise definition of food, food losses and food waste according to the considerations made above on the current externalities.
- Provide more detailed guidelines in relation to the sampling methodology and the minimum sampling size quantifying the minimum threshold requirements for direct data measurements to be collected.
- Make data collection and reporting method compulsory for each actor of the FVC, with minimum requirement on data reporting on a rotating basis (i.e. while MS reporting to Eurostat is mandatory at least every 4 years, a FVC operator should be obliged to measure and report on its FL/FW data every other year, or every 3 years, on a rotating basis).
- Developed easy to use digital reporting methods for FVC operators, where reporting is standardized across the EU MSs and where data are collected first at regional level, and then *aggregated at national* level. Define this reporting system in such a way to allow to differentiate and analyze FL and FW data

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for sub-categories within the same stage of the FVC (i.e. hotels separate from public service canteens, or tomato growers separately from peach growers).

- In order to understand possible drivers and interlinkages with other sectors, it is fundamental to understand what the current final destination and treatment of the food waste is. On the one hand, this helps to understand how much of the FW generated actually contributes to composting and is directed to organic waste treatment. On the other, such data will help to shed light of what shares of FW are used for green energy production, and which other uses are currently not accounted for. This exercise will also help to understand what are the shares of food waste that could potentially be exploited for food upcycling technologies, and monitor the FL and FW flows across time. We therefore suggest to make the filling of the questionnaire formulated by Eurostat compulsory to all FVC operators, and to include in the questionnaire questions on the final treatment and destination of the FW.
- Develop a supra-national control mechanism on the data being reported by member States to ensure compliance with reporting standards, and harmonization of data, while providing MSs the needed support in capacity building for data collection, analysis, monitoring and reporting where capacity from the MSs is not adequate or insufficient

Acknowledging the need for legislative changes in this direction, and provision of the needed technical (i.e. IT support) and human capacity (i.e. investment in a dedicate workforce that collects, aggregates and analyzes the data) would significantly aid European member States in their fight against food losses and food waste prevention and reduction.

Such steps would also help move away from a general definition of “food waste” disaggregating the terms in its different categories (i.e. meat, fish, tomatoes, apples) and start developing intervention action that are sector and food category specific.

7.2.3 Regulate

Finally, *regulate* is the third, yet not least, pillar of the transformative process. Better and more comprehensive regulation is needed at 2 levels. First, across the FVC to improve the current *modus operandi* of FVC operators with the primary aim to engage all actors to adjust their production practices and factor out FLW from their processes. Secondly, at a higher level, to regulate prices and power relations in the market, allowing farmers to set more equitable prices to their products and having access to production inputs at fair conditions, while protecting consumers from uni-directional prices volatility largely determined by retailers.

Being a transversal aspect, regulation efforts relate to all the legal and economic barriers that we identified throughout chapter 6 and 7. Reference is therefore made to the corrective actions proposed in these chapters for further details.

It is suggested that the regulation of the process is made through existing regulatory tools, creating harmonization and complementarities among the existing EU policies and directives. The upcoming Sustainable Food Systems legislative framework could in this sense act as the overarching reference document for all matters related to the role of FLW reduction as a key component of sustainable food systems. Throughout this process, it will be important to set the updated regulation based on the evidence produced by the measuring and monitoring pillar described in the previous session. A prescriptive (EU regulation) approach with defined and homogeneous targets for member states should be preferred over more flexible tools as directives and guidelines.

The updated legislative framework should aim at correcting the current market mechanisms (i.e. all deviating supplier-producers contractual relations, the taxing system on food donations) improving the way businesses and FVC operators manage food.

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To make the regulation effective, a country also need to have the technical and human capacity to formulate and adopt prevention and reduction measures, while leading national FVC actors in the transformation process and supervise compliance. In this process, it is therefore important to consider the level of (food) waste monitoring and management maturity of the implementing country and provide, from the EU institutional side, tailored support tools to national and regional public administrations that have not enough technical knowledge and capacity to adopt and enforce implementation measures.

7.3 Key messages related to game changer

In this last section, we briefly discuss on the importance of some key game changers that will shape the future of our food systems in the very near future. The degree to which policy makers will support their development and make use of these tools to reduce FLW will determine the degree of transformative change that Europe will be able to achieve for more sustainable food systems. Some of these aspects have already emerged in Chapter 6 and 7, and further reference can be found in those chapters.

7.3.1 Alternative Food Networks and the role of short value chains

Alternative Food Networks (AFNs) represent at the small scale the transformative change that should be brought at the wider food scale in terms of rebalancing producer-buyer relationships and paying fairer prices for food commodities.

In AFNs, the value of the food is placed on its quality and nutritional properties. Aesthetics and appearance market standards are not the primary criteria for selection and purchase of food items by consumers (especially applicable to fruits and vegetables). Moreover, producers recognize the value of the food products he/she produces and he/she automatically avoids the generation of FLW across the production process. AFNs also have a lower carbon footprint as they rely on local commercialization routes, and on a more direct producer-consumer relations.

Supporting at EU-level the re-introduction of this local, place-based food market places across MSs will help to decrease the reliance on intensive farming systems and on industrial food production processes where the linkage between the food commodity and the user (ether farmer or consumers) has somewhat being disrupted.

Also at the level of green public procurement, recent improvement have been adopted by the Commission with the amendment of Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement. Reference is here made to point 10 of Article 5 (Methods for calculating estimated procurement value). The amended article reports the following:

“In order to cause less emission and less food losses and waste, the method of calculation for public procurement for food shall be raised from 20 % to 50 %, including a relative increase of 80,000 euro in case of food from a local area (short chain supply).” (EU Platform on Food Losses and Food Waste, 2019)

7.3.2 Regulate the use of food surpluses for food upcycling technologies

Food upcycling technologies are new innovation models that take advantage of the food surplus in FVC and create new value out of the discarded food items. They are an important player of the FSC as they allow for food that would otherwise be wasted to find a second life. For this reason, businesses in the food upcycling technology sector are looking into new partnership models with businesses that produce the food by-product Their role in food waste reduction is not questioned.

It is nonetheless important to take a long-term perspective on the development of these food upcycling technologies and to consider the potential risk of indirectly creating distorting incentives to food surplus creation to feed these new innovations. For this reason, it is important to recall the 3 guiding pillars described in section

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8.2 where action for FLW eradication should first and foremost give priority to FLW *prevention* actions, where preventing the generation of food surplus is put on top of the need for food surplus creation for food upcycling. For ethical and social reasons, a similar reasoning should be applied in the duality between food redistribution to disadvantaged shares of the population, and profit-making food upcycling businesses. Secondly, only by better understanding the components of FLW generated across the FVC, one will be able to capture what shares of the FLW is worth to divert towards upcycling, taking for example into account the environmental footprint of other FLW destinations and treatment options. Third, taking into account the aspects just described, regulating the business sector for food upcycling will provide the needed guarantee to keep the focus on FLW reduction.

In conclusion, we affirm here that capital investment in food upcycling should be carefully balanced with investments in food waste prevention and reduction, and that food waste and food surplus should not become a new input source for food upcycling technologies where food waste and food surplus generation can be avoided in the first place.

7.3.3 Unexploited FW prevention action of food redistribution agents

The meetings and workshops organized by FOODRUS where representatives of regional food banks (FBs) were invited brought evidence of the fact that there is a large gap between the current capacity of FBs to collect food surpluses and the actual share of food surplus *available* from primary producers, wholesalers and retailers. Empowering actors like FBs and social enterprises in their role of food re-distributor actors, and agents that significantly contribute to food waste prevention is of utmost importance.

While representatives of food banks declare that in recent years the cumulative effects of the Covid crises, price inflation and FW reduction measures have decreased the overall volumes of products they collected from donors, there are still ample margins for FBs to collected the remaining share of food surplus that is currently diverted towards other destinations.

At present, these organization are not publicly financed to the level required, and fulfil their operational expenses with donations from private entities and individuals.

The societal role that food banks and social enterprises operating in this field currently have, require better recognition by the European institutions, as well as by the national and regional governments. These entities need more public financing, and technical support for the enormous logistics efforts that set in place on a daily basis. These actors are able to timely capture the food surplus from businesses, select it, sort it and redistribute it. Given the short time requirements for food redistribution, these organizations show high degrees of flexibility and adaptation through the seasons, and perform an essential role in preventing food waste that no other actor in the FVC does.

In France, after the 2016 Garot law that forbids supermarkets to throw away unsold food or intentionally let food to rotten, sector organizations report that stores had improved their internal practices of food management and that donations to food banks have increased up to 20%[31]. "*The French Federation of Food Banks agrees the law is working. It's a major middleman in the grocery store-to-charity food chain. Every morning, more than 2,700 supermarkets send nearly out-of-date food to nearly 80 warehouses around the country, rescuing 46,000 tons a year that would otherwise be thrown away*."[32]

An application of such an approach at the EU-level, with systematic controls on compliance would definitely be able to drastically reduce FW production at wholesale and retail level.

[31] Source: pbs.org accessed on 28 February 2024
[32] idem

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7.3.4 Mandatory inclusion of food surplus redistribution in legislation

Following from the section above, changes in the legislation that forbid FVC actors to produce food waste that could be otherwise avoided would become the greatest game changer in the current approach towards FLW prevention and reduction efforts.

A law like the one adopted in France in 2016, applied not only to retailers and wholesaler, but also to primary producers and the Horeca sector would on the one hand drastically reduce food wastage while increasing the flows of redistributed food items. In the medium term, this will produce optimization processes at the business level for each stage o the food value chain creating spillover effects on the environmental footprint of the food sector.

This therefore calls for a EU-wide law on the management of food surpluses, with a ban on food dumping on the one hand, and an obligation to donate on the other. The action should be complemented by parallel interventions on the taxation system of businesses, applying smart waste taxing frameworks like the PAYT (Pay As You Throw) (see briefing on policy instruments in Annex B for more details).

Any corresponding alignment in green public procurement procedures reflecting these changes would also be beneficial.

7.3.5 Adoption of IT tools for business in the FVC to improve food flows monitoring, forecasting and overall management of food

IT tools like track and trace devices, software for procurements and demand/supply matching, smart labelling systems, digital certification schemes and blockchain technology are important supporting instruments for both monitoring of performance and for improvement of the knowledge base on food flows across FVC operators. Some of these tools have been tested in the FOODRUS pilot sites, and several reports are available through WP1 and WP3.

Tools like smart labelling systems also serve as instruments to better inform the end-consumer, which can help households improve their decisions when handling food at home.

In our perspective, the current developments in the IT sector can offer valuable support in the fight against food waste. However, they cannot substitute the required planning and intervention effort required to businesses and governments. The application of blockchain technology could also be of help to increase the transparency of transaction between businesses and, for example, support buyers and sellers in reaching fair trade agreements while removing the practice of TBAs.

On the level of tax regimes, another option of using blockchain technology could be the provision of fiscal incentives to businesses that enter a certified blockchain network where food volumes and their paths are monitored, quantified and certified.

7.3.6 Use of an integrated, multi-actor system approach

Lastly, we find it important to stress the need for a holistic approach to FLW prevention and reduction. As the elements of the food systems are closely interlinked, effort on transformative change needs to be shared among all actors of the FSC equally. At present, the role of the end-consumer is over-emphasized while the role of the other players in the FSC receive less attention. A fairer multi-actor approach is therefore highly demanded.

There is also a need to work at multiple jurisdictional levels, from the small scale where producers cultivate their crops to the municipal and regional level where planning of resources use and management of food waste is

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coordinated. At national and European level action needs to be coordinated and guided through national FW prevention strategies and firm European ad-hoc legislation on the topic.

Only by engaging multiple actors at multiple levels through the support of a solid impact-drive policy framework, the transformative processes needed to eliminate food waste from our food systems can be achieved.

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9. Annexes

9.1 Annex A: Food regulation in the FOODRUS associated regions

9.2 Annex B: Policy brief on fiscal instruments

9.3 Annex C: Comparative overview of adoption of food losses and waste legislation in selected European countries

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