

Circular Food Strategies Documentation

D1.1

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1. Technical References

1.1. Deliverable Information

Project Acronym	FOODRUS
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¹ PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

1.2. Document History

Version	Date	Author	Reviewer	Description of main changes
1	30/05/2021	UD Contributors all	Pilots leaders	First version with overall structure, general description of pilots, procedures/surveys (CS5, CS6) and preliminary results (Phase 1 of CS5 and Phases 1 and 2 of CS6), first versions of stakeholders qualitative surveys

2	01/03/2022	UD Contributors all	SUA, ENG, Pilots leaders	Pilot's description updates including hotspots, Results of Phases 2 and 3 of CS5 and 3 of CS6, results about digitalisation surveys, Standardised terminology about causes and destinations, stakeholders qualitative surveys updated with terminology, KPIs sheets, final results about digitalisation, results of stakeholders mapping, diaries
3	07/09/2022	UD Contributors all	Pilots leaders	Included changes proposed by reviewers, calculation procedure of KPIs agreed with pilots, Results of Phase 4 of CS5, Annexes V and VI, formatting
4	28/09/2022	UD Contributors all	UD	Updated section 2 and Annex II to include comments provided by the PO and reviewers during the 1PR meeting. Additionally, other sections were updated with more current information: <ul style="list-style-type: none"> • The schemes of the FLW current management in the pilots (section 3.1.1). • The stakeholders map of Timisoara (associated region) was added (Figure 41). • The KPIs sheets (annex III). • The pilots' quantification methodology (annex VII).

1.3. Summary

The FOODRUS project will test 23 circular solutions to limit food loss and waste across three food value chains: vegetables and prepared salads (Spain); meat and fish (Denmark); and bread (Slovakia).

The solutions will empower and engage all stakeholders in the local food systems, creating a sense of community and building a multi-actor alliance to tackle the challenge of food loss and waste. FOODRUS will also empower citizens in order to make them an active part of the solution.

To promote the replicability of the tested solutions FOODRUS will prepare best practice toolkits involving six European regions as Followers, to replicate and adapt the solutions in: Timisoara (Romania), Budapest (Hungary), Linz (Austria), Plovdiv (Bulgaria), Halandri (Greece), Arnhem-Nijmegen (Netherlands), Amsterdam (Netherlands) and Catalunya (Spain).

This deliverable summarises the most relevant cross-cutting aspects of the FOODRUS project. In particular, the following aspects are covered:

- 1) Terminology framework (Section 2):
 - a) Establishment of definitions for the most relevant terms that will set the basis for the terminology used in the project. Particular focus on the definition of "food" and "food loss and waste" because of their importance for the quantification of food loss and waste (FLW)
 - b) Classification of the main stakeholders involved for an appropriate multi-actor approach
 - c) Identified causes of FLW generation and their connection with the stakeholders of the food value chain
 - d) List of destinations according to the food waste hierarchy

- 2) Co-design of the Circular Food strategies (Section 3):
 - a) Description of the pilots' current situation and scope of the Circular Food strategies:
 - i) Identification of the current FLW hotspots in each pilot's value chain and strategies to prevent it
 - ii) Establishment of the main objectives of the pilots
 - iii) Selection and boundary conditions of the product under study
 - iv) Description of the activities in the pilot
 - v) Main barriers and legal restrictions
 - b) Codesign of the FOODRUS solutions with the stakeholders:
 - i) Analysis of the FOODRUS expected results and solutions according to the Grant Agreement (GA)
 - ii) Collaborative workshop to achieve a common understanding of the results and solutions
 - iii) Reflection stage to brush up on the solutions
 - iv) Final design of the solutions
 - c) Stakeholders mapping of the pilots and followers that need to be engaged
- 3) Digital maturity analysis of the supply chains to assess the starting point of the pilots in terms of digitalisation and assess the potential relationship with FLW generation (Section 4):
 - a) State of the art of digitalization in the food industry
 - b) Analysis of the partners' level of digitalization
- 4) Stakeholders engagement (Section 5):
 - a) Analysis of the stakeholders' views on causes of FLW generation and potential solutions
 - b) Monitoring of the Pilots' Social Programmes
- 5) Establishment of the Food Loss and Waste Quantification and Prevention (FLWQP) methodology to monitor the impact of the prevention strategies of the project under the 3 sustainability pillars (Section 6)

This deliverable is directly related to the following deliverables:

- D1.2-Preparatory actions report, the definition of the scope of the FOODRUS solutions in D1.1 sets the basis for the identification of functional requirements, use cases and data sources for D1.2. The implementation of the Pilots' Social Programme from M7 to M18 will be also included in D1.2.
- D1.3-Preliminary test report. The first results of the implementation of the solutions and the Pilots' Social Programme from M18 to M28 will be included in D1.2.
- D1.4-Full test report. The first results of the implementation of the solutions and the Pilots' Social Programme from M29 to M40 will be included in D1.2.
- D1.5-"The future of Circular Food", a report compiling lessons learnt and the knowledge acquired in the three Circular Food Strategies developed in the FoodRUs pilots and the five followers.
- D2.1 Pilot's Social Programme, where the social action programme of each pilot is defined.
- D2.3 Citizen Science based methodology for Food Loss and Waste (FLW) reduction and prevention.
- D3.2 Circular food model specifications, the definition of the scope of the FOODRUS solutions in D1.1 sets the basis for the establishment of the different FOODRUS models.
- D3.1 Interoperability and backend platforms architecture & D3.4 FOODRUS suite: design of the operation & management and blockchain tools, will be set from the definition of the scope of the FOODRUS solutions in the present deliverable.

1.4. Disclaimer

Any dissemination of results must indicate that it reflects only the author's view and that the Agency and the European Commission are not responsible for any use that may be made of the information it contains.

2. Introduction

FoodRUs will deliver a deeper understanding of how local and regional food ecosystems are affected by food overproduction and overconsumption and ultimately by FLW and about the most successful strategies and policy mix that might contribute to resilience and sustainability of them through the implementation in 3 European supply chains of 23 solutions (S) (technological and non-technological) that have been grouped according to the expected output in 12 Results (R). One result (R) can be a unique solution or a set of solutions (Toolkit) as can be seen in Table 1. Moreover, FOODRUS project is a citizen-innovation project centred on the real needs of the end-user. For this purpose, a set of 10 Citizen Science (CS) activities based on 3 living labs (Result R6) has been defined. The methodology for each citizen science activity is described in Deliverable D2.3 Citizen Science based methodology for FL and FW reduction and prevention.

Table 1. FOODRUS results & solutions.

Result (R) Name	Solutions (S)	
R1 Process optimization tool	S1.1 Process optimization decision-making tool	Solution 1.1.1 Demand Forecasting
		Solution 1.1.2 Production quality and quantity forecasting
		Solution 1.1.3 Cold chain traceability
R2 Food losses and wastes toolkit	S2.1 FLW decision-making tool	Solution 2.1.1 Quality forecasting vs temperature
		Solution 2.1.2 Decision making tool for pre-waste management with multicriteria
	S2.2 - E-learning materials to learn about best practices	
R3 Audit toolkit	S3.1 Audit decision-making tool	Solution 3.1.1 Blockchain Framework for the registration of indicators for decision-making in food certification processes
		Solution 3.1.2 Unification and traceability of date marking
	S3.2 E-learning materials in certification using blockchain	
R4 Sustainable market toolkit	S4.1 Last mile solutions to ease local market and agile management of edible food	
	S4.2 An alert system to notify the offer of still edible products in different marketplaces	
	S4.3 E-learning materials to learn about new secondary products	
R5 Stocks optimization tool	S5.1 Stocks planner	
R6 Citizen Science based living labs methodology	S6.1 Set of Citizen Science activities (CSs)	CS1 Citizenship monitoring groups to identify shopping, cooking and waste generation habits and quality assessment of the main causes of FW.
		CS2 Working groups to co-create specific contents to develop the e-learning materials.
		CS3 Working groups involving women to assess the gender dimension.
		CS4 Participatory processes to discuss possible fiscal instruments, and building strategies.

		CS5 Working groups to define the scope of the project and co-create the different solutions of the project.
		CS6 Working groups to set the methodology for the quantification of FLW and its environmental, social and economic impacts as well as the evaluation of prevention actions.
		CS7 Working groups to discuss the result of the baseline, assess the causes and the existing solutions to identify potential solutions and barriers.
		CS8 A participatory process to define the municipal tax of the PAYT considering the impact of FW prevention.
		CS9 Actions to develop healthy and sustainable diets.
		CS10 Working groups to discuss innovative models with entrepreneurs (social and non-social) to develop new business as well as ecosystemic alliances among stakeholders and volunteer agreements signature.
R7 Equilibrated diet tool	S7.1 A tool for weekly planning of menus with the donated food for people in need.	
R8 Good Food toolkit	S8.1 Food Loop App to know about food waste generation.	
	S8.2 Cook App to promote plates based on local and sustainable products and the maximum exploitation of food	
	S8.3 E-learning materials to improve understanding about date marking and knowledge about food conservation.	
	S8.4 A dashboard with information about product traceability	
R9 Food waste management toolkit	S9.1 Track waste generation and food waste separate collection (biowaste and plastics fractions) tool	
	S9.2 Innovative PAYT invoice system that include not only biowaste separate collection but also FLW approaches and the use of Blockchain	
	S9.3 E-learning materials to foster self-composting	
	S9.4 E-learning materials to promote economic instruments by municipalities	
R10 Prevention of FLW by legal instruments briefing	S10.1 A briefing about policies, fiscal incentives, civil responsibility and other legal set of recommendations	
R11 Building capacity strategies for circular food briefing	S11.1 A briefing about building capacity strategies such as crowdfunding, crowdlending and, crowdequity through the collaboration of the ecosystem. Other strategies as ethical loans, microcredits, Business Angels, public grants will be assessed.	
R12 FoodRUs Knowledge Hub	S12.1 FOODRUS dashboard	S12.1.1 A tool to quantify and monitor FLW in the value chain.
		S12.1.2 A tool to identify root causes of the food waste issue from an integral perspective.
		S12.1.3 A tool to identify the best practices of the project to ease their replicability and transferability.

		S12.1.4 A tool to monitor the impact of the initiatives targeted to reduce food waste.
	S12.2 A repository with e-learning materials	

In order to establish a common framework for the 3 pilots that allows to assess the impact along the project, a literature review about FLW related terminology is presented in this introductory section. In particular, the following concepts are assessed: FLW definitions, stakeholders of the food value chain involved in FLW prevention, main causes behind FLW generation and final possible destinations. As a result, a final common framework for the FOODRUS project is established.

2.1. FLW definitions

With the goal of establishing the basic framework, a clear definition of the FLW related terms must be agreed upon. In order to accomplish this task, a literature review was performed in the first place to have an overview of the scientific community and the European legislation's perspective. Concretely, the following terms were explored because of their importance for using common terminology in the project: food, edible food, inedible food, food loss, and food waste (Table 2). Several disparities were encountered, although in some cases there was a widely accepted definition that was repeated in numerous sources for a given term.

In addition to these fundamental concepts for the proper delimitation of the FOODRUS framework, other concepts were tagged too as worthwhile to be explained in order to avoid confusion. To begin with, "eatable food" will be defined so that it is not mistaken for "edible food". Eatable food stands for the food which retains the necessary properties to be placed on the market for human consumption (Garcia-Garcia et al., 2017). So the edible part of a food product like an apple for example can become uneatable because of certain circumstances that have adversely affected its state.

With reference to the world of new technologies, there are other concepts closely related to the project which, according to the literature, should be clarified. These are "digitisation" and "digitalisation". They are normally used as interchangeable terms, but according to some authors they are not. In the view of Gobble M. M. (2018) and Reis, J. et al. (2020), several authors address the differentiation between digitisation and digitalisation. Although they are commonly used as synonyms, these two words imply different meanings. On one hand, digitisation refers to the transformation of analogue information into digital. In the words of P. Parviainen et al. (2017), digitisation is "the action or process of digitising; the conversion of analogue data (esp. in later use images, video, and text) into digital form". On the other hand, digitalisation consists of making business processes evolve through the implementation of digital technologies. In the review of the definition of digitalisation conducted by Reis, J. et al. (2020), it can be observed that in the literature this term is sometimes given a confusing definition. In some cases, this definition appears to mix both of the definitions presented above, and in other cases, the provided definition is more appropriate to "digitisation" nonetheless. Which can lead to incorrect use of the term and misleading conclusions.

Table 2. Definitions in the literature for food, edible food, inedible food, food loss, and food waste.

Source		Definitions				
		Food	Edible food	Inedible food	Food loss	Food waste
Scientific papers and other documents	The High Level Panel of Experts on Food Security and Nutrition. (2014). Food losses and waste in the context of sustainable food systems.	(Not given)	(Not given)	"What WRAP calls "unavoidable waste"."	"Decrease, at all stages of the food chain prior to the consumer level, in mass, of food that was originally intended for human consumption, regardless of the cause." → <i>It does not include inedible food.</i>	"Food appropriate for human consumption being discarded or left to spoil at the consumer level – regardless of the cause." → <i>It does not include inedible food.</i>
	Teuber, R., & Jensen, J. D. (2016). Food losses and food waste – Extent, underlying drivers and impact assessment of prevention approaches.	(Not given)	"The categories avoidable versus unavoidable and edible versus inedible are not clear-cut but depend on food safety considerations, available technologies and cultural factors."		It states that a general definition for FL and FW may not be feasible due to the complexities of FSCs. "It might be more realistic to work with different definitions according to the research objectives tackled."	
	FLW protocol (2016). Food Loss and Waste Accounting and Reporting Standard. Version 1.0.	"Any substance—whether processed, semi-processed, or raw—that is intended for human consumption."	(Not given)	"Components associated with a food that, in a particular food supply chain, are not intended to be consumed by humans."	"The FLW Standard is designed to allow for the fact that different organizations will have different reasons for quantifying FLW. These different goals lead to (or government regulations may even explicitly state) different definitions of what constitutes FLW."	

	<p>Garcia-Garcia, G., Woolley, E., Rahimifard, S., Colwill, J., White, R., & Needham, L. (2017). A methodology for sustainable management of food waste. <i>Waste and Biomass Valorization</i>, 8(6), 2209–2227.</p>	(Not given)	<p>"It is or has been expected to be consumed by humans at any point during its life cycle, otherwise the product is inedible." It requires the product to be in demand, otherwise, it is considered inedible.</p>	<p>"Inedible food waste" is thus considered unavoidable waste."</p>	(Not given)	<p>"Food materials (including drinks) originally intended to be used to feed humans and not ultimately sold for human consumption by the food business under study, and inedible parts of food." → <i>It includes donated food as FW.</i> Food wasted by consumers and managed at home (like home composting) is not considered.</p>
	<p>Teigiserova, D. A., Hamelin, L., & Thomsen, M. (2020). Towards transparent valorization of food surplus, waste and loss: Clarifying definitions, food waste hierarchy, and role in the circular economy. <i>The Science of the Total Environment</i>, 706(136033), 136033.</p>	(Not given)	(Not given)	(Not given)	<p>"The streams that are truly lost, i.e. inexplicable, whether because —not accounted for or disappearing from the accounting."</p>	<p>"Food that cannot be expected to be eaten by humans, due to either natural inedibility or inedibility due to the management of food, throughout whole FSC."</p>

FUSIONS project	FUSIONS. (2014). Definitional Framework for Food Waste. Full report.	"Any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be eaten by humans." It excludes inedible food.	It depends on "whether or not a substance or product is intended to be, or reasonably expected to be eaten by humans, which is determined by the person/company currently handling the raw material."	It depends on "whether or not a substance or product is intended to be, or reasonably expected to be eaten by humans, which is determined by the person/company currently handling the raw material."	(Not given)	(Not given)
	FUSIONS project. Gheoldus, M. (n.d.). FOOD WASTE DEFINITION. Eu- Fusions.Org. Retrieved October 28, 2021, from https://www.eu-fusions.org/index.php/about-food-waste/280-food-waste-definition	(Not given)	(Not given)	(Not given)	"Decrease in mass (dry matter) or nutritional value (quality) of food that was originally intended for human consumption." (FAO, 2013)	"Any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)."

FAO	FAO. (2014). SAVE FOOD: Global Initiative on Food Loss and Waste Reduction. Definitional framework of food loss.	"Any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drinks, chewing gum and any substance which has been used in the manufacture, preparation or treatment of "food" but does not include cosmetics or tobacco or substances used only as drugs. (Codex Alimentarius Commission, Procedural Manual, 2013)	(Not given)	(Not given)	"The decrease in quantity or quality of food."	"Removal from the FSC of food which is fit for consumption, or which has spoiled or expired, mainly caused by economic behaviour, poor stock management or neglect." It states the it is different from food loss because "the underlying reasons, economic framework and motivation of the FSC actors for wasting food are very different from the unintended food loss, and subsequently the strategies on how to reduce food waste are conceived in a different, targeted manner."
	FAO. Food loss and food waste. (n.d.). Fao.Org. Retrieved October 28, 2021, from https://www.fao.org/food-loss-and-food-waste/flw-data	(Not given)	(Not given)	(Not given)	"Decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, food service providers and consumers."	"Decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers and consumers."

	FAO. (2019). The state of food and agriculture. Moving forward on food loss and waste reduction.	"Any substance, whether processed, semi-processed or raw, intended for human consumption."	(Not given)	"Food components that, in a particular food supply chain, are not intended for human consumption (e.g. bones, rind)."	"The decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retail, food service providers and consumers." It indicates that the Food Loss Index , which is part of SDG 12.3 , includes the inedible parts in its quantification.	"The decrease in the quantity or quality of food resulting from decisions and actions by retailers, food services and consumers."
WRAP	WRAP. (2015). Strategies to achieve economic and environmental gains by reducing food waste.	(Not given)	Edible = Avoidable	Inedible = Unavoidable	(Not given)	"Any food that had the potential to be eaten, together with any unavoidable waste, which is lost from the human food supply chain, at any point along that chain." → <i>It includes edible and inedible.</i> → <i>It includes only food produced for human consumption.</i> → <i>It excludes food surplus heading animal feed.</i>

	WRAP. (2020). Food surplus and waste measurement and reporting. UK Guidelines.	"Any substance that is – or was at some point – intended for human consumption."	(Not given)	"Components associated with a food that would never have been intended to be consumed by humans."	"Determining the difference between what may be defined as food loss versus food waste consistently can be difficult. The term 'food waste' as defined in this document is intended to cover all stages of the supply chain."	"Any food and inedible parts sent to any of the Food Waste Destinations listed below. This definition excludes any material that is sent for redistribution to people, animal feed or, conversion into industrial products (collectively referred to as 'food surplus')."
	WRAP. (2021). Food surplus and waste in the UK – key facts.	(Not given)	"The parts which were intended for human consumption."	"Those parts associated with food that are not intended to be consumed (such as bones, egg shells)."	(Not given)	Total food waste = edible food + inedible parts.
European regulatory framework	EU REGULATION (EC) No 178/2002	"Any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans."	(Not given)	(Not given)	(Not given)	(Not given)

	European Commission. (2021). Guidance on reporting of data on food waste and food waste prevention according to Commission Implementing Decision (EU) 2019/2000.	"Any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans."	" Edible food parts are the components associated with a food, in its fresh mass status, that are usually consumed by humans in the MS, either as is (raw consumption) or after processing or cooking."	"Food also includes inedible parts , where those were not separated as by products from the edible parts when the food was distributed or processed, such as bones attached to meat destined for human consumption, orange peels, seeds..."	"Decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, food service providers and consumers." (FAO)	"Any food that has become waste under these conditions: 1. it has entered the food supply chain, 2. it then has been removed or discarded from the food supply chain or at the final consumption stage, 3. it is finally destined to be processed as waste."
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From this review some interesting conclusions were extracted:

- Regarding the definition of “food”, the fact that the product must be intended for human consumption is a common denominator in all the consulted sources. It is also the criteria to differentiate between edible and inedible food.
- Edible and inedible food are usually considered equal to avoidable and unavoidable food waste, respectively.
- Food loss is often related to a loss of quality or quantity of food along the FSC, as defined by FAO.
- Culture plays a key role when drawing the line between edible and inedible food.

The last point deserves special mention since it implies that FLW quantification could not be fully standardised for every part of the world according to such definitions of edible food and inedible food. And thus the solutions that could handle a hypothetical FLW would also be different, as the impact of cultural elements would determine them. Consequently, the theoretical lowest environmental impact for managing the same type of food surplus in the best way could be higher in a particular area in comparison to another merely due to cultural constraints.

Following this comprehensive analysis, the subsequent sections detail the definition of “food” and “FLW” in the context of the project. While the definition of FLW will be the one used as an umbrella term encompassing “food loss” and “food waste”, separate definitions for both terms are provided in this paragraph as well. And so the accepted definitions for edible and inedible food:

- Edible food: “Components associated with a food, in its fresh mass status, that are usually consumed by humans in the MS (Member State), either as is (raw consumption) or after processing or cooking. The definition of edible food parts might differ from country to country, or from region to region, according to local culture and habits.” (European Commission, 2021).
- Inedible food: “Parts of the food that were not separated as by products from the edible parts when the food was produced (including all the stages of production, processing and distribution)” (European Commission, 2021). In concordance with the definition of edible food, the definition of inedible food will depend on the culture and habits of the consumer.

2.1.1. Definition of food

First, a clear definition of food is given so that afterwards food loss and waste can be defined in compliance with it. According to Regulation (EC) N° 178/2002 (European Union, 2002a), food (or foodstuff) is “any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans.” It also includes any substance that has been intentionally incorporated into the food during manufacturing, preparation or treatment processes.

Although this definition of food explicitly excludes:

- Feed.
- Live animals (unless they are prepared to be marketed for human consumption).
- Unharvested plants.
- Medicinal products.
- Cosmetics.
- Tobacco products.
- Narcotic or psychotropic substances.
- Residues and contaminants.

Therefore, from this point onwards any mention of “food” will be alluding to this definition coined by the European Union in Regulation N° 178/2002.

2.1.2. Definition of food loss and waste (FLW)

Once the term “food” has been described, a definition of food loss and waste (FLW) is needed to find a common ground and ensure its appropriate measurement.

“Food waste” is defined by the European Commission (Eurostat, 2021) as any food that has become waste under these circumstances:

1. It has entered the food supply chain (FSC).
2. It has been removed or discarded either from the FSC or at the consumption stage.
3. Lastly, it is intended for being processed as waste.

Additionally “Food Loss” is defined as “Decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, food service providers and consumers.” (FAO).

It is important to highlight that both edible (parts of food intended to be ingested) and inedible (parts of food not intended to be ingested) food are covered by this definition. Therefore, they have to be included when quantifying FLW.

To avoid misunderstandings, hereunder some clarifications are made by Commission Delegated Decision (EU) 2019/1597 concerning products that are not considered food loss and waste and shall not be measured as such:

- Losses within the different stages of the FSC where certain products have not become food yet (like not harvested crops or animals killed by diseases).
- Faecal matter, straw and other natural non-hazardous agricultural or forestry material used in farming, forestry or for the production of energy from such biomass through processes or methods which do not harm the environment or endanger human health (agricultural material).
- Animal byproducts, including processed products covered by Regulation (EC) N° 1774/2002 (European Union, 2002b), except those which are destined for incineration, landfilling or use in biogas or composting plant.
- Food waste collected with packaging (1501 European Waste Codes).
- Food waste collected with street cleaning residues (200303 European Waste Codes).
- To the extent -possible, non-food materials that are mixed with food waste in the collection process.
- To the extent possible, non-food materials that predictably don't include food waste or in insignificant quantities (like soil or packaging).

Additionally, through the Delegated Decision 2019/1597 (European Commission, 2019) the European Commission also allows the voluntary measurement of:

- Food waste considered as composed of parts of food intended to be ingested by humans.
- Food waste drained as or with wastewaters.
- Redistributed food waste for human consumption.
- Food that is no longer intended for human consumption, commercialised to be transformed into feed.
- Former food: Foodstuffs, other than catering reflux, which were manufactured for human consumption in full compliance with the EU food law but which are no longer intended for human consumption for practical or logistical reasons or due to problems of manufacturing or packaging defects or other defects and which do not present any health risks when used as feed.

With the aim of being in accordance with European legislation, these are the rules that must be followed to set the scope of the FLW that will be quantified along the food value chain (FVC). Note that whereas the legislation makes use of the “food waste” term, in this document and along the FOODRUS project food loss and waste (FLW) will be the term generally used in concordance with the consulted bibliography.

Therefore, this terminology lays the basis on which all the actions and solutions deployed in the project will be built.

2.2. Classification of the stakeholders

A crucial step in the analysis of the prevention strategies is to clearly define the different groups of users which FOODRUS would like to take into account, as they are the primary stakeholders interested in the eco-solutions developed (both as active partners or end users). In the project, a specific target is specified regarding stakeholders involvement (80% of actors involved in each pilot). So, this map will also serve as the basis to monitor the achievement of this KPI (Key Performance Indicator) of the project.

The process of identification of the stakeholders cluster has been compiled in three steps:

1. Preliminary classification of stakeholders categories by University of Deusto
2. Identification and analysis of the specific stakeholders in each pilot by pilot partners
3. Refining of the classification according to the results obtained in point 2 by Pilot Leaders and the University of Deusto

According to the principle “what is not measured cannot be managed”, the FOODRUS project identifies stakeholders that generate (a), treat (b) or prevent (c) food surplus, loss and waste (FSLW) along the food supply chain (FSC). According to Figure 1 the first step in reducing food loss and waste and reaching the SDG 12.3 goal of “halving per capita global food waste at the retail and consumer levels and reducing food loss along production and supply chains including post-harvest losses by 2030” is clear definitions and measurement for the point of generation. For this purpose, we will apply the food waste hierarchy developed by Teigiserova et al. (2020).

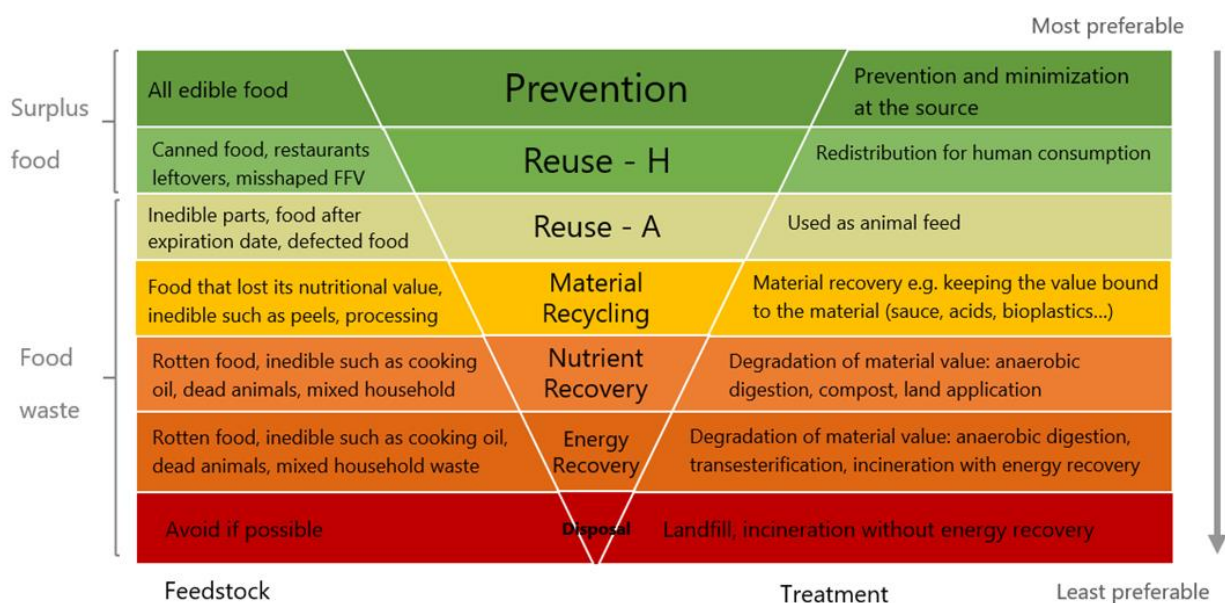


Figure 1. Updated hierarchy for food surplus and waste proposed herein building on terminology from major European and national projects (UNEP, 2014; WRAP, 2013; FUSIONS: Östergren et al., 2014).

*FFV fresh fruits and vegetables (Source: Teigiserova et al., 2020)

First, surplus food should be prevented by correcting the global food production and trade system to eliminate edible food from becoming waste. Edible food should, as a second priority, be redistributed for human consumption (people in need), and the third priority is reuse for animal feed. Ideally only inedible and unavoidable food loss and waste should move down to the fourth level of the food waste hierarchy and here lies the opportunity of sustainable circular food solutions using inedible and unavoidable food loss and waste fractions as input for food loss and waste biorefineries producing multiple high value output products.

The current situation with food waste disposal in the EU represents an opportunity for moving it up the waste hierarchy; i.e. from the least preferable option (landfill) towards energy recovery (second lowest step of the waste hierarchy) to combined nutrient and energy recovery.

Sustainable solutions for a future regenerative circular food system are described in detail in deliverables D4.1, D4.3 and D4.4.

Figure 2 shows the stages along the FSC where FOODRUS will measure food loss and waste generation in the reference systems of the pilots before implementing technical and social innovation solutions.

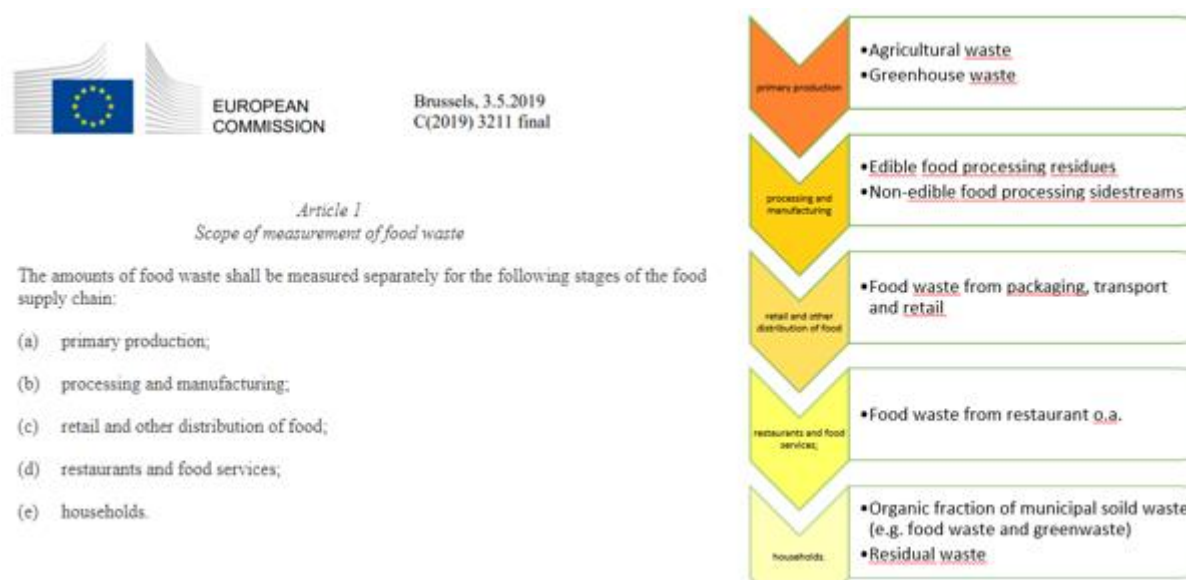


Figure 2. Food loss and waste generation along the food supply chain and points of measurement to be reported by EU member states from 2023.

Figure 3 and Figure 4 show the location of the partners involved in the 3 pilots and the 8 Associated Regions (ARs) involved as followers, respectively. In the next section, the methodology to identify the key stakeholders is explained.

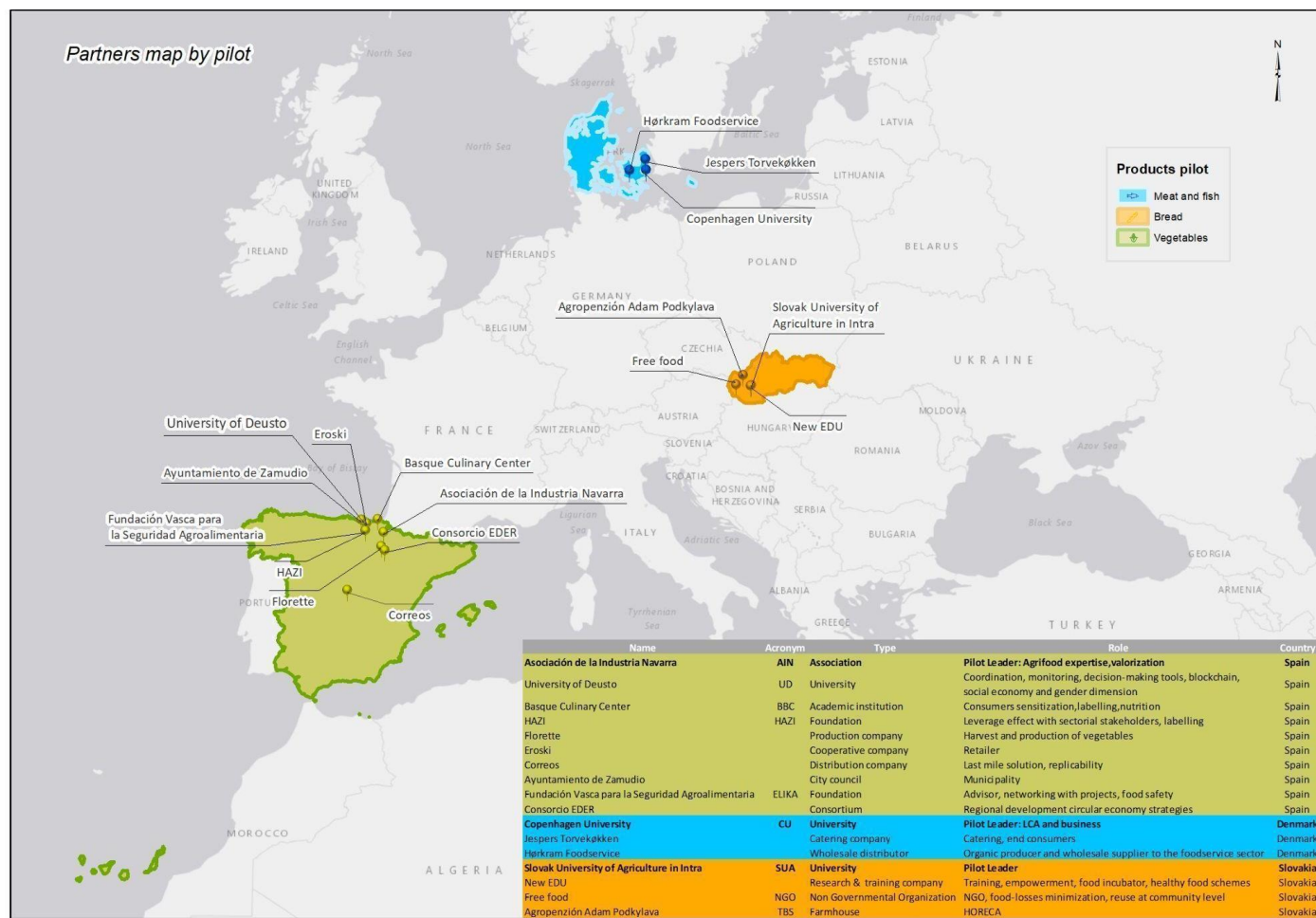


Figure 3. FOODRUS pilots map.



Figure 4. FOODRUS Associated Regions (ARs) map.

2.2.1. Classification of stakeholders methodology

A preliminary classification of the type of the stakeholders (Figure 5) has been carried out according to the following aspects:

1. Role in the context of food losses and waste (FLW); classification has been made according to the definition of food losses and waste, steps in the Food Value Chain, users of specific solutions compiling those with similarities in behaviour or user needs, including awareness and communication purposes. Under these premises, actors have been classified into 4 main categories:
 - a. Waste generators: actors of the FVC that are involved directly in the generation of FLW and the associated packaging waste. The classification follows the NACE code classification to be in line with the FLW quantification procedure.
 - b. Waste managers: actors that participate in the management of FLW according to the food waste hierarchy and consider all the stages in food loss and waste management
 - c. Sustainability actors: public and private organisations identified as pillars for the long-term sustainability of FOODRUS strategies
 - d. Empowerment actors: organisations needed to foster long-term behavioural changes based on empowerment of the FVC through information (and transparency), sensitization, education and instrument providers for the change
2. An additional classification has been carried out according to the innovation methodology in order to guarantee the five perspectives for the Quintuple Helix innovation model (Carayannis E.G, et al., 2012) in FOODRUS.

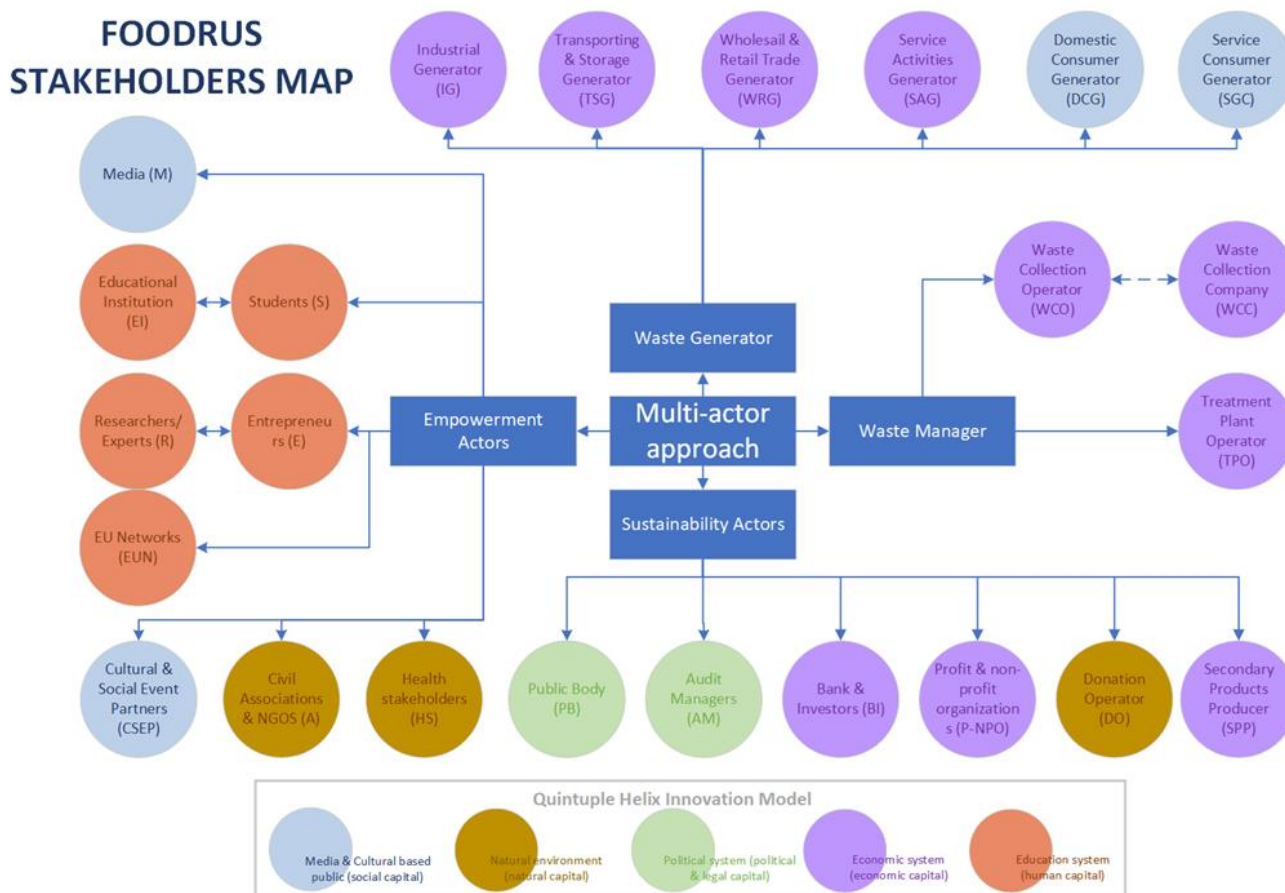


Figure 5. FOODRUS stakeholders map.

Table 3. Definition of the FOODRUS stakeholders.

	Target group	Acronym	Description
Waste Generator	Domestic generator	DG	The domestic generator is the generator at the household level that generates food waste (and associated packaging) due to their daily consumption and living habits and to their level of awareness inside their home.
	Wholesale & Retail trade generator	WRG	Commercial generators within the following economic activities: <ul style="list-style-type: none"> Wholesale Retail
	Service activities generator	SAG	End consumers and providers of services associated with: <ul style="list-style-type: none"> Human health and social work activities Accommodation and food service activities
	Industrial generators	IG	Industrial generators are those economic activities that generate food losses and associated packaging waste. It includes the following economic activities: <ul style="list-style-type: none"> Agriculture, forestry and fishing (producer) Manufacture of food products (manufacturer) Packaging activities

	Transporting and Storage generator	TSG	Actors related to the transport and storage activities that may cause food losses or have a direct influence over the quality of food.
	Non-residential generator	NRG	Non-registered residents have to be also taken into account. People renting a house, an apartment, a room (or internal domestic work staff), tourists, and refugees, may be some examples. Despite having a similar waste production as other residents (domestic) they are in a completely different group of users as they are unable to get the information on waste production in the bill, for example. There is a need to develop a specific communication campaign for this target group to ensure the understanding of the project's goals.
Waste manager	Waste collection operator	WCO	Waste management includes all the activities and actions required to manage waste from its generation to its final treatment (collection, transportation, recycling or disposal). The waste is managed to avoid its adverse effect on human health and the environment and, most of the time, to get resources from it (material or energy resources). The management of municipal waste (or industrial waste assimilated to urban waste) is generally the responsibility of the local government that typically entrusts to a company all the waste management activities. However, in the case of industrial waste the end-responsible is the company that can deal with it directly or through an external company. In the case of municipal waste, the municipalities are in charge of the taxes. This target group refers to the organization with the competencies in waste management in the pilots.
	Waste collection company	WCC	The waste collection process consists of a bunch of daily tasks that include personnel from both the waste collection operators and external companies. Thus, truck drivers and operators will fulfil the service thanks to the tools they are provided with.
	Treatment operator plant	TPO	This is the entity responsible for bio-waste valorization for material or energy recovery. Final disposal is also considered here if applicable.

Sustainability actors	Public body	PB	Public Bodies are responsible for waste management at the local, regional or national level. Strategies and decisions about how to manage waste are taken by policy makers both at the municipal and the regional/national level, by means of political or administrative guidelines or regulations. These decisions are also based on the advice of waste management technicians such as external consultants etc., that are aware and experts on all the technical issues regarding waste management. The policy makers can be different among EU countries, basically according to the national regulation and the transposition of EU Directives. This target group also compiles those public bodies that can act on waste prevention with indirect instruments not directly associated with waste such as fiscal policy or grants.
	Audit Managers	AM	Public bodies, institutions or companies related to the food certification processes.
	Bank & Investors	BI	Bank and potential investors that can promote the innovation and make it economically sustainable.
	Profit & non-profit organizations	P-nPO	This target refers to profit and non for profit organizations that are needed to make sustainable FOODRUS strategies under the perspective of social economy and solidarity based economy.
	Donation operator	DO	Donation operator is a person/entity responsible for the management of certain kinds of food (fresh or cooked) for donation for human consumption such as NGOs collaborating with the municipality, Food Banks or social services as social kitchens.
	Secondary Products Producer	SPP	Companies that collect and transform food losses and wastes in secondary products for human or animal consumption.
Empowerment actors	Media	M	Press media and social networks that participate in the communication and dissemination of results.
	Educational institution	EI	Refers to the physical space where people gather or congregate for education, receive, assimilate and learn knowledge and acquire, in addition, cultural and behavioural sensitization by previous generations. It is usually differentiated by age groups in compulsory education or by specific thematic.
	Students	S	Student is a person who learns, usually, someone who attends an educational institution. The Student could be enrolled or attend classes at a school, college or university. We usually refer to formal education and vocational studies.
	Researcher/Experts	R	Researcher is a person interested in the data recorded in order to make assessments, investigate solutions for FLW reduction and go beyond the reasons behind FLW.

	Entrepreneurs	E	Uptake of innovative solutions are needed to move towards more circular food strategies. In this regard entrepreneurs are key.
	EU Networks	EUN	Coordination and collaboration with EU and international networks is key for the adoption and transferability of results. Examples of this target group are sister projects, followers, European platforms, clusters, etc.
	Cultural & Social Event Partners	CSEP	Stakeholders related to the culture (traditions, values..) and social activities in the pilots (events organizers, culture promoters, organizations for inclusion and equity, etc).
	Civil Associations & NGOs	A	Associations or NGOs that promote sustainable life habits that prevent FLW.
	Health Stakeholders	HS	This target group refers to doctors, nutritionists or culinary experts that provide scientific knowledge about healthy and equilibrated diets based on maximum use of food, local products and innovation.

Section 3.1.4 shows the stakeholders identified for each pilot and associated region.

2.3. Causes of FLW generation

Food insecurity continues to grow today, with almost a third of the world's population (2.37 billion people) being food insecure by 2020 (FAO et al., 2021). This fact conflicts with the huge amounts of food that is being wasted because of an improvable performance along the food supply chain (FAO et al., 2013). Specifically, 1.3 billion tons of food per year are lost or wasted (FAO, 2011). It brings more evidence on how important it is to solve this problem in order to build a more sustainable food system since it is completely unbalanced. The causes why food can be lost or wasted respond to reasons that are either associated with a particular point in the FSC, or transversal (C. Chauhan et al., 2021). With a view to detecting these causes of FLW generation, a literature review was carried out in which many were identified. They are hereunder presented in different groups:

- FSC stakeholders' attitudes: Farmers, managers, and retailers' attitudes play a fundamental role in the generation of FLW. Sometimes FLW caused by an overproduction of food is seen by farmers as an acceptable deficiency and so no preventive measures are taken. Besides, there are no standard procedures to deal with that food surplus, which favour those situations (Pullman et al., 2017; Peira et al., 2018; Beausang et al., 2017; Garrone et al., 2016). Also, consumers and the rest of the actors' lack of awareness is a reason that feeds this issue (R. Diaz-Ruiz et al., 2018).
- Food management: Here it is highlighted that inappropriate food sourcing strategies in perishable food, and shelf life losses due to logistics obstacles provoke FLW (W. A. Rijpkema et al., 2014). Traffic issues and hostile weather conditions were remarked as some of such obstacles (Zhun, 2017). Long distances are a challenge especially when temperature conditions are not in control or packaging is not the best (R. Arivazhagan et al., 2016; R. Diaz-Ruiz et al., 2018). Shortening the FSC length is a key action line so that shelf life is as large as possible.

FLW is generated in international trade too, mainly as a consequence of political changes (Q. R. Al-Dalaeen et al., 2021).

- **Food aspect and quality:** Cosmetic and quality requirements are a matter of concern in terms of FLW generation. They exist not only because of restrictive policies and standards but also due to a self-imposed condition by stakeholders themselves (B. Devin et al., 2018; I. E. De Hooge et al., 2018; Gillman et al., 2019). This actors' behaviour is explained by consumer exigencies, market competition, pricing, logistics and costs of production (I. E. De Hooge et al., 2018). Actually, the so-called "one-third rule" is an unwritten law that appears to spur the disposal of still edible food. This rule is a division of the shelf life or best before date of the product among industry, supermarket, and consumption stages. In such a way that, if the product exceeds that corresponding time segment in the industry or in the supermarket stage, it is eliminated from the FSC (R. Diaz-Ruiz et al., 2018). Beyond the FLW triggered by the standards requirements themselves, the uncertainty and misinterpretations that their content holds cause broader waste (R. Diaz-Ruiz et al., 2018). Another menace to food quality integrity as well as shelf life is adverse weather (C. Mena et al., 2011).
- **Sale agreements:** A FLW driver in this context is related to returns and order cancellations between suppliers and retailers. This allows a rise in economic profits for retailers at the expense of additional costs paid by suppliers, who become responsible for the FLW (M. Eriksson et al., 2017; R. Ghosh et al., 2019). Moreover, some retailers order an excessive amount of products that end up becoming waste just because they want to obtain discounts and better prices. Another driver is the limited room for manoeuvre some companies have when managing food surplus of its own brand that cannot be sold anywhere else (Monrier et al., 2010; Parfitt et al., 2010; Gustavsson et al., 2011; BCFN, 2012; and IMECHE, 2013). Take-back agreements (TBAs) make up an extra cause as they submit providers to the power of supermarkets. They force supermarkets to pay not for the products they buy, but only for the products they manage to sell. This leads to overordering, as the supplier is the one who bears the costs (Ghosh and Eriksson, 2019; Devin and Richards, 2018). Supermarkets also play a major role in regards to the availability of flexible buyers. Their hoarding means that there are fewer flexible buyers willing to stockpile diverse and seasonal products depending on what is available (Feedback, 2018).
- **Retail and store operations:** There are several scenarios in the retail sector that are leading to a growth in the production of FLW. Attempts to meet the unpredictable consumer demand (which is even more unforeseeable when marketing campaigns have a considerable effect), products with a short shelf life left at the store, excessive amount of products either purchased from suppliers or stacked in the stores during promotions, trying to offer the widest variety of products for as long as possible, and supermarkets requirements to keep total on-shelf availability of products (C. Teller et al., 2018; R. Diaz-Ruiz et al., 2018).
- **Packaging issues:** Inadequate packaging design and unnecessary packaging may cause FLW instead of preventing it as it is supposed to do. A packaging design sometimes hampers the extraction of the food contained within it, which ends up being wasted (Wohner et al., 2020). Also, there are cases where the implementation of a packaging turns out to boost the amount of FLW. An example is given by Y. Goossens et al. (2019), who pointed out the example of a pack of apples that becomes entirely wasted when just one of them gets spoiled. Which is even more harmful to the environment since apples don't need to be packaged.
On the other hand, a lack of packaging can be the motive for this problem as well. In transportation, bad road conditions are a threat to product integrity if the packaging doesn't protect it well enough (R. Arivazhagan et al., 2016).
- **Food mishandling:** FLW is also a consequence of bad practices when harvesting, cleaning, screening and processing. Collecting products regardless of their maturity, and damaging them in harvesting and cleaning processes are spotted as causes of it. Not to mention the food mishandling delivered when there is a labour shortage (R. Arivazhagan et al., 2016). The lack of scientific methods decreases the efficiency of such activities (M. Balaji et al., 2016). Although this improper management of the food is

performed also by consumers in supermarkets when wrongly manipulating fresh food (R. Diaz-Ruiz et al., 2018).

- Stakeholders coordination and communication: Coordination and communication between actors in the FSC are reported to be other factors inducing FLW (M. Balaji et al., 2016). Looking at the FSC as a whole, its structure is as solid as its interconnections are, hence any disharmony implies an inefficiency in the handling of the product.
- Consumers' habits: In households, consumers tend to generate FLW due to a misconception or confusion when it comes to distinguishing between shelf life and best before date, bad previous purchasing planning, and other cooking mistakes such as cooking more than they will eat or not taking advantage of leftovers due to a lack of knowledge. As well as preserving it not in the way it should be. Concerning diets, it is believed it can be making more FLW in the same way (R. Diaz-Ruiz et al., 2018). Limited cooking abilities can also be an obstacle to making good use of all the food. And in some specific retail points such as buffets, consumers may cause FLW by taking more food than necessary, which afterwards will not be placed where it was (Monrier et al., 2010; Parfitt et al., 2010; Gustavsson et al., 2011; BCFN, 2012; and IMECHE, 2013). These habits can be even harder to predict when there are major fluctuations in weather conditions (C. Mena et al., 2011).
- Cold chain interruptions: To guarantee food safety it is mandatory to keep food under predetermined conditions, mainly through the control of the cold chain. An interruption of such a cold chain may result in FLW (R. Diaz-Ruiz et al., 2018).
- Farmers' behaviours: As mentioned for retail and store points, at a farm level the demand prediction represents an obstacle to avoid FLW too. Apart from that, it may occur that farmers grow the products they consider to be more profitable according to last season prices as stated by R. Diaz-Ruiz et al. (2018). By doing so, some seasons become disproportionately productive, which leads to missed food surplus.

But on the contrary, sometimes farmers don't harvest products because their market prices have dropped and they are no longer profitable (C. Muriana, 2017). Additionally, it is stated that the capability of farmers' cooperatives to cope with food surplus situations is softened by the farmers who show individualist attitudes at the moment of trading.

There are some policies that promote overproduction of food due to production subsidies (Bengtsson et al., 2018; Pritchard, 2012), which constitutes another reason for FLW generation. And finally, farmers' dependence on climatological conditions is noticed as an FLW driver since there may be an overproduction due to a boosting climate (R. Diaz-Ruiz et al., 2018).

- Investments in FLW prevention: Likewise, innovations aimed at preventing FLW along with technical training of actors in this regard, are major enablers of FLW prevention that are not being taken into account sufficiently (C. Chauhan et al., 2021).

This analysis and resulting standardisation of the causes was later employed for several purposes: labelling those KPIs for food loss and waste prevention activities that were also potential indicators of a cause of FLW generation; providing scientifically validated causes as options to choose: (1) in a questionnaire for external stakeholders that is further explained in Section 5.1 and (2) in the FLW quantification tools employed for the deployment of the CS1. Additionally, the possibility of employing these causes to estimate the individual impact of each FOODRUS solution on the FLW generation and thus on the environmental footprint of the FVCs will be evaluated.

All of the above causes listed are shown in Table 4 together with the stakeholders to which they apply. The classification of stakeholders was done according to the EU NACE codes, as explained in section 1.2.

Table 4. Causes of FLW generation and responsible stakeholders.

Nº	Cause	Industrial Generator (IG)		Transporting & Storage Generator (TSG)	Wholesale & Retail Trade Generator (WRG)	Domestic Consumer Generator (DCG)	Service Activities Generator (SAG)	Service Consumer Generator (SCG)	Domestic Consumer Generator (DCG)
1	Lack of/inaccurate demand forecasting.	✓	✓	✓	✓		✓		
2	Farmers grow the most profitable crops according to last season's prices, which generates food surplus.	✓							
3	Farmers' individualistic decisions not aligned with cooperative's, whose capacity to deal with food surplus is reduced.	✓							
4	Inadequate climate conditions.	✓							
5	Farmers collect products that are not mature enough or overmature.	✓							
6	Products are damaged due to bad practices in some processes (harvesting, cleaning, screening, processing...).	✓	✓						
7	Supermarkets' hoarding leads to more food waste since they are less flexible and do not accept to purchase some seasonal and diverse products in comparison to other buyers.	✓							
8	Subsidies for production promoting overproduction, which generates food surplus.	✓							
9	Low market prices for some products forcing farmers to waste them because it's less expensive.	✓							
10	Lack of innovative technologies and solutions for more efficient harvesting and processing.	✓	✓						
11	Labour shortage.	✓	✓						
12	Equipment and systems breakdowns.	✓	✓	✓	✓		✓		
13	Poor investment in food waste prevention innovations and technical specialisation.	✓	✓	✓	✓		✓		
14	Food quality and aspect requirements in standards and policies.	✓	✓	✓	✓		✓		
15	Food aspect requirements self-imposed by stakeholders (clients, consumers...).	✓	✓	✓	✓		✓		
16	Lack of/insufficient standards, policies or regulations for food surplus management.	✓	✓	✓	✓		✓		

17	Standards, policies or regulations for food surplus management are too rigid (their requirements are too demanding).	✓	✓	✓	✓		✓		
18	Standards are uncertain or difficult to interpret.	✓	✓	✓	✓		✓		
19	Cold chain interruptions.	✓	✓	✓	✓		✓		
20	Political changes resulting in food waste generation in international trades.	✓	✓	✓	✓		✓		
21	Absence of a corporate social responsibility policy that leads to food waste generation.	✓	✓	✓	✓		✓		
22	Lack of awareness concerning food waste.	✓	✓	✓	✓	✓	✓	✓	✓
23	Lack of/inefficient coordination and communication of information between actors in the value chain.	✓	✓	✓	✓	✓	✓	✓	✓
24	Inappropriate food sourcing strategies (i.e. selection of providers) that lead to food waste generation.		✓						
25	If there is an excessive delay, the product is withdrawn prematurely.		✓	✓	✓		✓		
26	Shelf life losses due to logistics obstacles: Traffic congestion, hostile weather, long distances...			✓					
27	Product damage due to bad roads conditions and lack of a protector packaging.			✓					
28	Packaging design favouring food spoilage (for example: it favours the spread of a disease among food units, it hampers food extraction...).			✓	✓		✓		✓
29	Stocking policy favouring overstock, which leads to food waste generation.				✓		✓		
30	In order to obtain discounts oversized orders are placed, which leads to overstocking.				✓		✓		
31	Our sales strategy promotes the stock of an excessive amount of products during promotions, which leads to food waste generation.				✓				
32	Overstocking due to offering a wide variety of products.				✓		✓		
33	The purchasing strategy exempts the company from the responsibility of food surplus generation (take-back agreements).				✓		✓		
34	Keeping total on-shelf availability of products, which leads to overstocking.				✓				
35	Improper manipulation of fresh food by consumers.				✓				
36	Weather fluctuations changing expected consumers' orders.				✓		✓		
37	Food waste due to spills and other mishandling by the employees.				✓		✓		

D1.1. CIRCULAR FOOD STRATEGIES DOCUMENTATION

38	The product is not chosen because its image is not attractive enough (ugly food).					✓		✓	✓
39	Information provided regarding the sustainability of products in terms of food waste is missing or not understood/trusted by consumers.					✓		✓	
40	Consumers purchase/order/take more food because they don't calculate well the quantity they will eat.					✓		✓	
41	Consumers' diets don't allow them to eat some edible parts of the food they purchase/order/take.								✓
42	The amount of leftovers is so small that is not worth keeping.							✓	✓
43	The packaging design is inadequate for food preservation once opened.						✓		✓
44	Consumers do not make an adequate purchasing plan.						✓		✓
45	The difference between "use by" and "best before" dates is not always clear to consumers.						✓		✓
46	Kitchen staff or consumers cook/order/take more than necessary because they don't calculate well the quantity they will cook/they don't have to pay more for it.						✓	✓	✓
47	Kitchen staff or consumers do not know how to make the most of the leftovers.						✓		✓
48	Kitchen staff or consumers' ways to preserve food is inefficient.						✓		✓
49	Even if consumers know how, they don't make the most of food because of their limited cooking abilities.						✓		✓
50	Consumers' lack of time to cook more efficiently.						✓		✓
51	The packaging size obliges me to buy more food than needed.						✓		✓
52	The menu's flexibility/description doesn't fit my diet/taste.							✓	
53	Consumers buy products with a long "use by" date left even if they plan to cook/consume it much sooner.					✓	✓		
54	Consumers do not take into account the "use by" date when managing the fridge/pantry.						✓		✓
55	More sustainable decisions are not taken if they are more expensive.	✓	✓	✓	✓	✓	✓	✓	✓
56	Consumers do not have the possibility to bring the leftovers home.							✓	

2.4. Destinations

A standardisation of the possible destinations to which food loss and waste can be sent is presented in this section. This list of destinations summarises the well known food waste hierarchy, which of course includes the prevention level, in which it is worth mentioning that not all the options are “destinations” as such. This level also contains solutions at the point of FLW generation. For the definitions of the 4 levels of which the list is composed (prevention, recycling, recovery, and disposal), the Waste Framework Directive (Directive 2008/98/EC) has been taken as a reference. Reuse will not be deemed as an alternative in the food waste hierarchy as its definition implicitly assumes that the product has been already used (i.e. consumed in the case of food) before assigning it to the reuse destination. This classification is in accordance with the food waste hierarchy established by WRAP that is showcased in Figure 6 (WRAP, 2018).

Table 5 summarises the categorization of the destinations depending on the stakeholder group. The standardisation procedure was supported by a review of the literature, from whose sources the definitions of the destinations/solutions are cited hereunder.



Figure 6. Food waste hierarchy (WRAP, 2018).

Table 5. Destinations per stakeholder group. In grey those stakeholders identified in the literature. In blue those stakeholders additionally identified in FOODRUS project.

Level of the food waste hierarchy	Destination/solution	Supply chain				Consumer	
		Industrial Generator (IG)	Transporting & Storage Generator (TSG)	Wholesale & Retail Trade Generator (WRG)	Service Activities Generator (SAG)	Domestic Consumer Generator (DCG)	Service Consumer Generator (SCG)
Prevention	Technological solutions						
	Managerial & Organizational solutions (demand forecasting, stocks optimization...)						
	Social solutions (social economy)						
	Financial instruments (PAYT, fiscal incentives)						
	Redistribution for human consumption: Donation						
	Redistribution for human consumption: Internal distribution						
	Animal feed						
	Sales with promotion and discounts						
	Dynamic discount pricing						
	Sales in secondary markets						
	Marketing actions and sponsorships						
	Raising consumer awareness (social marketing, labelling, education, communication campaigns)						
Recycling	Remaking (remanufacturing and repackaging) the same product						
	Revalorise food loss and waste into new food products						
	Revalorise food byproducts from food processing						
	Revalorise food loss and waste into added value products						
	Landspreading						
	Ploughing back into the soil						
	Composting						
	Anaerobic digestion						
Recovery	Thermal treatment with energy recovery						
	Incineration with energy recovery						
Disposal	Incineration without energy recovery						
	Drained as or with wastewaters						
	Landfill						

2.4.1. Prevention

The following destinations/solutions stand for those in which the food has not acquired the condition of FLW yet as stated in the Waste Framework Directive (Directive 2009/98/EC). Therefore it is prevented from becoming FLW in the first place. The following ones are regarded as prevention strategies:

- Technological solutions: Information & Communication technologies, Food Processing technologies, Robotics... (FOODRUS solutions)
- Managerial & Organisational solutions such as demand forecasting, stocks optimization... (FOODRUS solutions)
- Social solutions based on social economy innovations (FOODRUS solutions)
- Financial instruments such as fiscal instruments, PAYT systems, building capacity strategies... (FOODRUS solutions)
- Raising consumer awareness: Awareness-raising programmes that highlight the importance of the problem of food waste, making citizens aware of the consequent environmental impact (Filimonau and De Coteau, 2019).
- Dynamic discount pricing: It consists of pricing the product according to its characteristics and changes in its condition (Liu et al., 2008). This solution is applied to reduce wastage while providing the consumer with food at a price according to its expiry date.
- Sales with promotions and discounts: Selling in primary markets through promotions and discounts is an option that some consumers accept in exchange for an earlier expiry date. This option can avoid wastage when a risk of expiry is detected (Garrone et al., 2016).
- Donation: This refers to the redistribution of food surplus for human consumption. The food surplus is donated for free to non-profit organisations so that it is delivered to people in need. These organisations encompass: soup kitchens, social supermarkets, food banks, etc (Garrone et al., 2016). This is reported to be the best option for food surplus since the original function for which the product was conceptualised is fulfilled (Garcia-Garcia et al., 2017).
- Internal distribution: Free or reduced-price distribution of food to the company's own workers. Usually occurs when the product is no longer marketable but still edible (Garrone et al., 2016).
- Sales in secondary markets: When the option of selling in primary markets is not possible, the search for sales alternatives such as through distributors specialising in surplus sales or special sales outlets that the company itself manages. These channels are called secondary markets (Garrone et al., 2016).
- Marketing actions and sponsorships: The organisation of sporting, charity, or simply tasting events opens a door to the prevention of food waste. At these events, food can be given to participants and specific brands can be promoted (Garrone et al., 2016).
- Animal feed: It consists of using the food surplus for feeding animals instead of disposing it. It is considered to be the best alternative for food surplus once it has become not suitable for human consumption (Garcia-Garcia et al., 2017).

2.4.2. Recycling

According to the definition of recycling given by the Waste Framework Directive (Directive 2008/98), it implies the reprocessing of the already generated FLW into materials or substances. The corresponding recycling destinations/solutions deemed are:

- Remaking (remanufacturing and repackaging) the same product: Remanufacturing in the case of production errors, and repackaging when there is a fault in labelling or in the packaging process itself

are options for some companies depending on the type of product. This remanufacturing is possible and efficient in very specific cases such as chocolate, pasta, or meat (Garrone et al., 2016).

- Revalorise food loss and waste into new food products: It comprises the techniques employed to create a new food product from the food loss and waste. For example, making breadcrumbs from bread. Another less preferable option is converting food loss and waste into a new food item by recovering its nutrients (Giroto and Piazza, 2022).
- Revalorise food loss and waste/byproducts into added value products: Food loss and waste or food byproducts can be processed to become a different product with added value while keeping the high value of the molecular bonds in the material. This solution may involve the participation of an external company, giving rise to industrial symbiosis (Sanchez Lopez et al., 2020; Pinto et al., 2022).
- Landspreading: Process of covering the ground with food scraps to provide nutrients to the soil (Garcia-Garcia et al., 2015; Environment Agency, 2013).
- Ploughing back into the soil: This management option implicates ploughing the soil before spreading the food scraps into it.
- Composting: Biological decomposition process of organic matter that can be either aerobic or anaerobic and produces (Eurostat, 2015).
- Anaerobic digestion: Anaerobic process of biological decomposition of organic matter by the action of bacteria. It produces biogas and digestate as outputs (EPA, 2019).

2.4.3. Recovery

In the case of recovery a couple of destinations were included, both of which refer to processes where the energy content of the FLW is harnessed. Which according to the Waste Framework Directive (Directive 2008/98), correspond to recovery operations. They are:

- Thermal treatment with energy recovery: This destination covers both pyrolysis and gasification processes. They are operations in which energy is extracted from the waste to obtain synthesis gas. In the case of pyrolysis, this is done in the absence of oxygen, and in the case of gasification, the air is used but below the stoichiometric level (Dong et al., 2019; Luz et al., 2015).
- Incineration with energy recovery: Combustion process where the energy generated as a result of the exothermic reaction is harnessed (Eurostat, 2013a).

2.4.4. Disposal

As stated in the Waste Framework Directive (Directive 2008/98), disposal destinations here refer to those other processes that are not considered as recovery. The least preferred options shaping the bottom part of the food waste hierarchy, are:

- Incineration without energy recovery: Combustion process where the energy generated as a result of the exothermic reaction is not exploited and is dissipated (Eurostat, 2013a).
- Drained as or with wastewaters: Disposal of the food by flushing it down the sink (Eurostat, 2021).
- Landfill: Land space intended for being a waste disposal deposit. The waste can be piled up either on the surface or underground (Council Directive 1999/31/EC; Eurostat, 2013b).

2.5. FOODRUS framework

In conclusion, FOODRUS project will follow the FLW methodology proposed by the Commission Delegated Decision (EU) 2019/1597 but some specific considerations will be applied:

- Updates in the FLW characterization parameters used:
 - Consideration FLW also of the amount generated during the preharvest phase
 - Consideration as FLW also of the amount that has been disposed of and collected with the packaging
 - Differentiation in the quantification according to FL and FW definitions
 - Differentiation among eatable and non-eatable in order to improve the FLW management in the pilots
 - Differentiation among cooked and non-cooked in order to identify possible legal restrictions for particular destinations such as donation
 - Groups of food products to characterise the FLW in different product families that ease the analysis of the results. The groups defined in the FRESH project have been selected although in FOODRUS, meat and fish will be in separated groups due to the specific behavioural changes expected in the consumption habits in the DP. These groups are: Cereals; Bread; Meat; Fish; Vegetables; Fruits; Dairy products; Roots and tubers; and Legumes and oilseeds.
- Using the standard terminology defined in the previous sections for: FLW causes (Section 1.3), destinations (Section 1.4) and stakeholders and FSC stages classification (Section 1.2).
- Identification of the generator using 4-digits level NACE codes following the methodology previously proposed by Barco et al, 2019.

3. Co-design process of the FOODRUS circular strategies

3.1. Common vision

The main objective to define the scope of the circular food strategies that will be implemented in FOODRUS pilots is to create a common vision among the agents involved in each value chain. Every actor must understand their role and the value chain as a whole creating a sense of belonging and looking for the common good. To this end a four-step process involving the main actors in each pilot has been carried out:

1. Diagnosis to identify the main needs of each pilot: 1) Describe all the processes and subprocesses highlighting those which generate food loss and waste and the main actors involved in their management, 2) Identify in each subprocess which kind of strategies are being currently carried out according to waste hierarchy, and 3) Identification of threats and impact of COVID pandemic
2. Definition of the scope of the pilot: 1) Identify the main objectives, 2) Selection of the specific product (type of food that will be directly evaluated during the pilot), 3) Comprehensive description of the activities and, 4) Identification of the main barriers and restrictions including legislative issues (preliminary identification)
3. Co-design of FOODRUS solutions: 1) Identification of the main needs in each pilot, 2) Agreement on the main functionalities and priorities.
4. Mapping of the stakeholders needed to be involved in the project

3.1.1. Pilots diagnosis

Pilots have been assessed in terms of FLW generation. For this assessment the main generation points including the type of food loss and waste, the main cause that originates it, and the current final destinations of such FLW have been identified. Additionally, the main solutions available at the local level have been mapped as well so as to be aware of the possibilities to enhance the baseline scenario situation.

3.1.1.1. Spanish pilot

FLW critical points

Figure 7 shows the Scheme of the Spanish pilot's value chain. In brackets, the estimated FLW generation shows a global vision of the pilot based on literature data. Figure 8 summarizes the critical stages in terms of FLW involved in the pilot supply chain. Figure 9 organises these stages according to NACE codes. Figure 10 and Figure 11 summarise the main hotspots where FLW is generated from field to retailer and Figure 12 to Figure 14 collect the main causes identified behind its generation as well as their current destinations.

In Florette, where prepared salad production and processing is carried out, 13 FLW critical points have been identified. In Eroski, prepared salads distribution, 2 FW critical points have been identified.



Figure 7. Scheme of the Spanish pilot's value chain. In brackets the estimated FLW generation.

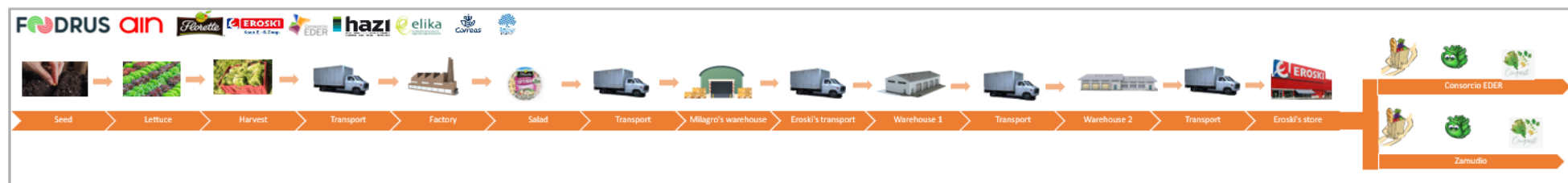


Figure 8. Stages of the Spanish pilot's value chain.

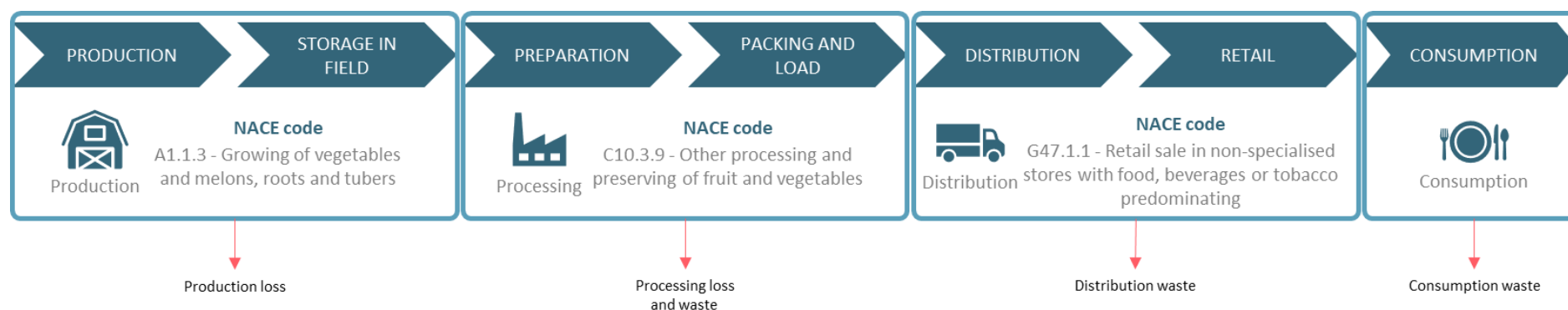


Figure 9. Identification of FLW stages according to NACE classification in the Spanish pilot: Global scheme.

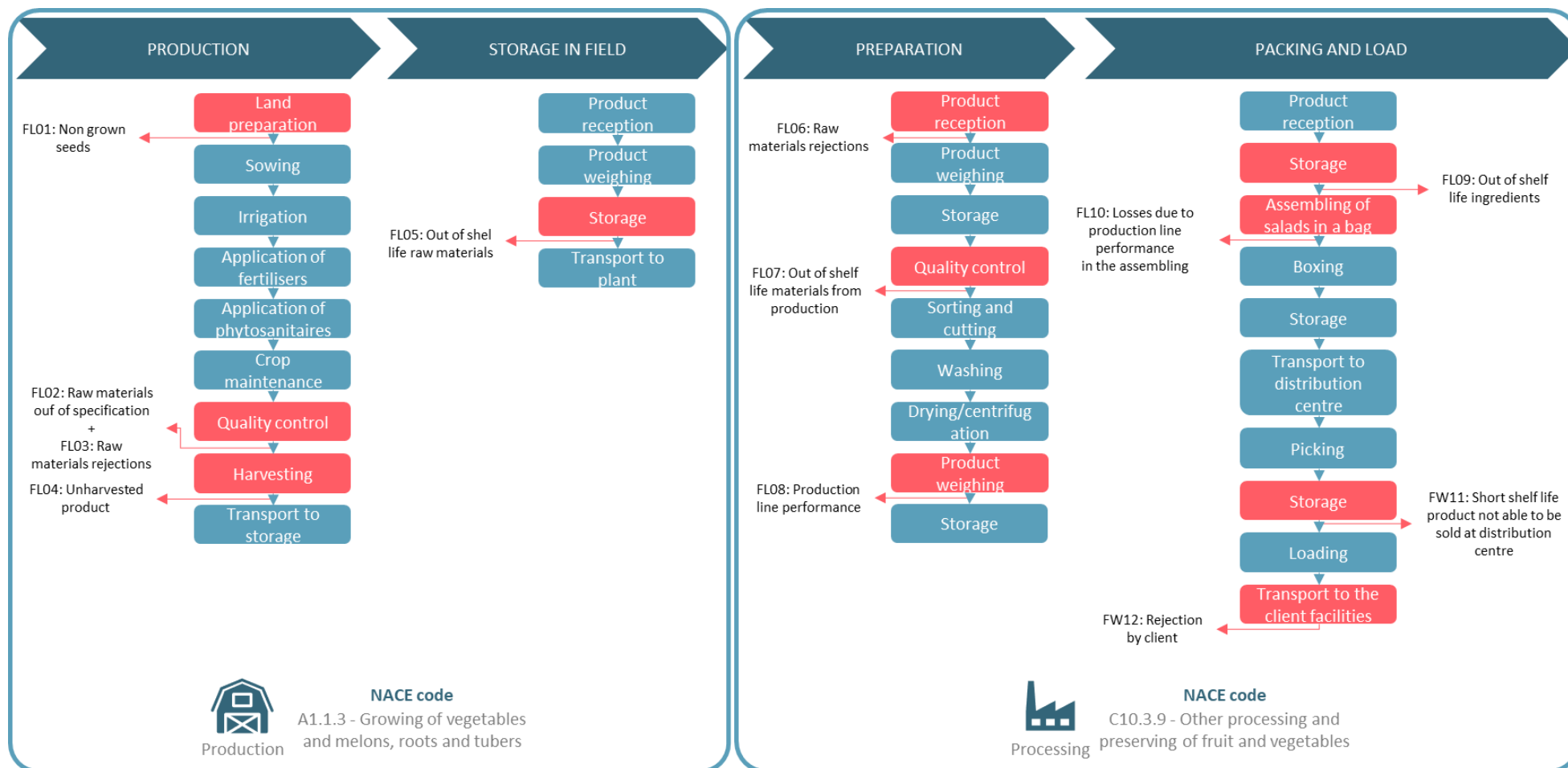


Figure 10. Identification of FLW hotspots (highlighted in red) in the Spanish pilot: Production and processing.

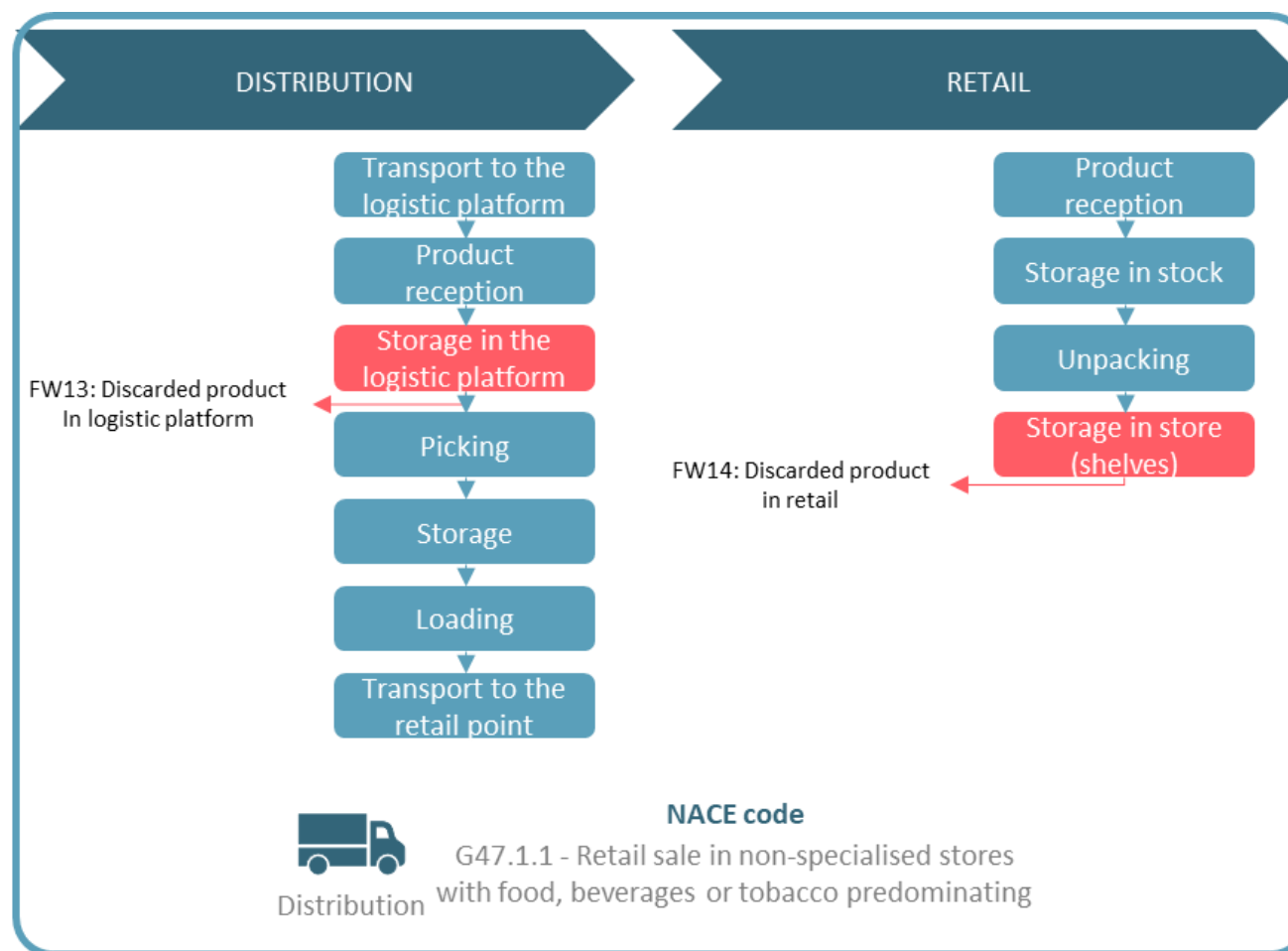


Figure 11. Identification of FLW hotspots ((highlighted in red) in the Spanish pilot: Distribution.

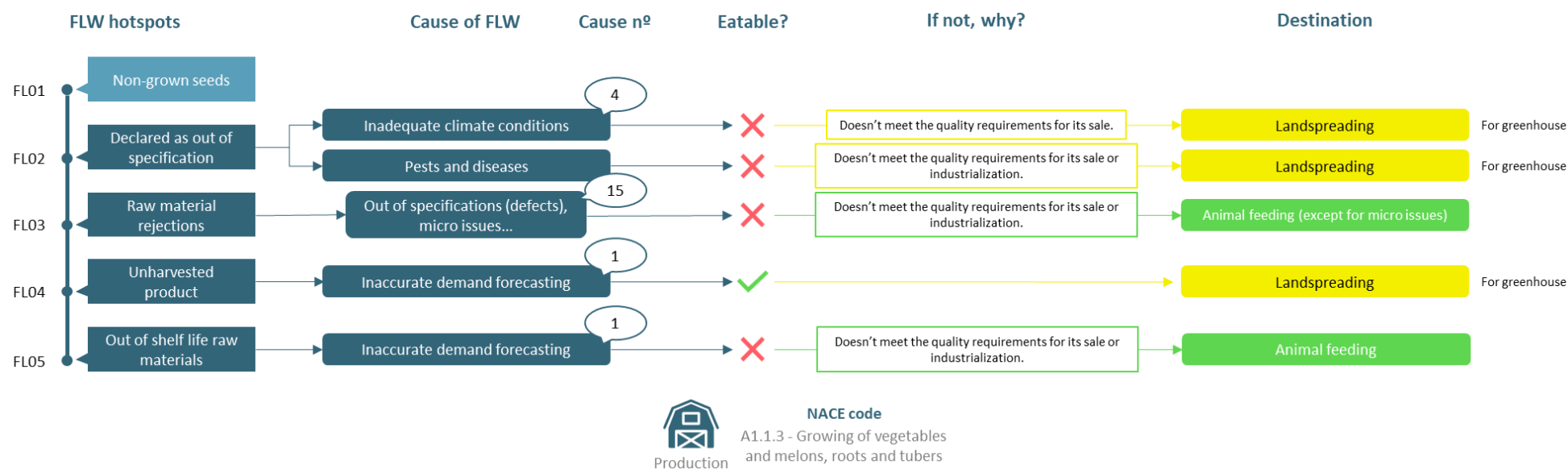


Figure 12. FLW current management in Florette (Production).

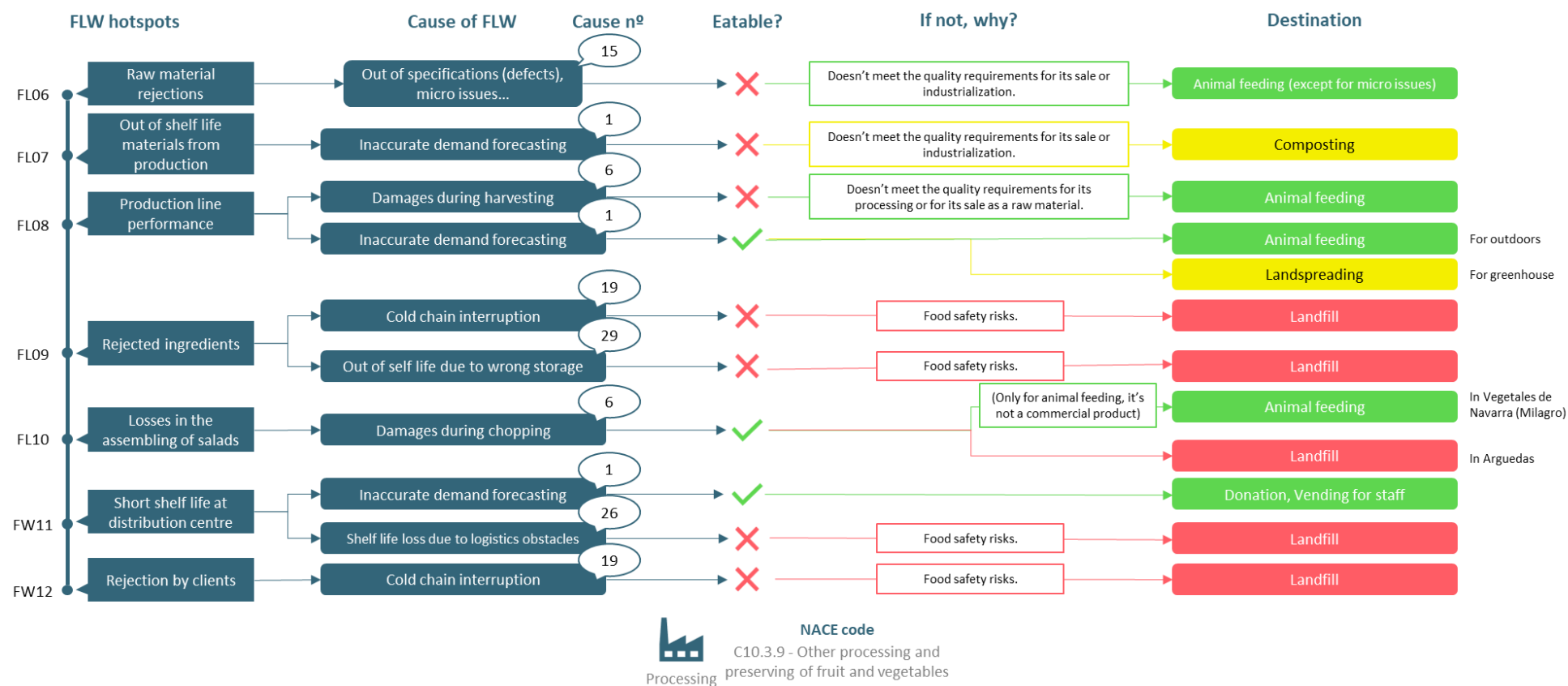


Figure 13. FLW current management in Florette (Processing).

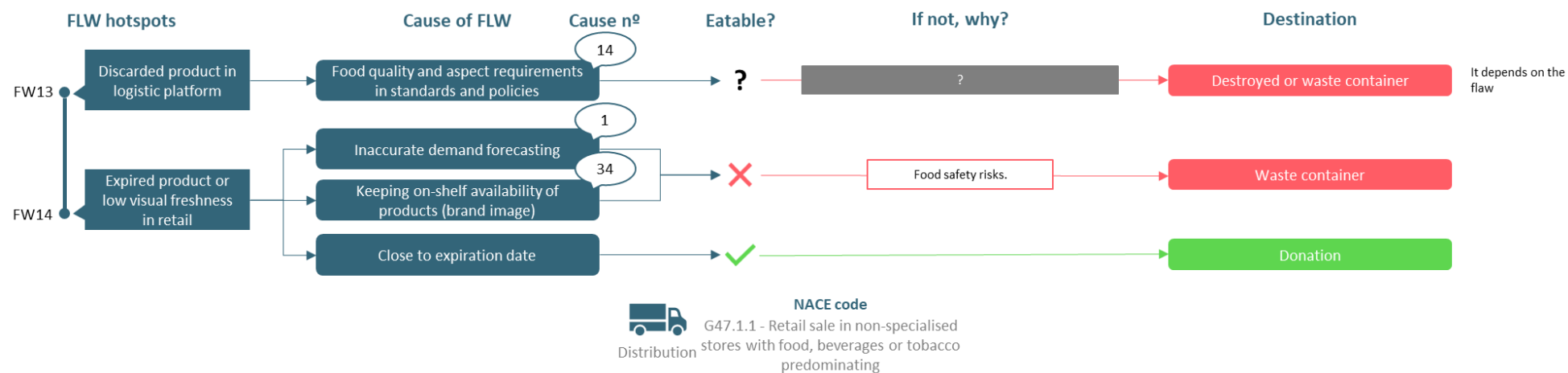


Figure 14. FLW current management in Eroski.

Florette- Prepared salad production and processing: 13 FL&FW critical points identified:

- FL01- % non-grown seeds
- FL02- At primary production, the product that is not harvested
- FL03- Product declared as out of specification at industrial level (lettuce)
- FL04- Raw material rejections
- FL05- out of shelf-life raw materials
- FL06- Food losses at production stages due to production line performance: raw material performance
- FL07- Out of shelf-life raw materials coming from “Vegetables de Navarra” (lettuce)
- FL08- Out of shelf-life/rejected ingredients to be added into the prepared salads
- FL09- Losses due to production line performance in the assembling of salads in bowls.
- FL10- Over dosage of topping ingredients
- FL11- Over dosage of the complete salad bowls (salad+sauce+topping ingredients)
- FL12- Short life product not able to be sold at Milagro’s distribution centre (consumers orders lower than production)
- FW13- Finished product rejected by the clients (Eroski). Product returned.

Eroski- Prepared salads distribution: 4 FL&FW critical points identified:

- FW01- Product on expiration date between supplier transport to the logistic platform 1
- FW02- Visual freshness quality lower than defined during the platform storage
- FW03- Reduced complaint with quality standards- visual or expiration date between transport platform to retailer
- FW04- Reduced complaint with the quality standards-visual or expiration date in the retailer

In the case of Zamudio, a municipality in Basque country where the Eroski store is located and where the payment per waste generation is implemented, one FLW critical points has been identified as the municipality is in charge of measuring the bio-waste generated by citizens and companies (including catering services) and it is difficult to separate FLW from all the biowaste collected in the brown bin (FW05).

As regards Consorcio EDER, a consortium of municipalities in the Navarre region where Florette producer and Eroski stores are located, 4 FLW critical points have been pointed out:

- FW06- Food waste managed in the Ribera Alta Consortium by an external manager
- FW07- Food waste managed in the Ribera Baja Consortium by an external manager
- FW08- Food waste managed in the EDER’s composting plant (own managing)
- FW09- Food tourism tours which is a social activity where FLW can be managed by Consorcio EDER

The other organisations (ELIKA, HAZI, AIN and CORREOS) are not directly involved in the generation or management of FLW, but act as key actors in contact with direct and indirect stakeholders that should/could be involved in the pilot definition, implementation and evaluation.

Current strategies for FLW prevention

Project partners directly involved in the prepared salad value chain have been working during the past years in the implementation of strategies for FLW prevention or setting the pathway through its monitoring.

In the case of Florette, prepared salad production and processing, different strategies have been adopted in the different hotspots identified:

- FL01- % non-grown seeds- selection of more productive seeds.
- FL02- At primary production, the amount of product that is not harvested is recorded in the management control and digital data generated.
- FL03- The amount of product declared as out of specification at the industrial level (lettuce) is a parameter recorded in the management control and digital data generated.

- FL04- Raw material rejections: improvements of storage conditions
- FL05- Out of shelf-life raw materials: management of clients demand forecasting.
- FL06- Food losses at production stages due to production line performance (raw material performance) by the management of clients demand.
- FL07- Our of self-life raw materials coming from “Vegetales de Navarra” (lettuce) by controlling the storage conditions.
- FL08- Out of shelf-life/rejected ingredients to be added into the prepared salads by control of storage conditions and improvements in the clients demand forecasting.
- FL09- Losses due to production line performance in the assembling of salads in bowls. Processing data digitalised.
- FL10- Over dosage of topping ingredients by the improvement in the process automatisation
- FL11- Over dosage of the complete salad bowls (salad+sauce+topping ingredients) by the improvement in the automatisisation process.
- FL12- Short life product not able to be sold at Milagro’s distribution centre (consumers orders lower than production) by controlling storage conditions.
- FL13- Finished product rejected by the clients (Eroski). by controlling storage conditions.

Related to salads packaging waste generation, Florette uses 100% recycled PET and 100% recyclable PET in the prepared salads products, for Florette and Eroski branding. The cutlery included in the prepared salads are made from bio-based compostable plastics.

In the case of Eroski, prepared salads distribution and for their main FLW causes identified has implemented digital tools for the traceability and control of transport temperature. Eroski also identifies the expiration dates of salads and located salads in the first order in the point of sale. In order to boost the consumption of salads closer to expiration dates some discounts are applied.

Zamudio: Municipality in Basque country where Eroski store is located, a Pay As You Throw system is under implementation which will serve as a driver to prevent FW. This action should be extrapolated to salad consumption parameters.

Consortio EDER: consortium of municipalities in the Navarre region where Florette producer and Eroski stores are located, has offered different food tourism tours in most of the municipalities located in the region where cooking strategies for FW reduction are shown with citizens. Consortio EDER also works with schools in order to share knowledge about FW reduction habits.

ELIKA works in the identification and quantification of FLW generated in Basque country, they elaborates training and dissemination materials about FLW reduction strategies addressed to industry, citizens and other organisations.

3.1.1.2. Danish pilot

FLW critical points

Figure 15 to Figure 18 show the general description of the Danish pilot. As it may be seen from the overall value chain for the Danish pilot, the top three biggest FLW generation are comprised by the HORECA step, the Wholesale and Retail step and Processing and Packaging step of the FSC.

Fin Fisk is selling local fresh brought in by the Danish fishery sector and has insignificant sidestream cut-offs corresponding to less than 1% of the gross weight catch. The potential hotspot FLW is therefore to be found downstream the FSC.

Hørkram is the main upstream food supplier to JTK, covering all food categories consumed by the Danes. A critical issue is the contractual requirements of 7-10 days before “the best before date” at the day of transaction which is a hotspot for surplus food becoming food loss.

For the Danish Pilot, the first potential hotspot for reduction of surplus food becoming FLW, occurs at the HORECA step occurring at JTK, where the design of food and ingredient composition for the downstream cantinas at Aarhus University occurs.

For the Aarhus University (AU) cantinas, the chefs are key stakeholders in the design of the buffet. Surplus foods served in the canteens can not be donated due to regulatory barriers and therefore represent the main hotspot for surplus food becoming waste.



Figure 15. Scheme of the Danish pilot's value chain. In brackets the estimated FLW generation.

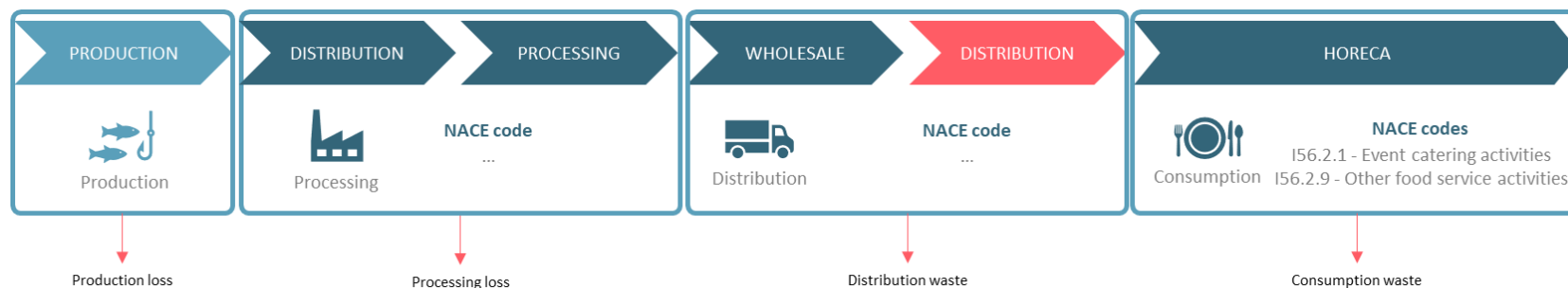


Figure 16. Identification of FLW stages according to NACE classification in the Danish pilot: Global scheme.

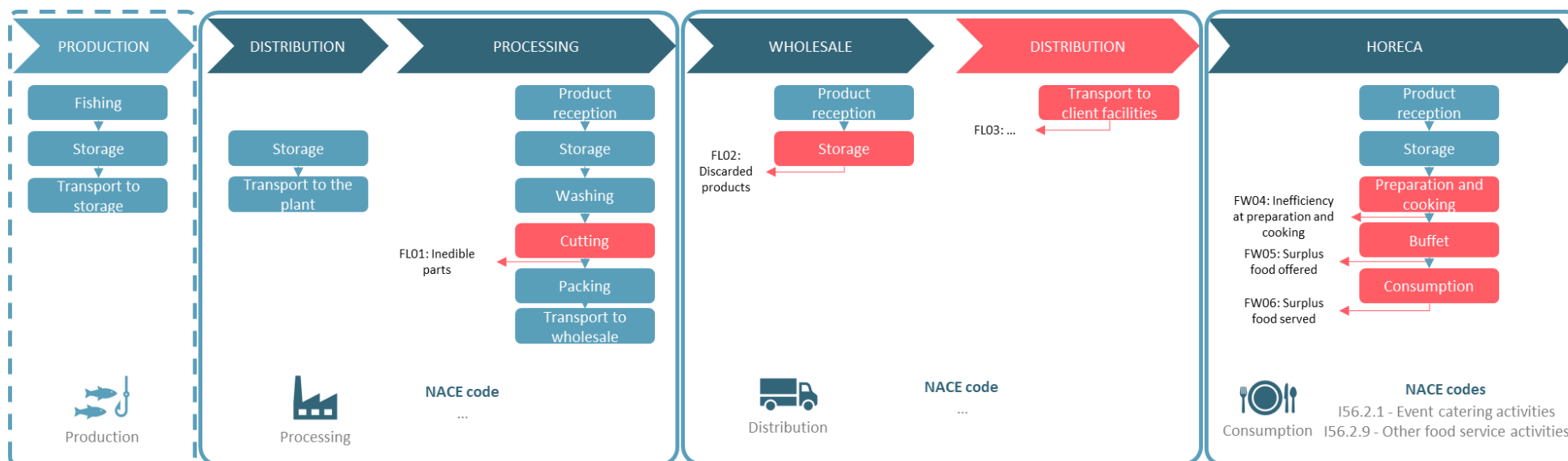


Figure 17. Identification of FLW hotspots in the Danish pilot.

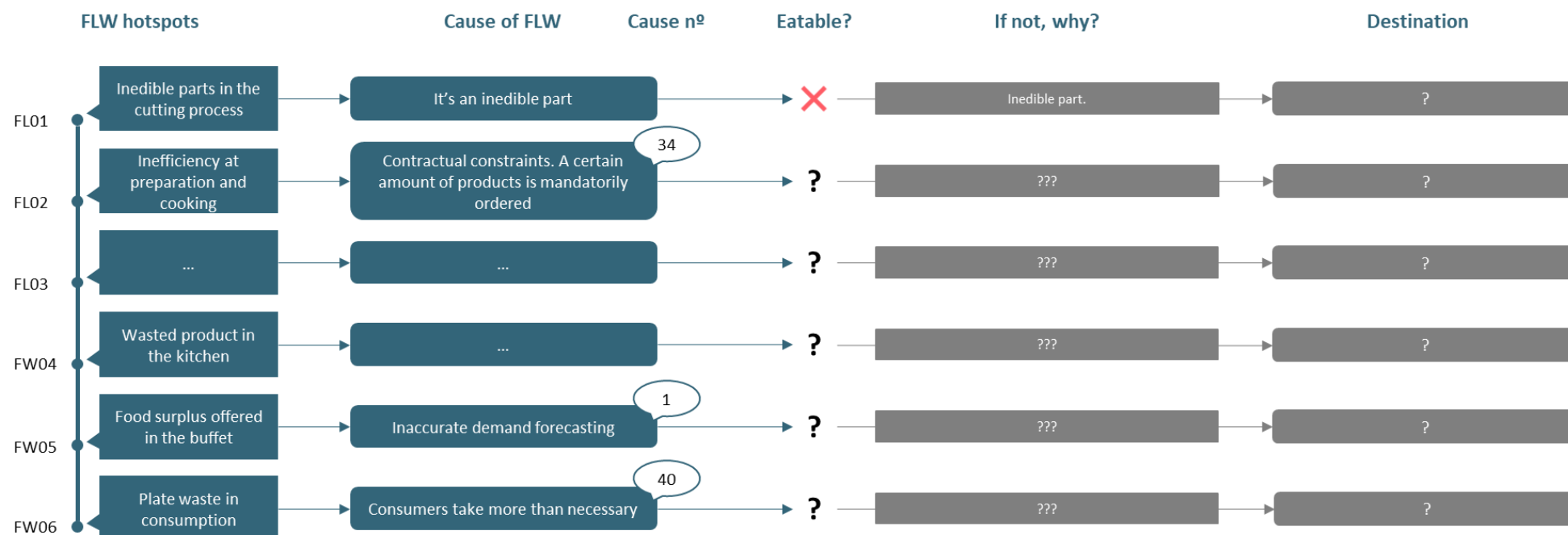


Figure 18. FLW current management in the Danish pilot.

Current strategies for FLW prevention

Upstream JTK, the Danish pilot will focus on a surplus FLW reducing BtB model between Hørkram and JTK aiming to avoid surplus perishable food items to be lost or wasted. The potential reduction of loss of surplus food represents a significant opportunity, as the downstream JTK value chain may buy and serve perishable food close to the expiry date. As such, design for trade of food with short shelf life remaining, will reduce FLW at the wholesale and retail step of the FSC within the Danish Pilot.

At the HORECA step of the value chains, i.e. in FoodRus represented by JTK central kitchens and downstream University cantinas, the main focus is on zero food waste cooking at JTK main quarters (central kitchen) as well as at the University Cantinas. The latter, strongly supported by innovative cooking and services monitored by the cloud-based weighting system which will allow to map consumer preferences and in time balancing of the amounts of food served in the buffets in the cantinas with the demand of customers/users.

3.1.1.3. Slovak pilot

Description of value chain

Figure 19 to Figure 22 show the general description of the Slovak pilot. After thorough research, involving public and private institutions, availability of data on bread FW in the value chain is very low and therefore the figures provided below are qualified estimates provided by the research team. These estimates can be adjusted over the project running, when new information is gathered.

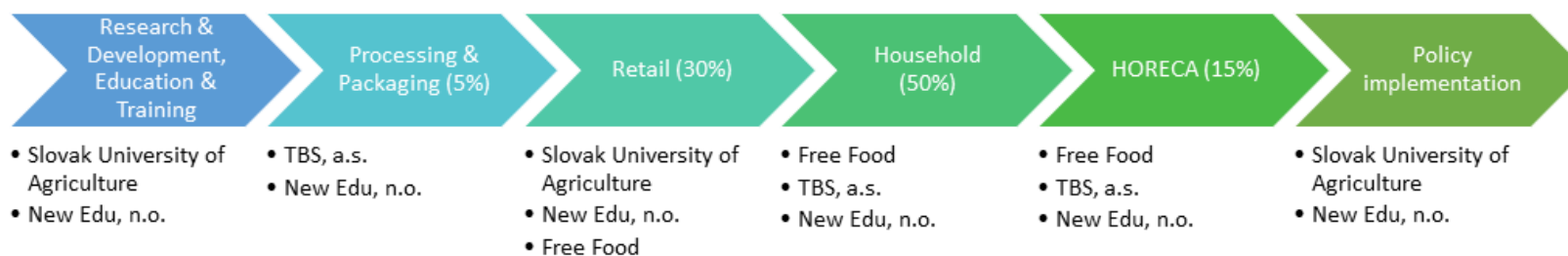


Figure 19. Scheme of the Slovak pilot's value chain.

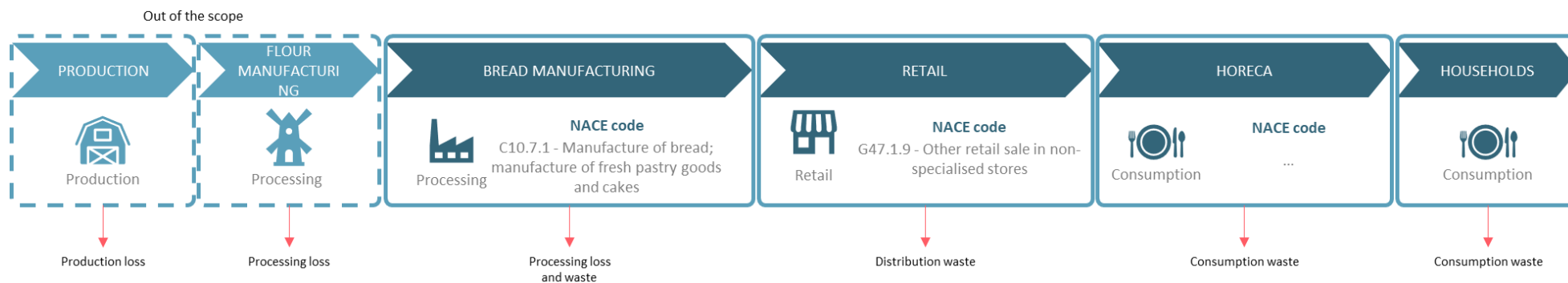


Figure 20. Identification of FLW stages according to NACE classification in the Slovak pilot: Global scheme.

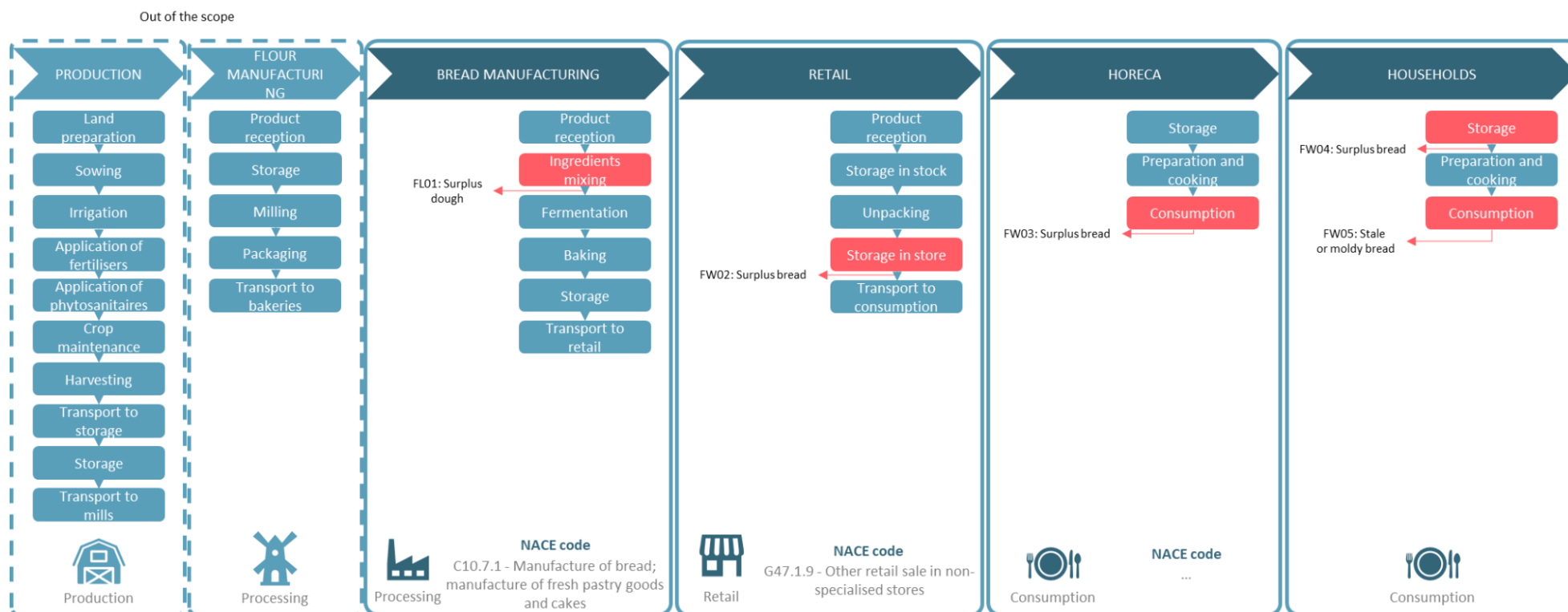


Figure 21. Identification of FLW hotspots in the Slovak pilot.

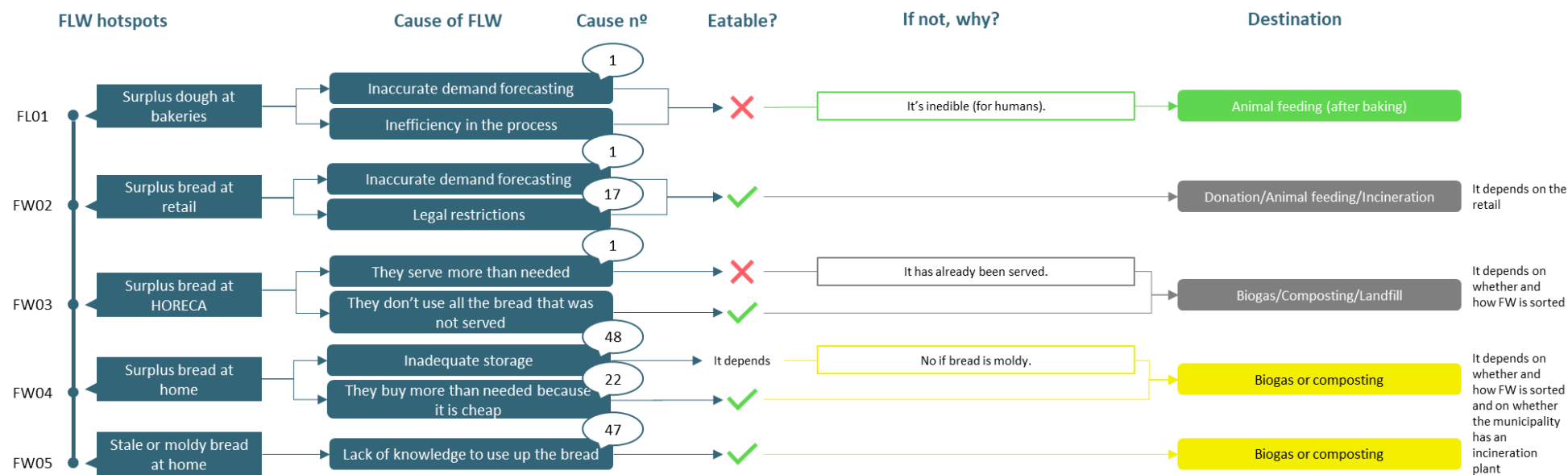


Figure 22. FLW current management in the Slovak pilot.

Primary cereal production is rather effective in terms of both FLW, and material and energy recovery, excluding some unforeseen circumstances such as drought, freezing, or natural catastrophes. Common harvesting techniques allow the grains to be separated already during harvest, while the remaining parts of the cereal are usually ploughed back to the soil to fertilise it with the straws being dried out and used mostly as animal feed. After the harvest, the grains are pre-cleaned, dried out, and sorted in order to get ready for storage or to be dispatched to the buyers. We distinguish different storage techniques depending on how long we plan to store the grains. The grains are usually sold rather quickly by the farmers to the buyers and are being stored in silos at the mills.

Importantly, wrong harvesting techniques or bad weather conditions can lead to the deterioration of grain quality already at the production level.

When arriving at the mill and before any further processing, the grains are controlled for their quality and low quality / defected seeds are separated. When stored, decisive factors are temperature and humidity creating the right environment for the grains, which also need to be turned constantly in order to let the air circulate better and hence, prevent moulds from appearing. Dry grains can last up to a year in silos. The milling process contains on average up to 6 milling rounds. Different types of flour are made this way including one for animal feed. In general, whole grain flour is more prone to get infested or attacked by moulds. Germs and brans are separated during the milling process itself and further processed as animal feed, for industrial baking, or even direct human consumption. If all of the above conditions are met, there is no FLW occurring at this stage.

When the harvesting and (mainly) the storing conditions are not optimal, a decrease in nutritional / energy value of the grains can occur.

Slovak mills usually supply flour to bigger clients including restaurant chains, or pizzerias, and traditional mills are almost non-present in Slovakia.

Three types of bakeries have been identified - industrial bakeries, bakery chains, small bakery shops or artisanal bakeries (could be described as “start ups”, too). During production, there is technological waste occurring, amount of which is insignificant. The biggest percentage of waste is generated from bread, buns, and rolls. Some bakeries sell or donate surplus as animal feed, since there is some demand from farmers, zoos, or hunters. Industrial bakeries have their regular clients who are mostly retailers, restaurant chains, hotels, which allows them to optimally adjust supply to demand. In the past, the system was set on the basis of returns of unsold products, which no longer exists. As a result, the waste burden moved onto retailers, restaurants, or hotels. In addition to this, surplus bread cannot be upcycled, that is e.g. used to make breadcrumbs which are made from fresh and dried bread produced exclusively for this purpose.

Value chain inefficiency has been exacerbated by another issue, which is the display time for fresh unpacked bakery products which changed to 12 hours from 24 in 2017. A huge trend taken up from abroad is pre-baked frozen bread and pastries which are defrosted and baked at the store - their shelf life is much shorter, and are often sold as fresh despite the fact that it is forbidden. Slovak bakeries are allowed to use a number of conservants which prolong the shelf life of bread, yet the combination with plastic packaging shortens it again (bread more prone to get moulded).

Bakery products are divided into different categories mainly according to the volume of water they contain. They are mostly packed, while packaging is considered to be expensive and time consuming. Also, mostly plastic packaging is used, which increases the ecological footprint.

Retailers are an individual category which can encompass all of the above models of bakeries. The highest amount of bread and bakery products are sold to customers here, while the retailers obtain these products mainly from different suppliers. An increasing trend in buying cheap pre-baked frozen products from abroad has

been observed. These are then oven baked directly at the store giving the impression they are fresh. On the contrary, these types of products are prone to getting moulded or stale easily since they contain a lot of water. Some retailers also have their own bakeries where they bake fresh bread “from scratch”. Customers in bigger supermarkets got used to getting warm bread up until closing time, which in return destabilises the supply-demand optimization.

In the HORECA sector, most bread and bakery products are wasted in breakfast buffets, caterings or as a result of irrational servings of bread as a side dish or as a soup bowl, which is common in Slovakia.

Households produce the largest amount of food waste, and bread is not an exception. According to a recent poll, households are responsible for up to 53% of all uneaten food, while most food waste is produced from fresh food, especially fruit, vegetables, bread, salami and cheese. However, 40% of Slovaks perceive the importance of their own responsible approach to saving food. According to the internal analyses of the Ministry of Agriculture and Rural Development, Slovaks throw away about 100 kg of food per person per year.

The initial intention was to bring solutions reducing FLW along the whole bread value chain, from production to consumption. Based on further analysis of FLW pertaining to bread and bakery products, however, none to negligible amounts of food loss and waste have been identified in the first stages of the food value chain involving grain producers, mills and industrial bakeries. Hence, the focus of the research will be directed mainly towards the final stages of the food value chain, that is consumers, as being the largest FLW producers, and then the retail and the HORECA sector. Even though it was impossible to quantify food loss and waste along the whole supply chain in Slovakia (different entities do not measure and / or report their food loss and waste), information about different processes along the food supply chain have been gathered and combined with data provided by the Slovak Food Research Institute on bakery waste (2019) and households waste (2017) and baseline estimates were made.

Key findings:

- At the primary production phase, all the residues from harvesting cereals are used up as animal feed, fertiliser or for biogas production.
- During the milling process, germs and bran from cereal seed are separated during the milling process itself (unless whole grain flour is made). They can be used as a byproduct for human consumption, eventually germs are used as a replacement for nuts and bran mostly as animal feed for livestock.
- At the production / processing phase, there is a very low percentage of FLW at the industrial bakeries which are the biggest producers (1-5%). This is also due to the rather recent abolishment of reverse flow of materials from retailers to bakeries.
- Waste from bakery products generated by bakeries has been calculated as 1,800 t per year (calculation based on data obtained by the Slovak Food Research Institute in 2019 from 50 bakeries of different sizes in Slovakia) versus 15,000 tons of food waste generated by households (calculation based on the research carried out by the Slovak Food Research Institute on a sample of approximately 500 households through direct measurement and diary method). Data from the retailers are also problematic since individual reports differ to such an extent that it is impossible to provide a number indicating overall food waste, or “per commodity” food waste (Slovak Association for Modern Business or SAMO). According to SAMO (2021), 35% of all food waste generated by retail is represented by bread and bakery products.

As a result, the critical points or “hotspots” in the value chain have been identified. Since food waste hierarchy is the first point of reference where prevention is priority, actions directed towards consumer behaviour shall be developed. Additionally, unlike FLW from the previous stages of the food value chain, bread still ends up mainly in landfill in these hotspots, representing further opportunity for reducing ecological footprint.

This approach is also in line with SDG 12.3 dedicated to halving per capita global food waste at the retail and consumer levels by 2030. Slovakia is far from achieving this goal, which urges for implementing the most effective solutions. Behavioural change depicting the real value of bread can be the main game changer turning consumers into a generation of “Zero Waste Bread”. Consumer behaviour can change not only the amount of food waste at the household level but significantly influence the material flow optimization at the HORECA, and the retail sector, further transforming the whole system.

Current strategies for FLW prevention

Next the main strategies carried out to reduce FLW are summarized:

- Keeping optimal harvesting and storage techniques (further material recovery at the primary production level)
- By-products used up at the processing level (although mostly used as animal feed despite possessing high nutritional value for human diet)
- Demand-supply optimization at industrial bakeries
- Donating bread to ZOO or selling it to hunters to feed wild animals
- Different strategies at retail level - some supermarkets have already introduced some prevention measures, such as not unloading additional bread after certain hour, donations to Food banks and ZOOS
- Generally, the legislation for bread donation is interpreted differently by the retailers. According to the Ministry of Agriculture, donation of unpacked bread and pastry is not allowed, contrary to the most EU countries, where this commodity is classified in the lowest risk group
- Some individual cases in HORECA, where crumbs are made from stale bakery products for creative cooking.

3.1.1.4. FLW more effective destinations

In order to assess potential improvements in the current FLW management schemes, an assessment of the potential destinations at local and regional levels has been started. Following the potential catalogue of prevention solutions identified in Section 1.4 their possible application is being discussed in each pilot according to their technical and legal viability. This assessment will allow the drawing of a specific decision tree for each pilot and the possibility to assess the level of improvement according to the current practices that will be included in the Deliverable 3.2 *Circular food models specifications*, in particular in solution Section 2.1.2

3.1.2. Definition of the scope of the pilots

In this section and according to the diagnosis of each pilot carried out in the previous section the main objectives for each pilot are defined as well as the key activities that will set the basis for the Pilots’ Environmental Programme that will be defined in detail in Deliverable D2.1. Additionally, main barriers have been detected that will be assessed in more detail in WP4 in the following months.

Finally, a mapping of the main stakeholders that should be engaged in the pilots is included. Please note that this is a preliminary mapping and will be updated as far as the Pilots’ Social Programme unfolds.

3.1.2.1. Spanish pilot

Objectives of the pilot

The key objectives are the following ones:

- Use of TICs for a better decision making process

- Improvement in the cold chain management and new technological solutions
- Evaluation of consumer habits and informing about FW avoidances (recipes, cooking shows, educational tools...)
- Improvements in the municipal FW management and valorisation tools

Selection of the product

The selection of product is based on the participation of Florette and Eroski companies in the pilot. Florette produces different types of salads and other packaged food and vegetable products. One of the more valuable products is the prepared salads (ready to eat salads) that are produced for their own branding Florette, but they also produced for the Eroski distribution branding. Both products are sold in Eroski distribution stores and are product highly consumed in the municipalities involved in the pilot.

Description of the activities

The main activities proposed in the SPP are:

- Citizen awareness in terms of waste reduction and reuse.
- Validate Payt schemes by introducing the prevention variable of the FW
- Improve the traceability of the cold chain
- Optimization of stocks and fast consumption stickers process + Extension of donation alliances
- Reduce raw material rejections
- Donations traceability

Main barriers and legal restrictions

The main barriers identified for the pilot implementation is the lack of specific information about the prepared salads and the volume of the FW generated after consumers. The salads not consumed are mixed with other FLW products and the evaluation about how strategies for FW reduction in the consumer part of the pilot will be needed to be extrapolated.

Another key challenge is the identification of the common parameters that should be measured, managed and digitalised during the pilot and between all the partners involved in the pilot.

An additional barrier is the high level of waste reduction strategies already applied in the industrial and commercial part of the value chain, that will make it difficult to achieve a high rate of FLW reduction compared to the baseline.

3.1.2.2. Danish pilot

Objectives of the pilot

The aim of the DP is to test and monitor different interventions focusing on the transition into nutritional healthy and low EF (Environmental Footprint) diets. The overall goal is to monitor the transition into a plant-based diet, while reducing FLW. In this transition we will monitor consumer preferences upon testing of different meat alternatives. We will also monitor, verify and report the relationship between, e.g., the variety of servings and the amount of plate loss (Juvan et al, 2018) and plate size and plate loss (Jensen and Teuber, 2018; Dolnicar & Juvan, 2020).

Selection of the product

The pilot will test different meat alternatives in the transition towards a plant-based diet and identify best available solutions according to the preferences of the users of the cantina/-s.

Description of the activities

The main activities proposed in the DP are:

- Mapping of hotspot risks of surplus food becoming FLW at Hørkram Food Services location will take place in 2022.
- In parallel implementation of innovative and effective BtB surplus food reduction trade schemes to prevent FLW
- Plant-based buffet design at testing and optimised at JTK catinas according to monitored consumer preferences.
- Social readiness level training through nudging experiments
- Surplus food sellings and donations

The specific activities will be further developed and refined based on ad hoc experience and knowledge collection during the FoodRus project.

Main barriers and legal restrictions

- Consumer preferences for meat
- Low social awareness and acceptance of alternative proteins
- Partners involved in the Danish Pilot are frontrunners in FLW prevention which represents a barrier for obtaining the FoodRus reduction goals of 50%
- Regulatory requirement: a) of a risk analysis and self-monitoring procedure performed by actors involved surplus food donations and b) it has to be donated through aid organisations to the homeless and socially disadvantaged.

3.1.2.3. Slovak pilot

Objectives of the pilot

The overall ambition of the pilot is to contribute to a significant reduction of FLW through prevention. Main strategic approach is that the best waste is the one that was never created. Therefore, an absolute priority is given to finding solutions that prevent FLW and improve the distribution of surplus bread for human consumption through dismantling the current limitations and obstacles in donations. At the same time, wasting bread should be made socially unacceptable.

As consumers waste bread the most in the food chain, the main focus is on awareness raising campaigns on the impact of FLW on our societies, economies and environment. That requires a lot of concentrated effort on changing the mindset of people based on solid and legitimate information distributed broadly that clearly explains that it is not only about bread being wasted, but also natural, human and financial resources needed for its production, including water, land, energy, labour, capital, fuel for transport. It also has a severe environmental impact as it contributes to greenhouse gas emissions contributing to climate change. Therefore, within the project the behaviour of consumers will be challenged to adopt new patterns with the aim to prevent and reduce FW. More sustainable shopping habits of consumers need to be developed and encouraged. There is a significant difference between rural and urban areas. In rural areas the offer of bread on shelves is limited in terms of quantity and variety and reflects better the demand of local consumers. On the other hand, in cities and urban areas the supply does not match the demand and the policy of certain shops is to have all sortiment available during the whole opening hours as a matter of prestige.

Waste hierarchy is created with priority on food loss and waste prevention, further encouragement of food donations and making food recycling more available to the public and HORECA.

More active cooperation and participation of all relevant actors along the whole food chain and across all the involved sectors will be established over all stages of the project.

Selection of the product

In Slovakia bread represents the national customs and traditions. It is our cultural heritage. As an integral part of national pride it should not feature among the top most wasted foods in the country.

Bread is an integral part of human life. Absolute majority of people eat it on a regular basis. It has accompanied humanity since ancient times and its preparation is about as old as the grain itself. And while it may not currently have the respect it deserves, it has always been, is, and will be an everyday part of our lives. Only flour, water and a little yeast or leaven can create something that has saturated humanity for centuries. But bread is much more than just food. It also has important social, cultural and economic meaning.

Bread is undervalued and yet so important. It is very valuable in terms of worthiness, culture, history, labour and energy.

It is not only in Slovakia, but every country, every nation or ethnic group has its original way of making, serving and consuming bread. But even though there is such a variety in its types and methods of preparation, bread is always something that must not be missing on a daily basis on any covered table.

In the past when food sufficiency was not so natural, bread was not only considered a valuable food, but it was also a symbol of wealth, even used in the ancient past as a currency.

Bread was typically produced from the whole grain, when the grains were freshly grinded. Switching to the white bread happened with the beginning of the industrial revolution, when the process of separation of the whole grain to the bran and endosperm began - it was mostly common for the Aristocracy.

With the rising standard of living, some basic values and traditions of our ancestors are forgotten. We take fresh bread for granted. The fact that there is never a shortage of bread on our table means that the skilful hands of the farmers tried to grow enough grain all year long for the hard-working millers to grind it into flour, from which our bakers bake crunchy breads in the early morning when we are still sweetly sleeping.

Wasting food (in our case bread) is also connected to the lack of knowledge about healthy eating habits. Due to this reason, it is very relevant for our pilot to focus on educating public that whole grain breads that are naturally using all parts of the grain are more nutritious as the bran is rich in fiber, B-vitamins, iron, zinc, magnesium, antioxidants and phytochemicals, etc. and the germ is for instance rich in healthy fats. Studies show the importance of maintaining the right balance between the consumption of white and whole grain meal products from the nutritional point of view.

The path leading to the final product of bread is very long and difficult. Therefore, we should start to appreciate it a little more and especially let our children learn more about it. Let us teach them to love and cherish bread, to treat it with respect and not to waste it, because the survival of entire nations has often depended on it in the past. And the current circumstances suggest that these times may not be so irretrievably gone.

The low price of bread does not reflect its real value in terms of resources, labour and environmental costs related to its production. On the contrary, it devalues its true value and thus contributes to its wasting. Learning more and getting deeper knowledge and understanding of the true value of bread could significantly contribute to increasing its importance and prominence and thus making it more valuable and less wasteful.

Description of the activities

The main activities proposed in the SLP are:

- Regular coordination of partners of SLP.
- Establish an active network of relevant stakeholders and actors.
- Engage stakeholders in co-creation of results and solutions.
- Create a model for prioritizing use of edible surplus bread for human consumption.
- Prepare Communication and Media Plan.

- Develop e-learning materials to improve understanding about FLW, date marking and knowledge on appropriate practices for bread conservation.
- Develop a Book of Recipes or Cook App for households to encourage and promote utilization of stale bread for easy home made recipes for its maximum exploitation. It will include information on the cultural and social value of bread and the social, economic and environmental impact of bread wasting.
- Search for solutions encouraging new ways of using bread to avoid its wasting.
- Monitor the bread preferences of customers in supermarkets and how to influence them to buy only what they need.
- Evaluate the long-term and short-term impacts of the current global pandemic on the bakery sector (increased packaging, new technologies required, increased costs and bread prices, boom of home baking etc.).
- Evaluate nutritional aspects of bread consumption.
- Assess bread eating habits of consumers.

Main barriers and legal restrictions

The following barriers have been identified for the SLP:

- Significant legislative barriers to bread donations in terms of definitions, responsibilities and clarity of rules for donations.
- Fresh unpacked bread cannot be donated for human consumption since the legislation requires that it can be sold up to 12 hours from its baking time and it is not clear how it should be handled afterwards.
- Insufficient and uneven coverage of distribution networks for bread donations.
- Absence of clear rules for handling fresh bread that cannot reach the retail sector for different reasons (absence of label on packaging etc.).
- Problem with responsibility for food safety of donated bread that is currently in the retail sector. Evaluate the option of moving this responsibility from retail to food banks since it is subject to biological processes that cannot be controlled by the retail sector after being moved to the storage houses of food banks.

3.1.3. Co-design of FOODRUS solutions

Once pilots have a clear idea about the current status of the 3 supply chains, the aim of this activity is to define the scope of the different solutions that will be developed in FOODRUS in a collaborative way involving all the actors of the value chains. This activity corresponds to the implementation of the first step of the Citizen Science number 5 (Co-creation of the FOODRUS solutions) which methodology is described in deliverable *D2.3 Citizen Science based methodology for FL and FW reduction and prevention*. In the present deliverable the results obtained during the implementation in the pilots are included. As a result of this initiative, the solutions will not be created under an individualist perspective but they will benefit all the actors involved under a more holistic and cooperative vision. Moreover, the results obtained will allow the responsible of the solutions to fit their design to the real needs of the sector as well as to develop solutions more easily transferable to other value chains. Additionally, the activity will contribute to fostering cooperation from the very beginning of the project generating a shared community sense that will ease the cooperation along the whole project.

3.1.3.1. Phase 1: Analysis phase

The **first phase (analysis phase)** is to analyse the 12 Results that the FOODRUS project expects to achieve according to the target group and the processes that will be improved. These results are divided in one or more Solutions (S). In total, there are 23 solutions. 11 of those solutions are technologic solutions (based on ICT tools and technologies) and 12 are social solutions (based on methodologies, learning materials, recommendations,

or new strategies). The co-design activity will use the level of Solutions as working concepts instead of Results, and technological solutions and social solutions will follow a different pathway within the CS5 activity.

The project stakeholders have been categorised within the stage of the supply chain they belong to: Production, Processing/Transformation/, Transportation, Retail, Consumers, Valorisation and Other (public authorities). This nomenclature of these stages is preliminary to simplify. In further phases of the project, they will follow the names of the corresponding NACE codes, but the significance keeps the same.

Finally, the solutions have been related with the processes typically used in the supply chains and that they expect to improve:

- Demand forecast.
- Product development.
- Production/consumption.
- Storage.
- Relation with clients.
- Social responsibility.
- Policy making (for public authorities).

These processes will be used also for the Digitalization Maturity diagnosis explained in Section 4.

As a result of these three steps, two types of outputs are generated. On the one hand, a worksheet is developed that connects the 23 solutions to the supply chain processes. The following image shows a summary of this analysis for the case of the Slovak pilot.

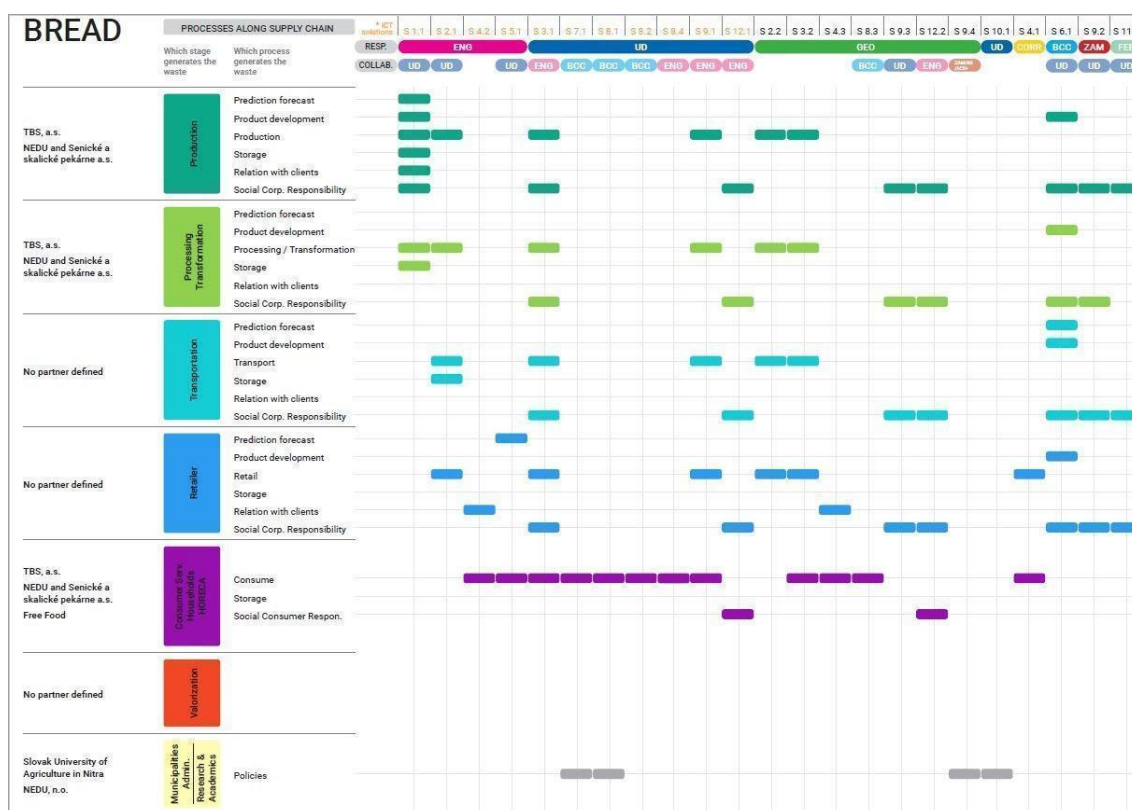


Figure 23. Solutions and actors involved in the Slovak pilot (bread product).

In the rows, there are supply chain stages and their internal processes. In the columns, there are acronyms of the solutions (S1.1, S2.1, etc.) sorted by technological (yellow) and non-technological (black). Each solution

has a solution manager (RESP) and key partners (COLLAB) who have been preliminary identified but validation with partners is looked for in this stage. Each coloured dot has a description of the project outputs (OP) that are expected of each solution in each process.

On the other hand, very simplified documents are created describing each solution objective in a non-technical language and visualising only the stage of the supply chain that each solution points out. As an outcome of this analysis, it is noted that the description (writing) of each solution in the GA has MANY objectives. This further complicates the common understanding of solutions. In this stage, sub-solutions are envisioned in order to cover all the expected outputs (OPs) of each solution. These materials can be consulted in Annex Ia (Confidential).

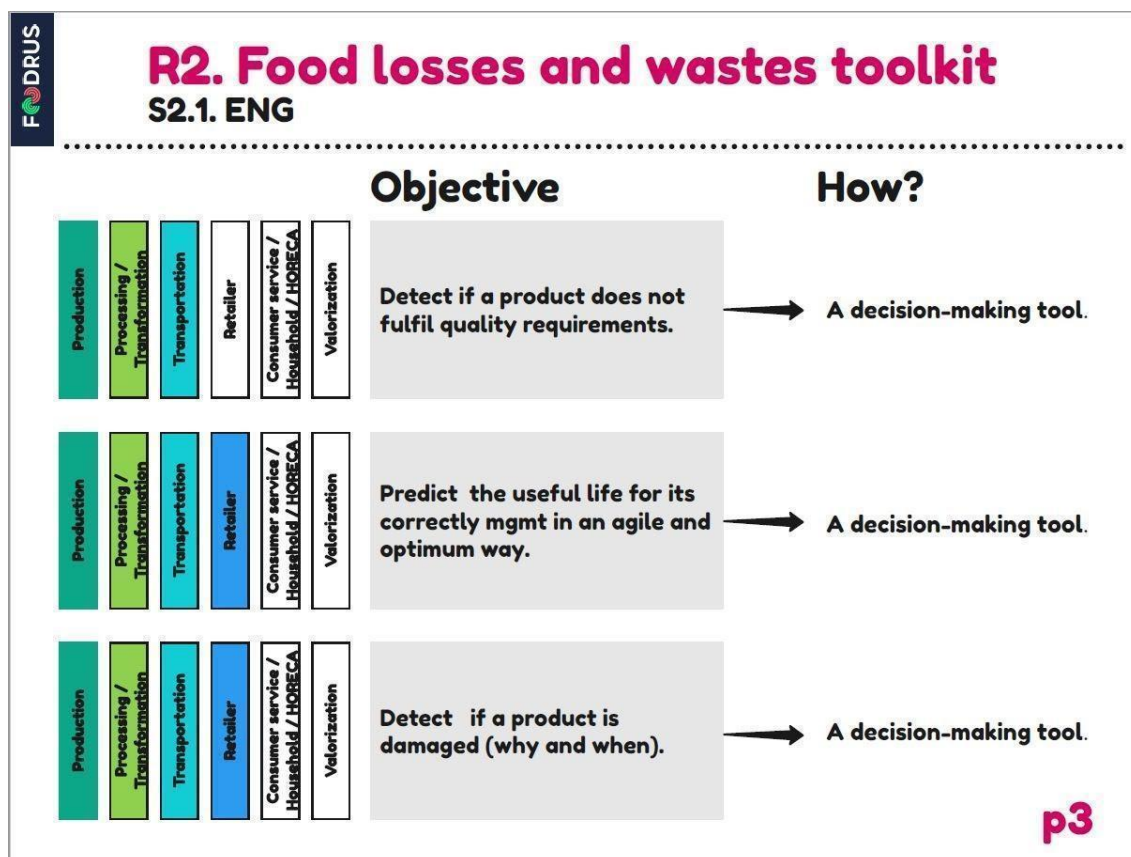


Figure 24. Example of the material developed for the co-creation activity for the Result 2 (R2).

This first stage is carried out by the manager of the CS5 activity. The results (worksheets and documents) are introduced and explained to and shared with the three Pilot leaders at the same time. This first co-creation meeting with Pilot managers is also used to introduce them to the methodology of the CS5.

Each pilot manager holds brainstorming meetings with their pilot partners at their convenience. As part of the first phase of the CS5 activity, they are asked to do two tasks:

1. Confirm that they are well located in the matrix that relates solutions and supply chain stages.
2. Brainstorm about these three aspects to prepare Phase 2 of the CS5:
 - Own understanding of the solution.
 - Particular interests in the solution.
 - Difficulties of the solution.

This phase was carried out by the 3 pilots.

3.1.3.2. Phase 2: Collaborative phase

The **second phase (collaborative phase)** of the activity is a workshop in which partners that share the same solution share the outcomes of the brainstorming done in the previous phase. The solution managers explain the objective and scope of each solution and try to achieve a common understanding among all partners that are involved in each solution. This workshop is different for each pilot, and this is due to 3 main reasons:

1. COVID restrictions that made it not possible to perform a face to face workshop in the same format with the 3 pilots.
2. The complexity of the three pilots is different, and the scope of some of the solutions differs quite a lot, mainly the technological ones that have to do with the production and processing phases. It is proposed to address this phase separately in each pilot. The most complex pilot in terms of agents involved, the Spanish one, will be conducted first. This will allow the most complex challenges to be taken on from the beginning and will serve as an example for the other two pilots to facilitate their understanding of the scope of each solution.
3. The language used in this phase is key to create a good understanding between industrial and technological partners. It is decided that the person facilitating the discussion of each solution should use a language close to the mother tongue of the industrial partners to facilitate feedback. Coincidentally, the people in charge of the technological solutions are from the same country as the Spanish pilot, the most complex one, which reinforces the first decision. Once the Spanish pilot solutions are defined, at least at a high level, the solution managers will train the leaders of the other two pilots to act as facilitators of their particular workshops.

The Spanish workshop was held online due to COVID restrictions. The workshop was divided in two days: one day for the technological solutions (11) and one day for the social solutions (12). This eased the participation of people who claimed to participate in many solutions. Each day was scheduled in two parallel tracks with 6 virtual rooms in each. This allowed meeting the requirement of the pilot leaders to keep the duration of the online workshop to 3 hours in order to ease the participation. Each virtual room held the discussion of one solution and the order of the rooms avoided overlapping the participation of stakeholders.

Each solution manager led the discussion in each room, giving the opportunity to the other partners to share their reflections from the previous phase. The inputs from each partner were collected in an online tool (Miro) prepared specifically for the project. Next figure shows an example of this tool. They are whiteboards where partners can add their inputs regarding these three questions, and other whiteboards available for other open questions. The completed whiteboards resulting for this phase can be consulted in Annex Ib (Confidential). Please note that the social solutions didn't use this tool. In that case solutions managers presented the general description of the solutions and the next steps in the co-creation process that will follow a different process in each case as explained in the corresponding deliverables:

- D2.2 Implementation of the FOODRUS e-learning platform (Solution 2.2 E-learning materials to learn about best practices, Solution 3.2 E-learning materials in certification using blockchain, Solution 4.3 E-learning materials to learn about new secondary products, Solution 8.3 E-learning materials to improve understanding about date marking and knowledge about food conservation, Solution 9.3 E-learning materials to foster self-composting, Solution 9.4 E-learning materials to promote economic instruments by municipalities, Solution 12.2 A repository with e-learning materials)
- D2.3 Citizen Science based methodology for FLW reduction and prevention (Solution 6.1 Set of Citizen Science activities (CSs))
- D2.4 Last mile solutions (Solution 4.1 Last mile solutions to ease local market and agile management of edible food)

- D4.2 Building capacity strategies for circular food (Solution 11.1 A briefing about building capacity strategies)
- D4.6 Prevention of FLW by legal instruments (Solution 10.1 A briefing about policies, fiscal incentives, civil responsibility and other legal set of recommendations)

R1. Process optimization tool

Production Processing / Transformation Transportation Retailer Consumer service / Household / HORECA Valorization Municipality / Public Admin / Research & Academia

S1.1 / ENG

Objective **How?**

Adjustment of production → A decision-making tool based on demand and quality of products forecast (forecasting in cascade from end consumers to farmers).

To increase of productivity and to optimize the use of resources. → A decision-making tool based on tracing the product detecting alterations in the product.

To minimize breaks and predict the shortening of product life. → A decision-making tool with the Traceability of the cold chain.

Fluent communication with stakeholders, coordination and confidence. → Not defined yet.

Write your name →

Your understanding of the scope of the solution?

What particular result would you like to obtain from the solution?

What difficulties do you see in the solution?

Open Feedback: Other solutions or comments?

Figure 25. Example of the workshop tool used as part of the co-creation activity for the Result 1 (R1).

The workshop closed the second phase of the Spanish pilot. However, the second phase of the other two pilots started after the third phase of the Spanish Pilot. This second phase in Slovak and Danish pilots were led by their pilot leaders and in this case several joint sessions were organised with involved stakeholders. Since their preference was to work leading the process by the Pilot Leaders, the consultations with the solution managers on one basis were organised in the form of on-line meetings, set of questions and answers documents, and e-mail communications for further clarifications and specifications, first directly with the Pilot Leaders and later involving the different stakeholders to ease technical comprehension. The collection of the inputs hasn't followed a structured procedure as in the case of the Spanish pilot and the contributions have been included directly in Phase 3. Moreover, this has extended the expected duration of the process and these consultations are still on-going in some cases. In the case of the Slovak pilot it has been even more complicated as most stakeholders such as supermarkets, waste management companies, bakeries, mills, civil-society organisations, public authorities and charities, are not directly involved in the project consortium.

3.1.3.3. Phase 3: Reflection phase

The **third phase (reflection phase)** of the activity lasted two weeks after the workshop in the case of the Spanish pilot, and allowed each partner to return to the Miro and complete their contributions, while observing the rest of the contributions of the other partners. It should be noted that in the meantime a physical visit to the

Spanish pilot was possible, which greatly helped to interact more actively among stakeholders and understand better the supply chain and the potential scope of many of the solutions.

From this point on, the technology and social solutions managers continued the co-creation activity in a different way. Those managers of social solutions continued with co-creation using the corresponding deliverables directly as a working tool. However, technology solution managers integrated all the content generated so far for each solution into a single descriptive document. These documents were the first high-level design of the solutions, in some cases detailing the use cases, and will serve as the basis for Deliverable *D1.2 Functional Requirements*. These documents are written, in the first instance, in the same language in which all the activity has been carried out in the Spanish pilot to facilitate understanding between the industrial partners. The structure of these documents is divided into 4 parts. The first part describes the solution in a general way, applicable to any pilot. The other three sections are to detail the solution designed for each pilot. There are solutions where this differentiation does not apply, so there will only be two sections.

The first version of the document is also shared with the other two pilots (in English) so that they can move on to phase 3 of this activity. For example, the Slovak pilot, as the outcome of phase 2, a table of Use Cases was created in which each partner and associated partner indicated in which solutions they wish to engage and which stakeholders are involved. In the second stage pilot Leaders for each solution were identified. These leaders are also responsible for drafting the text input and work in close touch with the individual solution managers to design pilot specific models. These working documents are alive documents that are updated as far as pilots outline their needs. The last consolidated versions can be consulted in Annex Ic (Confidential) and are the basis for the functional requirements specification in Deliverable D1.2 *Preparatory actions report*.

3.1.3.4. Phase 4 of CS5

The **four phase (transfer phase)** of the activity is a continuous work of meetings between the solution developers and the partners involved in each solution of the three pilots. In this phase, group meetings are exchanged with individual meetings. All agreed design aspects are transferred into solution description documents.

At the time of preparing this deliverable, the solution descriptions for some of the pilot solutions are still under development. This has been due to the fact that phase 2 of the other two pilots have started at the end of phase 3 of the Spanish pilot, and that this process is a hard work of consensus building among various types of stakeholders. The following table summarises this situation.

Table 6. Solutions to be applied to the pilots and partners involved.

Solutions	Spanish pilot (SPP)	Slovak pilot (SLP)	Danish pilot (DP)
S1.1 – Demand forecasting	SPP1 (Florette and Eroski).	SLP1 (Supermarket and bakeries)	DP1
S1.2 – Production forecasting	Not applicable.	SLP2 (Associated bakery Senpeck)	DP2
S1.3 – Cold chain monitoring and traceability	SPP2 (Florette and Eroski).	Not applicable.	DP3
S2.1.1 - Product quality (shelf life) prediction model as a function of temperature profile	SPP3 (Florette and Eroski).	Not applicable.	DP4
S2.1.2 - Tool to assist in the management of products	SPP4 (Florette, Eroski and Correos).	SLP3 (Supermarket and bakery)	DP5

whose shelf life has been affected prematurely			
S3.1 - Blockchain Framework for the registration of indicators for decision-making in food certification processes	SPP5 (All partners).	SLP4 (TBS and New Edu)	DP6
S3.2 - Unification and traceability of date marking	SPP6 (Florette).	Not applicable.	Not applicable.
S4.1 – Last mile solutions to ease local market and agile management of edible food	(Correos).	Not applicable.	DP7 (Food donations)
S4.2 – Alert system to notify the offer of products in different marketplaces	(Correos).	Not applicable.	D8 (HORKRAM)
S5.1 – Stocks optimization tool	SPP7 (Eroski).	SLP5 (Supermarket)	DP9
S7.1 – Weekly planning tool	SPP8 (Food donors).	SLP6 (FreeFood)	DP10
S8.1 – Food loop app	SPP9 (Consumers and HORECA).	SLP7 (SUA and TBS)	DP11
S8.2 – Cook app	SPP10 (Consumers).	SLP8 (SUA and New Edu)	DP12
S8.4 – Product traceability dashboard	SPP11 (Citizens and stakeholders).	SLP9 (SUA and New Edu)	DP13
S9.1 – Waste generation and food waste separate collection tracking	SPP12 (Zamudio).	Not applicable.	DP14
S9.2 – PAYT tool for the correct identification and quantification of waste generated	SPP13 (Zamudio).	Not applicable.	Not applicable.
S12.1 – FOODRUS dashboard	SPP14 (All partners).	SLP10 (All partners).	DP13 (All partners).

Next table identified the hotspots that will be covered by each solution in the three pilots.

Table 7. Solutions and pilots' FLW hotspots where they will be applied.

Solutions	Spanish pilot (SPP)	Slovak pilot (SLP)	Danish pilot (DP)
S1.1 – Demand forecasting	FL02, FL04, FL05, FL07, FL08, FL11.	FW02.	FL01.
S1.2 – Production forecasting	To be defined.	FL01.	FW04, FW05.
S1.3 – Cold chain monitoring and traceability	FW11, FW12, FW13, FW14.	Not applicable.	FL02, FL03.
S2.1.1 - Product quality (shelf life) prediction model as a function of temperature profile	FW11, FW12, FW13, FW14.	Not applicable.	FL02, FL03.

S2.1.2 - Tool to assist in the management of products whose shelf life has been affected prematurely	All FLW hotspots.	All FLW hotspots.	All FLW hotspots.
S3.1 - Blockchain Framework for the registration of indicators for decision-making in food certification processes	All FLW hotspots.	All FLW hotspots.	All FLW hotspots.
S3.2 - Unification and traceability of date marking	FW14.	Not applicable.	FW04.
S4.1 – Last mile solutions to ease local market and agile management of edible food	FW13.	Not applicable.	FL03.
S4.2 – Alert system to notify the offer of products in different marketplaces	Any point in the FSC	Any point in the FSC	Any point in the FSC
S5.1 – Stocks optimization tool	FW14.	FW02.	FL02.
S7.1 – Weekly planning tool	Any point in the FSC	Any point in the FSC	Any point in the FSC
S8.1 – Food loop app	From FW05 to FW09	FW03, FW04, FW05.	FW04, FW05, FW06.
S8.2 – Cook app	FW14	FW02, FW03.	FL02, FL03, FW04, FW05.
S8.4 – Product traceability dashboard	All FLW hotspots.	All FLW hotspots.	All FLW hotspots.
S9.1 – Waste generation and food waste separate collection tracking	Applicable to waste management collection	Not applicable.	Not applicable.
S9.2 – PAYT tool for the correct identification and quantification of waste generated	FW05	Not applicable.	FW06.
S12.1 – FOODRUS dashboard	All FLW hotspots.	All FLW hotspots.	All FLW hotspots.

3.1.4. Identification of FOODRUS stakeholders

The identification of the FOODRUS stakeholders consists in the identification of the specific organizations involved in each pilot. For this purpose, a survey has been conducted and fulfilled by the partners involved in each pilot site. Previous classification has been used in order to facilitate the identification of roles. However, the description of the roles and the relationship with FLW is requested in order to check the adequateness of this classification to be updated or widened if necessary. In particular, the survey is divided into 4 sections:

1. Stakeholders' information: to collect information about the stakeholders organisation following the general categorisation presented in Section 1.2.

2. General information: to understand the relationship with this stakeholder. Additionally, a question regarding the flux of information with stakeholders are included in order to have a preliminary idea about the pre-project level of cooperation.
3. Food information: to know the information related to food that is currently provided by the stakeholder.
4. Additional information: to collect any relevant information including the website and if they have been already contacted to collaborate in the project.

In total 185 stakeholders have been identified in the 3 pilots and 4 of the 6 follower regions. Next a summary of the main results are described.

3.1.4.1. Spanish pilot map

In the SPP 31 stakeholders from 13 different types of stakeholders covering the 4 main areas have been identified but 11 types of stakeholders have not been identified as key agents.

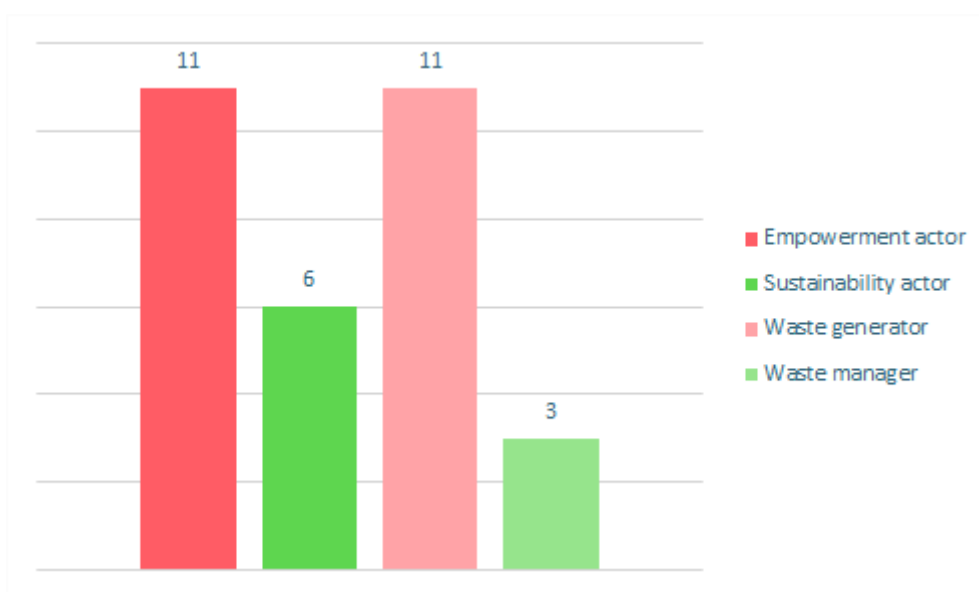


Figure 26. Number of stakeholders (4 main categories) in the Spanish pilot.

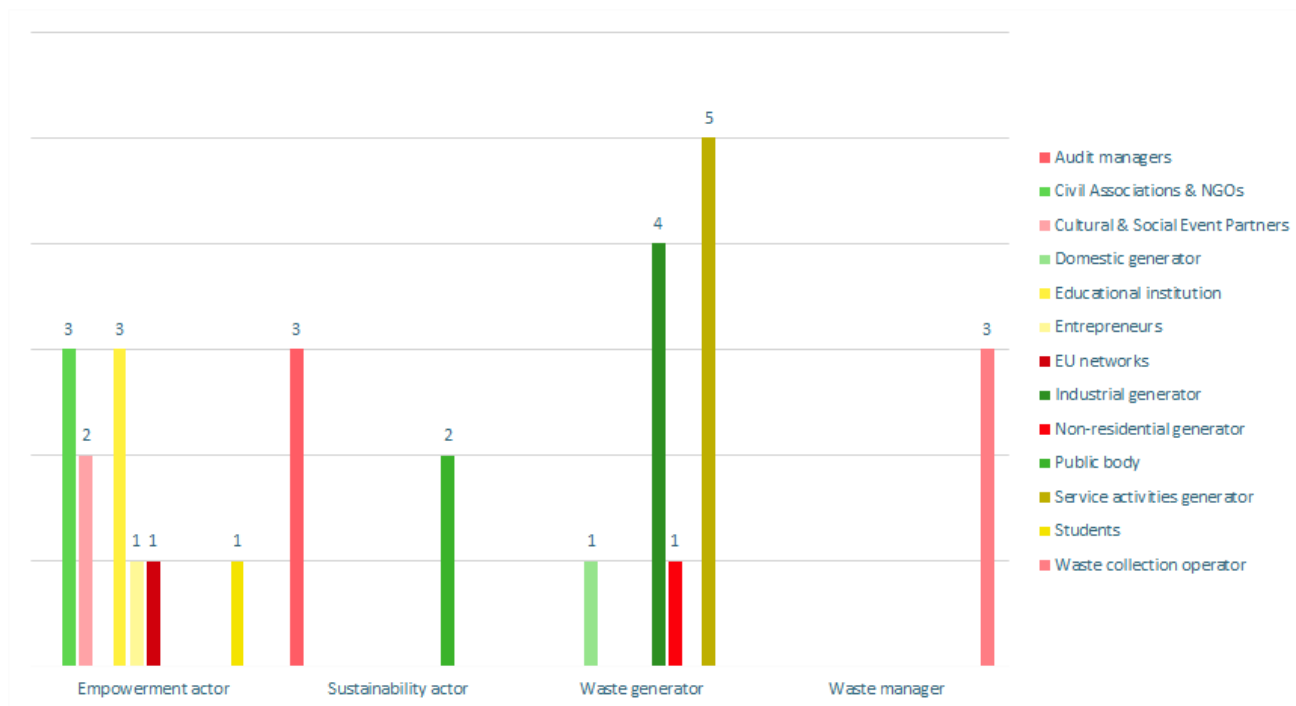


Figure 27. Number of stakeholders in the Spanish pilot classified by type.

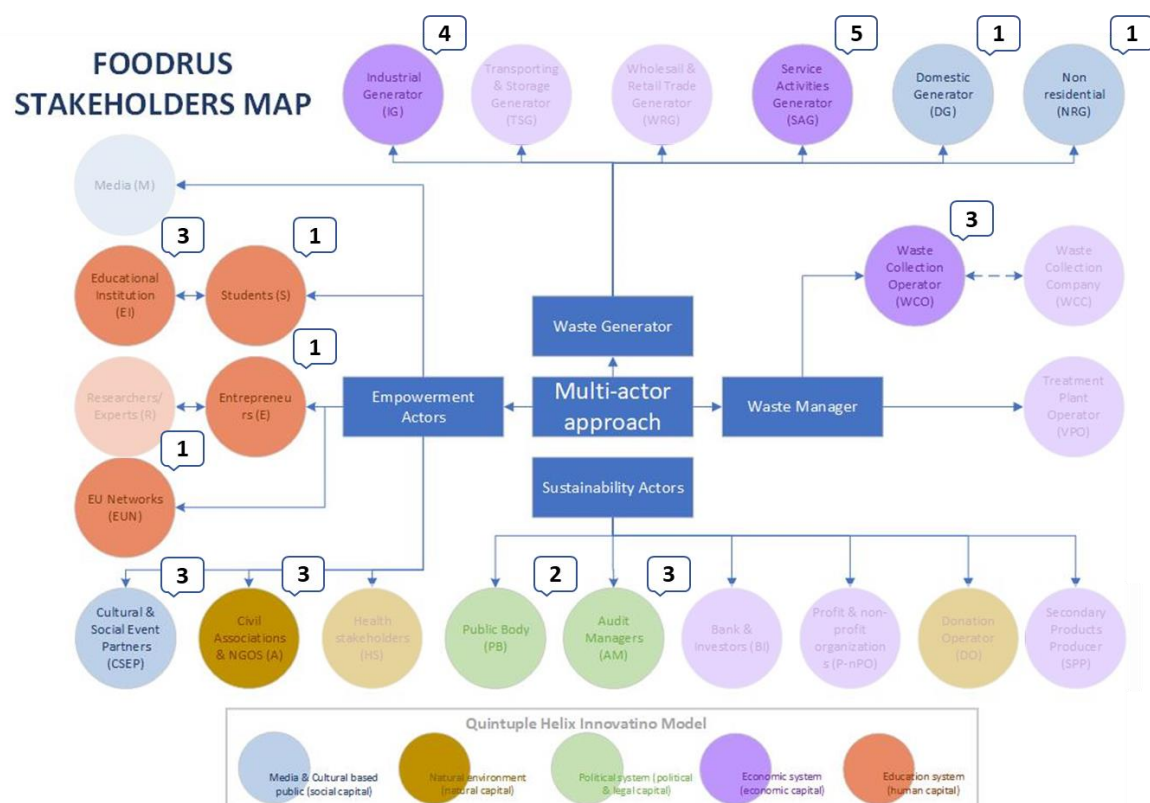


Figure 28. Summary of Spanish pilot's stakeholder map according to the classification established in the Section 1.2.

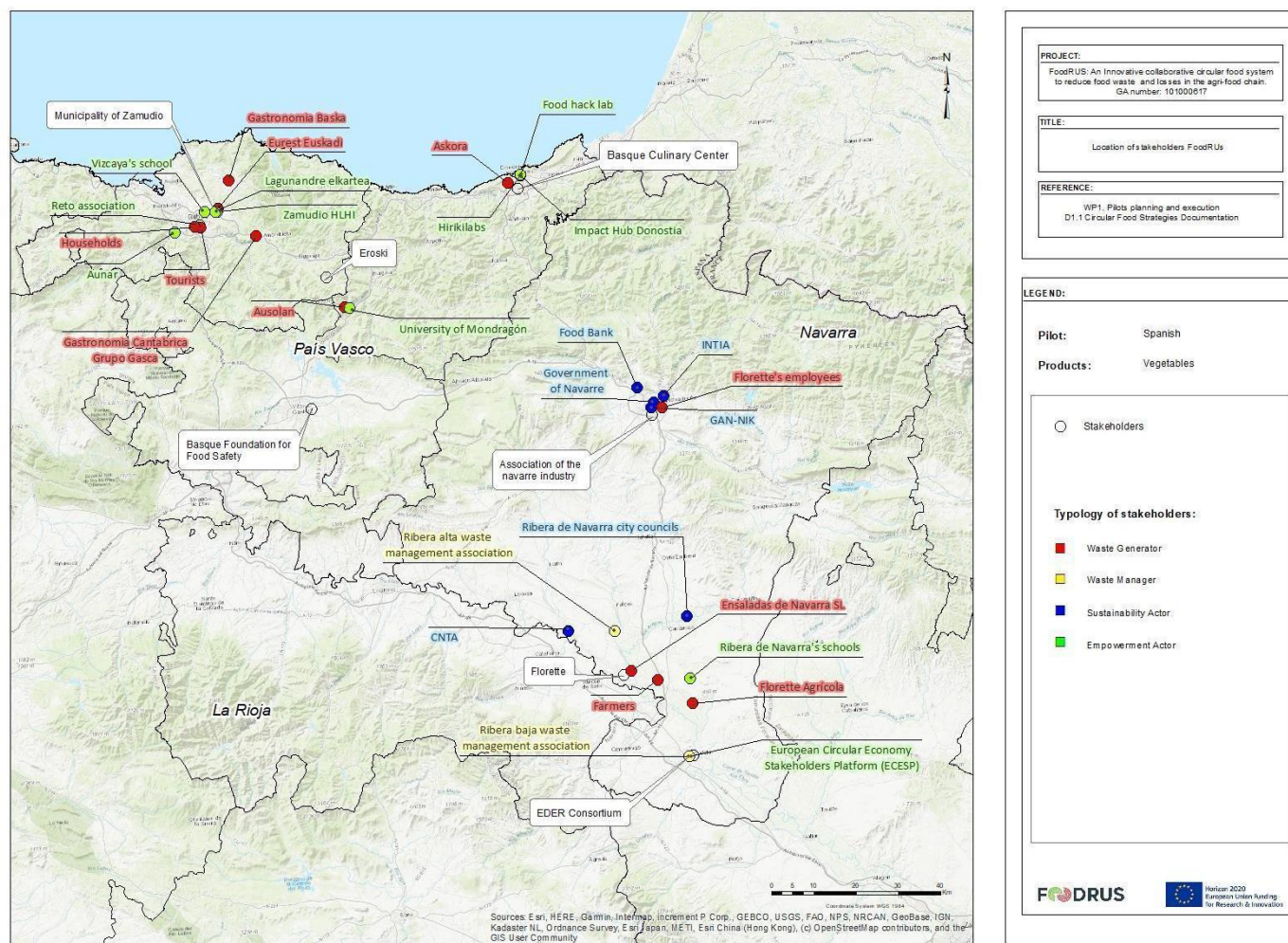


Figure 29. Spanish pilot's stakeholder map.

3.1.4.2. Danish pilot map

In the DP 32 stakeholders from 10 different types of stakeholders covering the 4 main areas have been identified but 14 types of stakeholders have not been identified as key agents.

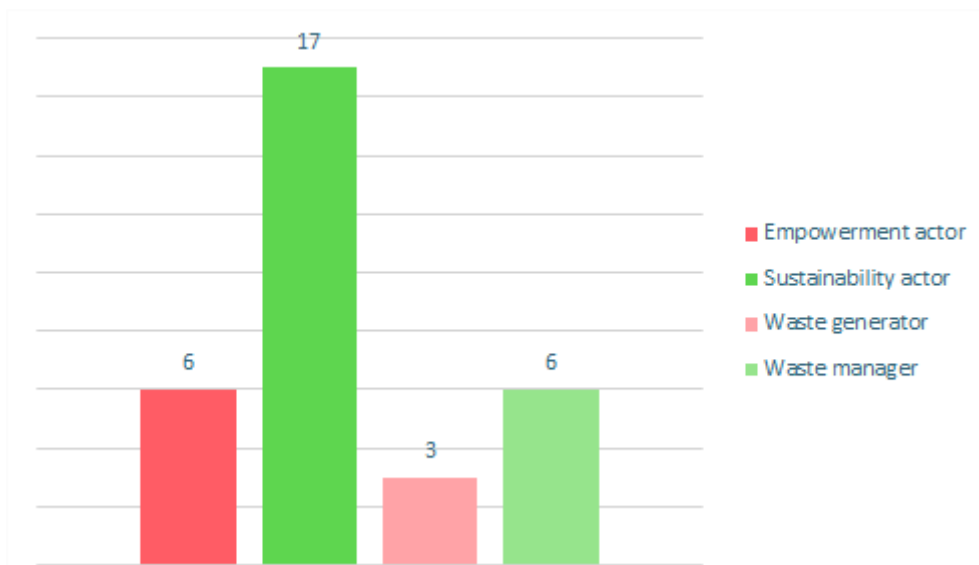


Figure 30. Number of stakeholders (4 main categories) in the Danish pilot.

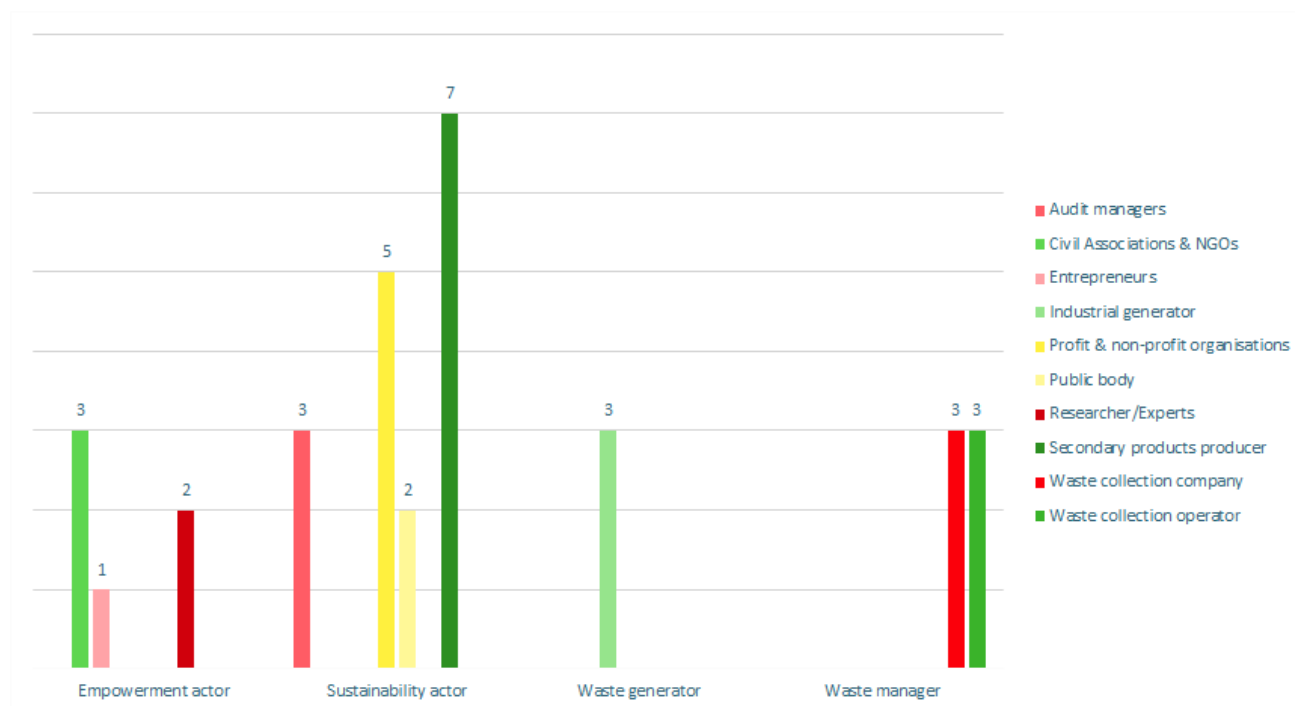


Figure 31. Number of stakeholders in the Danish pilot classified by type.

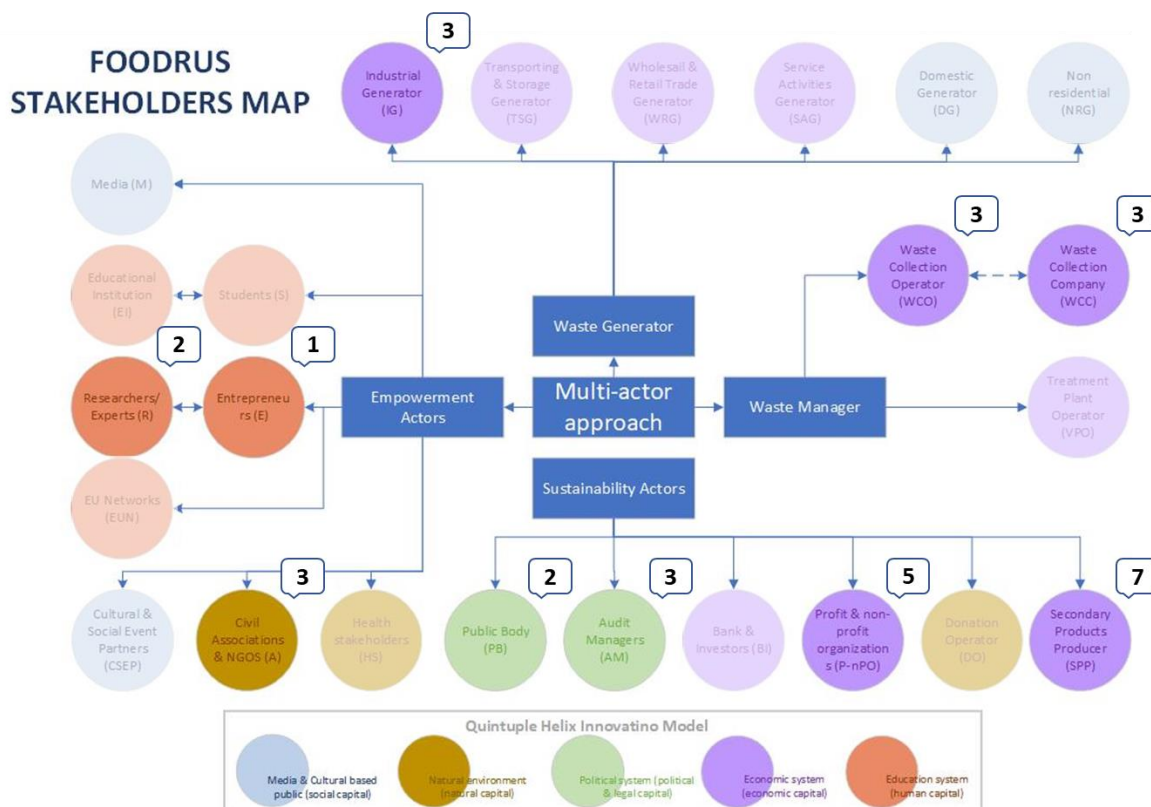


Figure 32. Summary of Danish pilot's stakeholder map according to the classification established in Section 1.2.

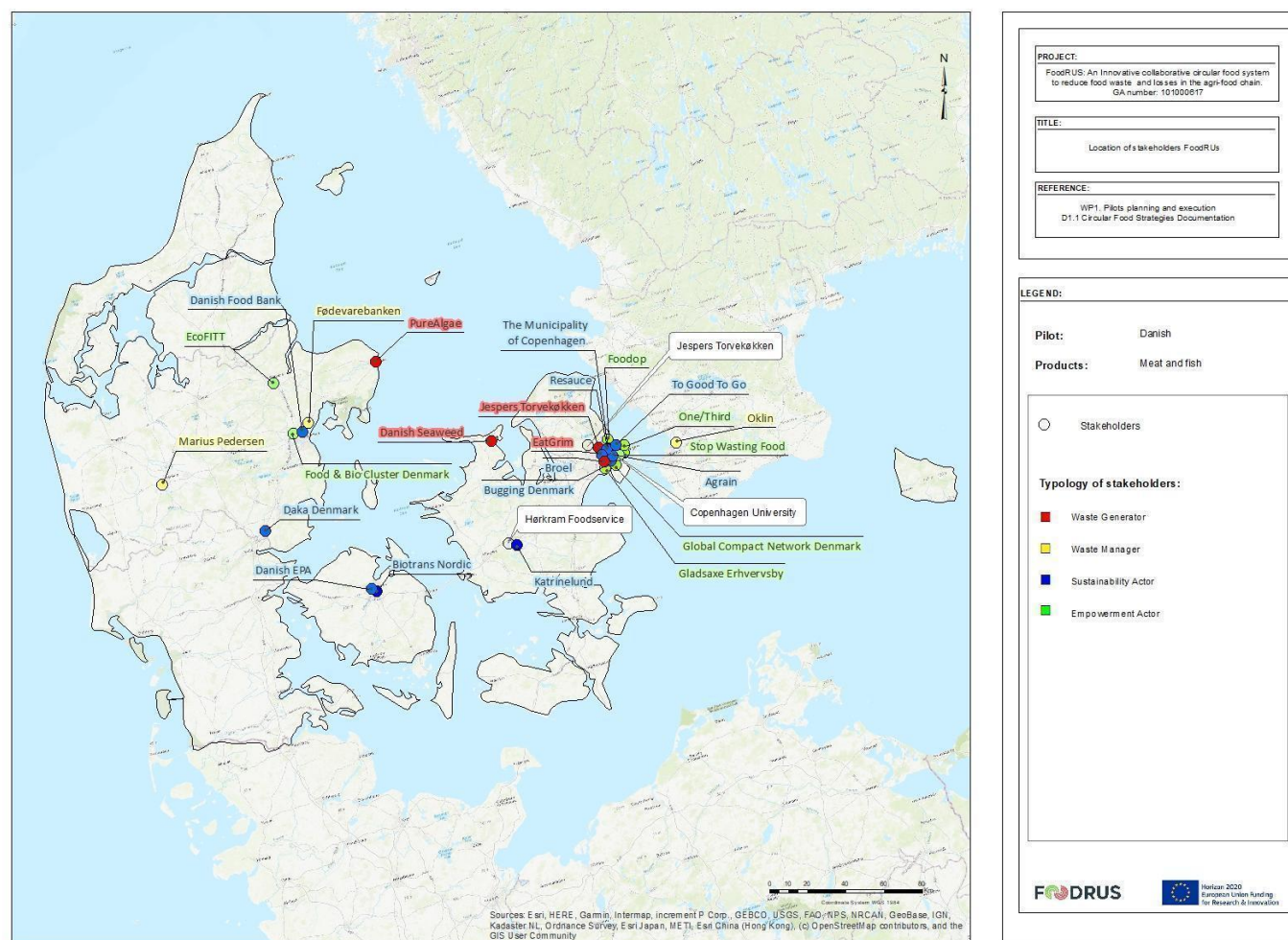


Figure 33. Danish pilot's stakeholder map.

3.1.4.3. Slovak pilot map

In the Slovak pilot 14 stakeholders from 7 different types of stakeholders have been identified. However, no waste managers have been spotted. 17 types of stakeholders have not been identified as key agents.

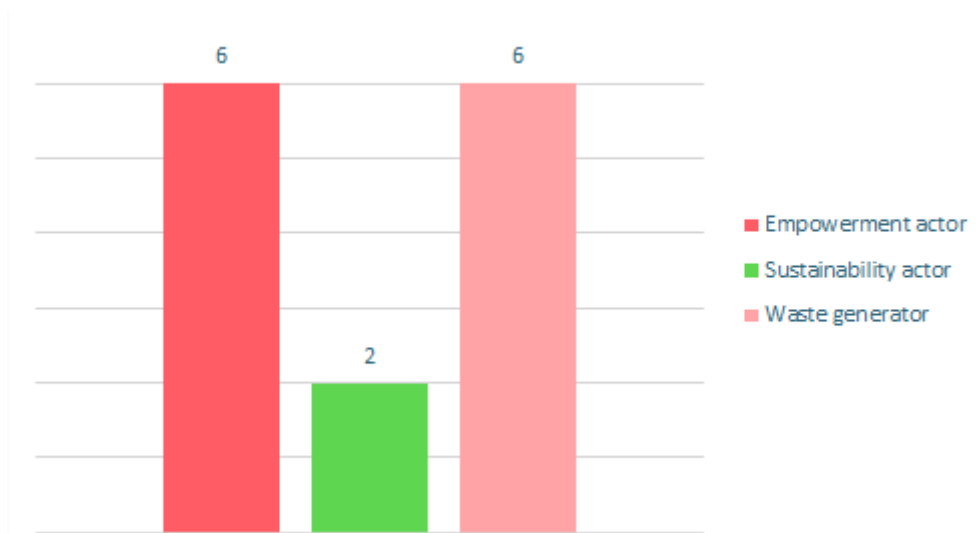


Figure 34. Number of stakeholders (4 main categories) in the Slovak pilot.

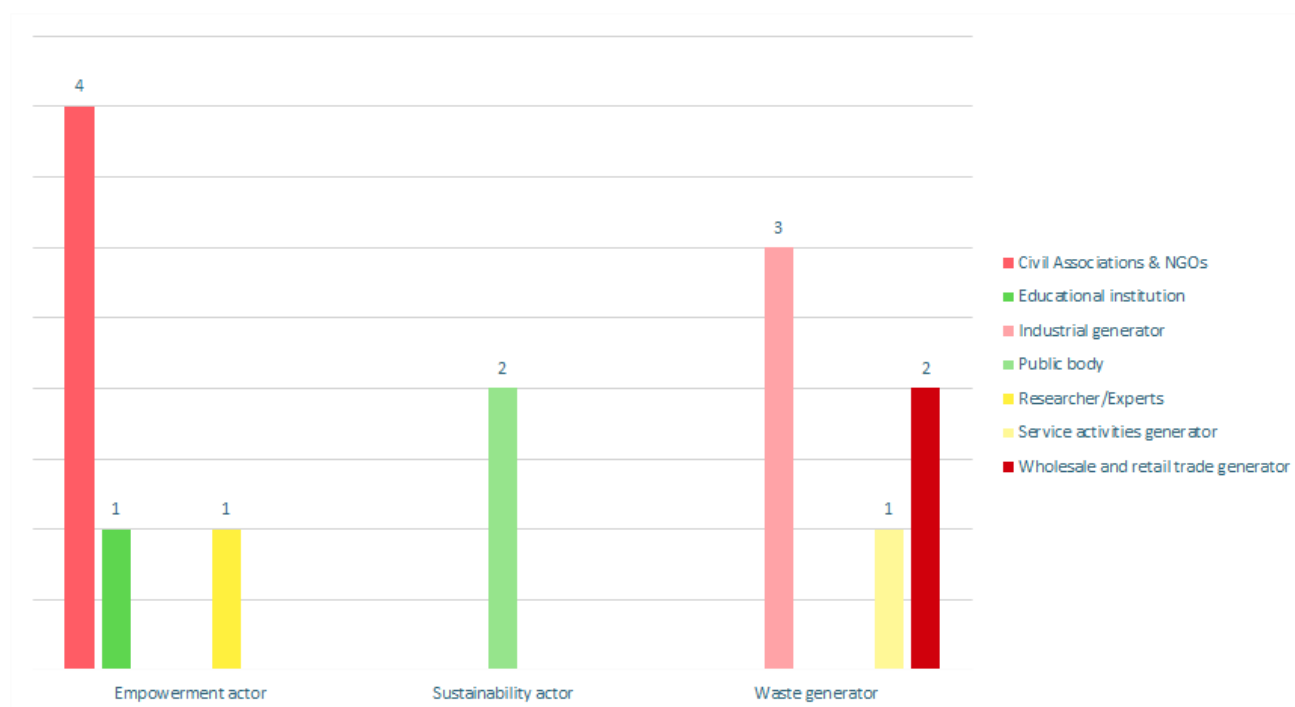


Figure 35. Number of stakeholders in the Slovak pilot classified by type.

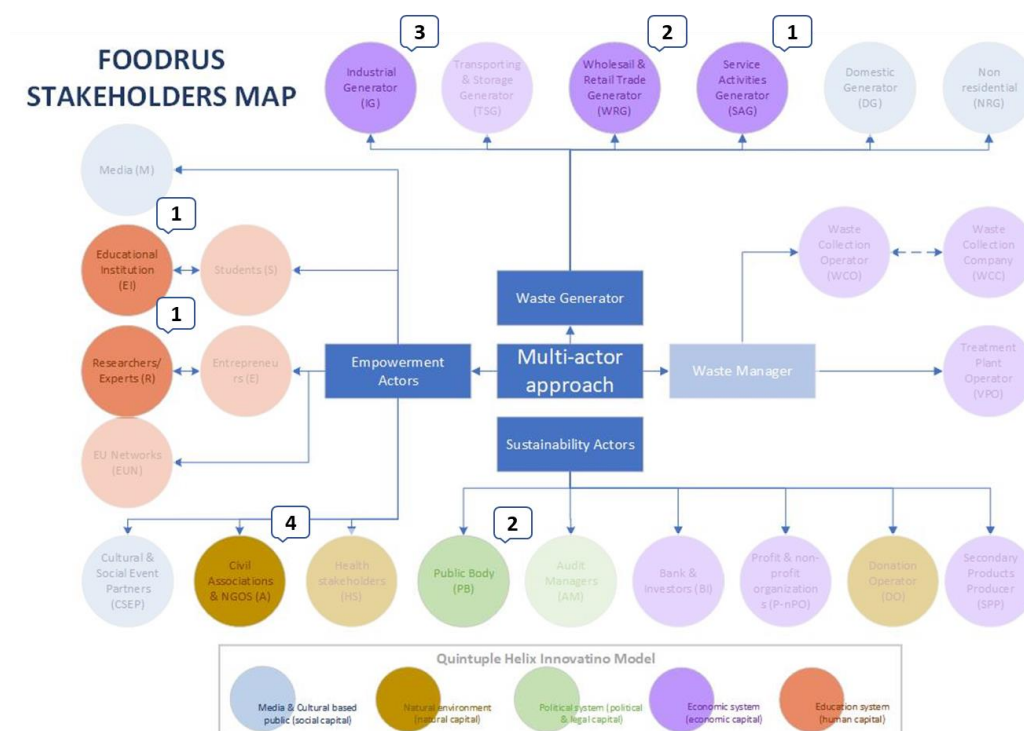


Figure 36. Summary of Slovak pilot's stakeholder map according to the classification established in Section 1.2.

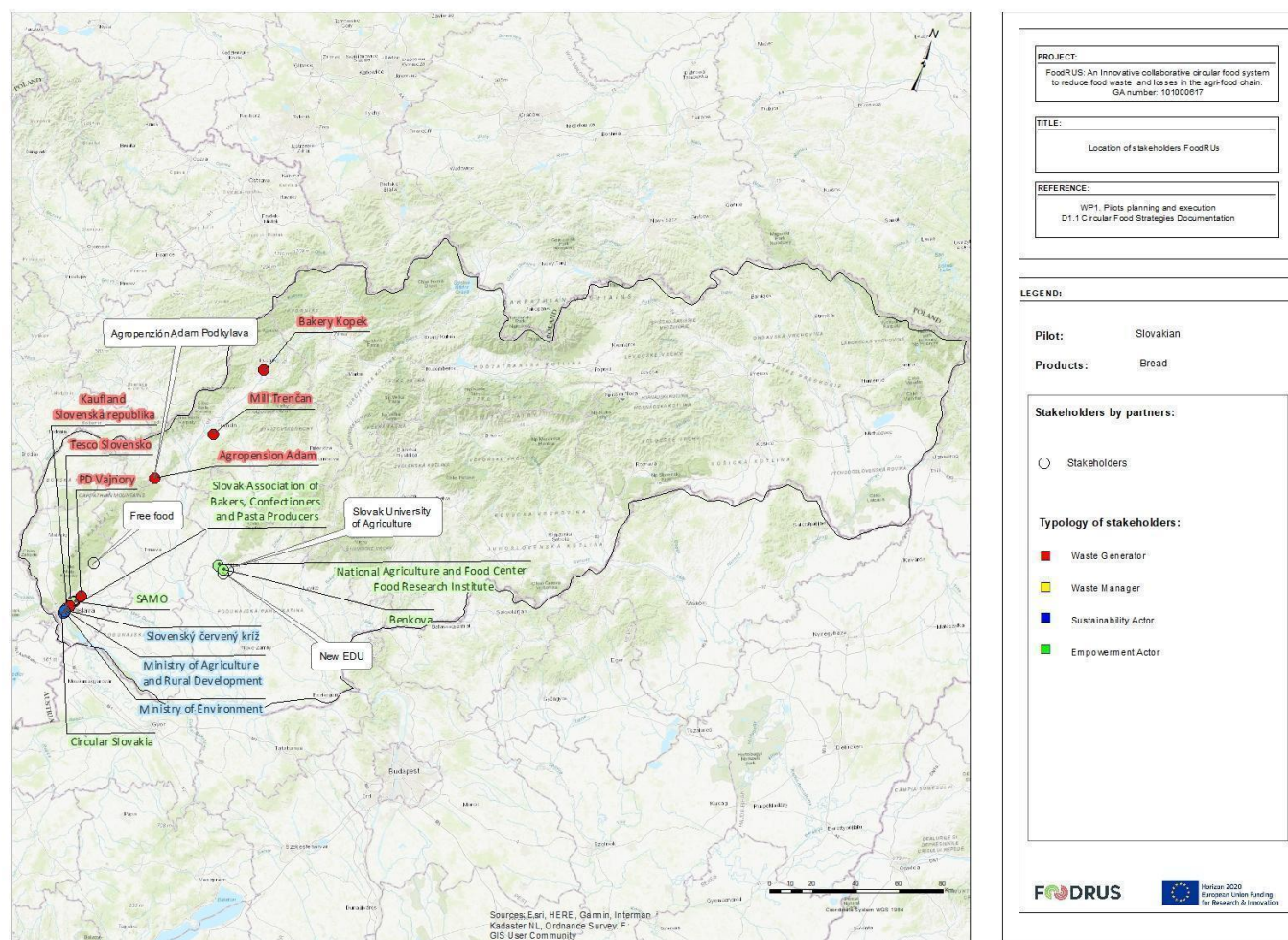


Figure 37. Slovak pilot's stakeholder map.

3.1.4.4. Timisoara (Romania) map

In the Romanian region, 8 stakeholders from 6 different types of stakeholders have been identified but 17 types of stakeholders have not been identified as key agents.

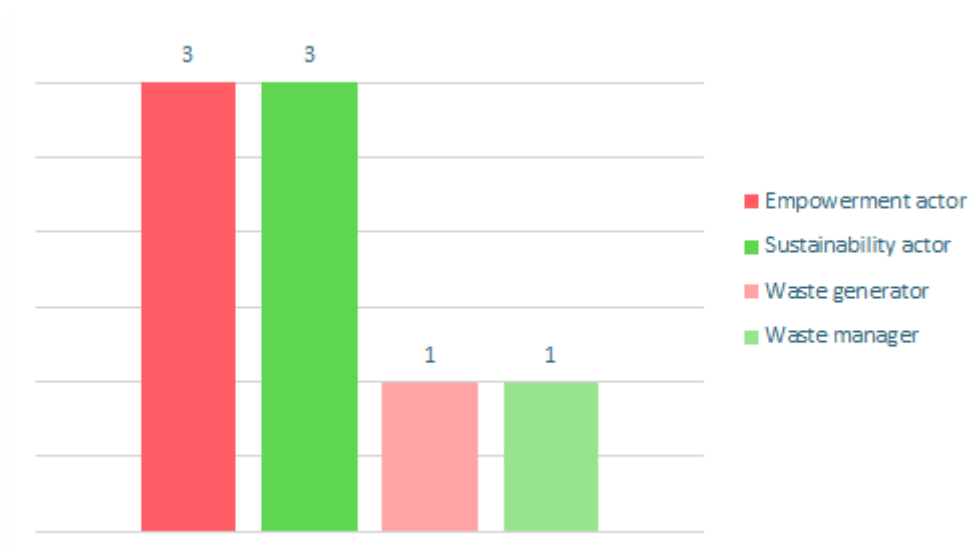


Figure 38. Number of stakeholders (4 main categories) in the Romanian region.

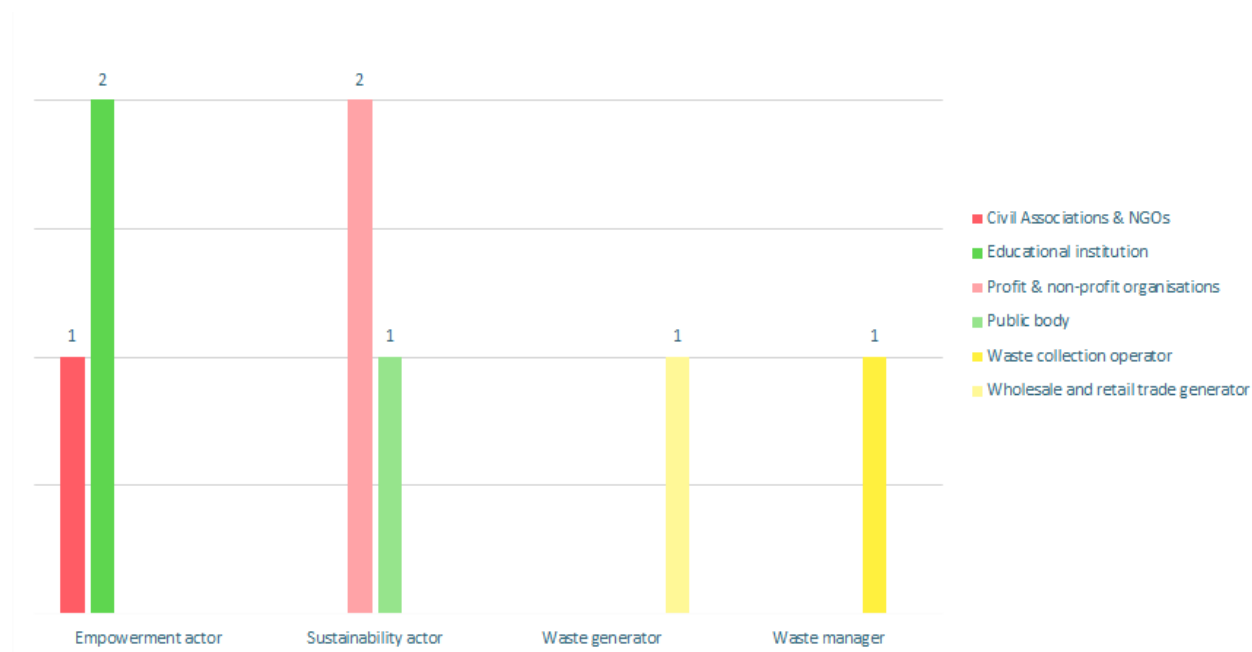


Figure 39. Number of stakeholders in the Romanian region classified by type.

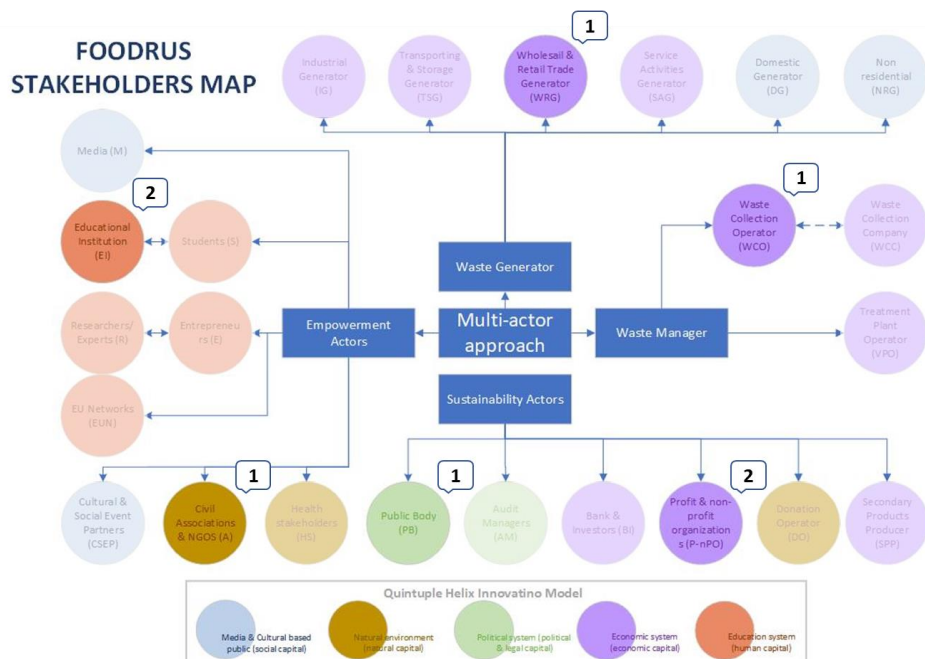


Figure 40. Summary of Romanian region's stakeholder map according to the classification established in Section 1.2.

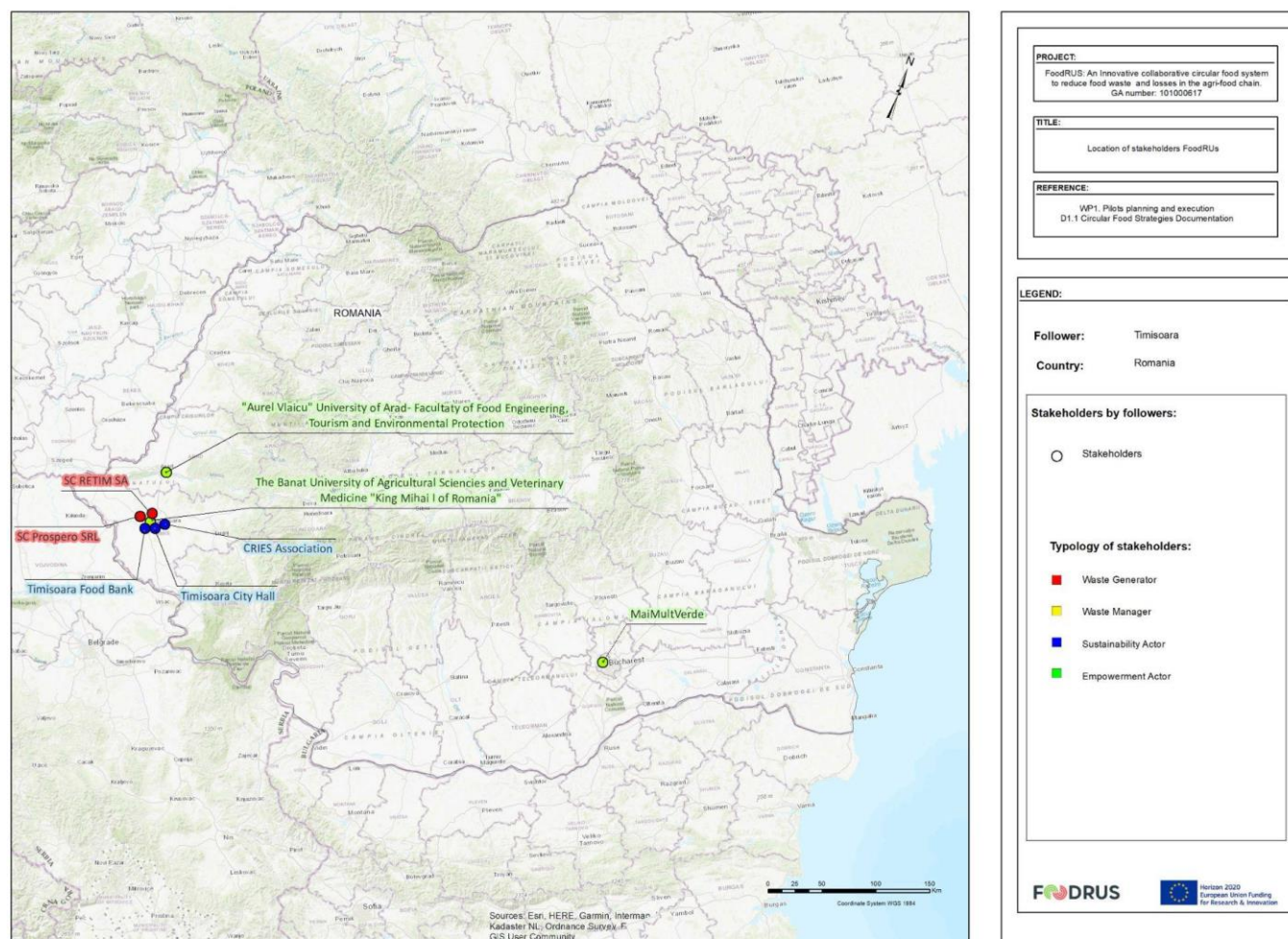


Figure 41. Timisoara AR's stakeholder map.

3.1.4.5. Linz (Austria) map

In the Austrian region, 34 stakeholders from 10 different types of stakeholders have been identified but 13 types of stakeholders have not been identified as key agents.

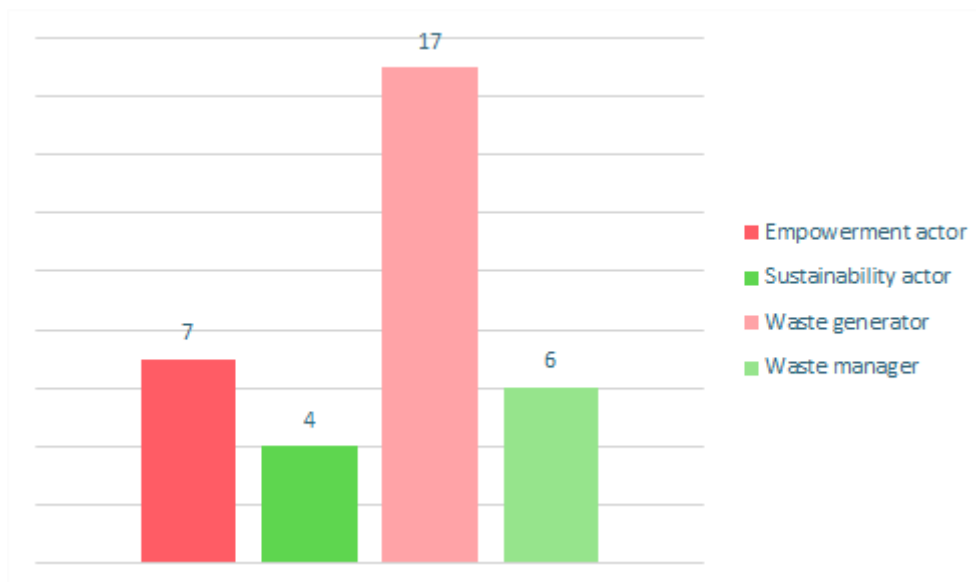


Figure 42. Number of stakeholders (4 main categories) in the Austrian region.

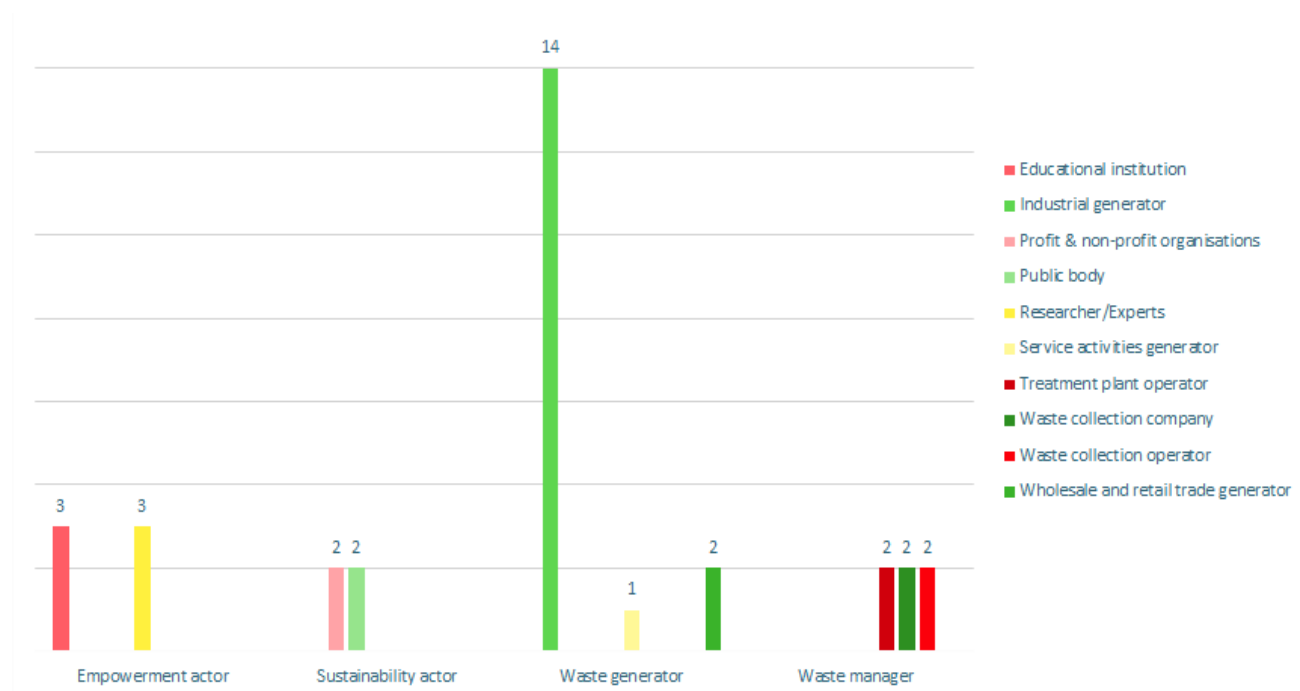


Figure 43. Number of stakeholders in the Austrian region classified by type.

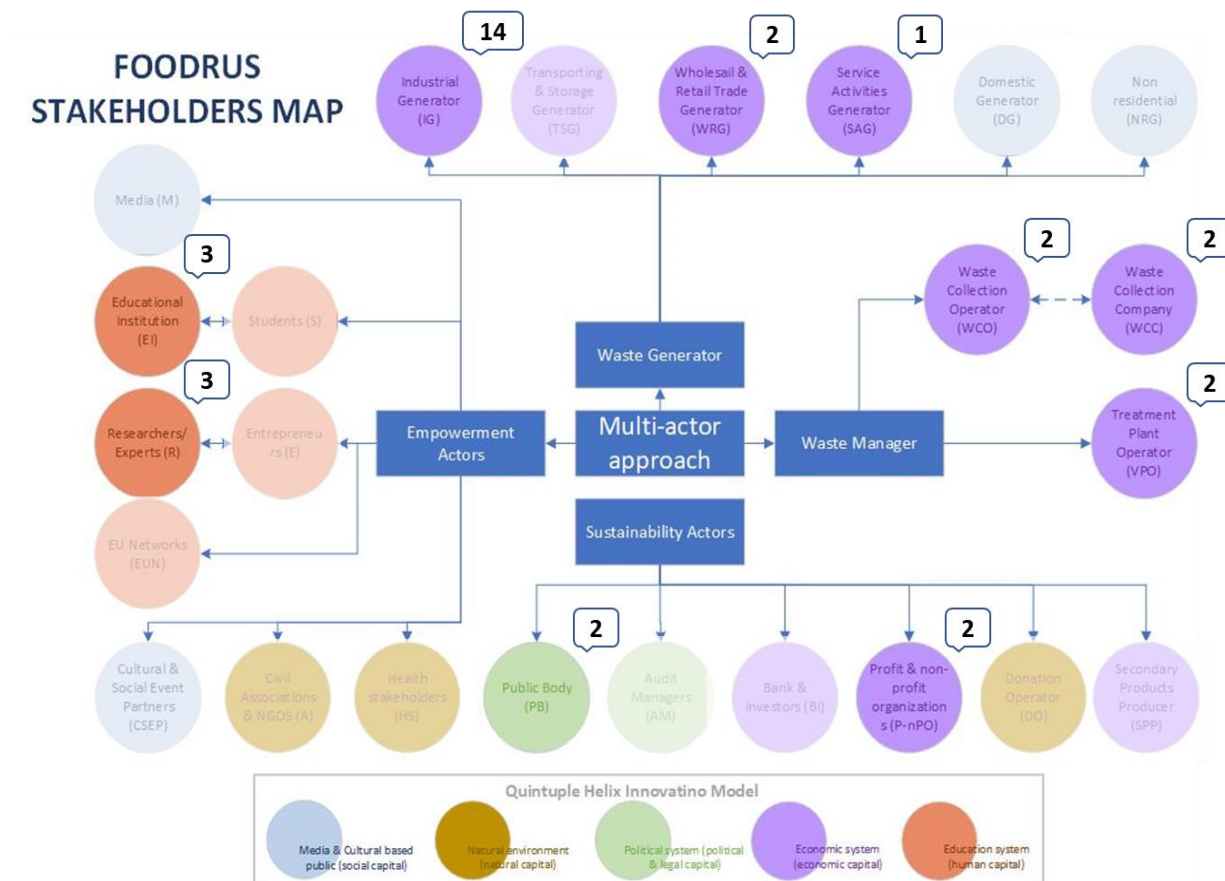


Figure 44. Summary of Austrian region's stakeholder map according to the classification established in Section 1.2.

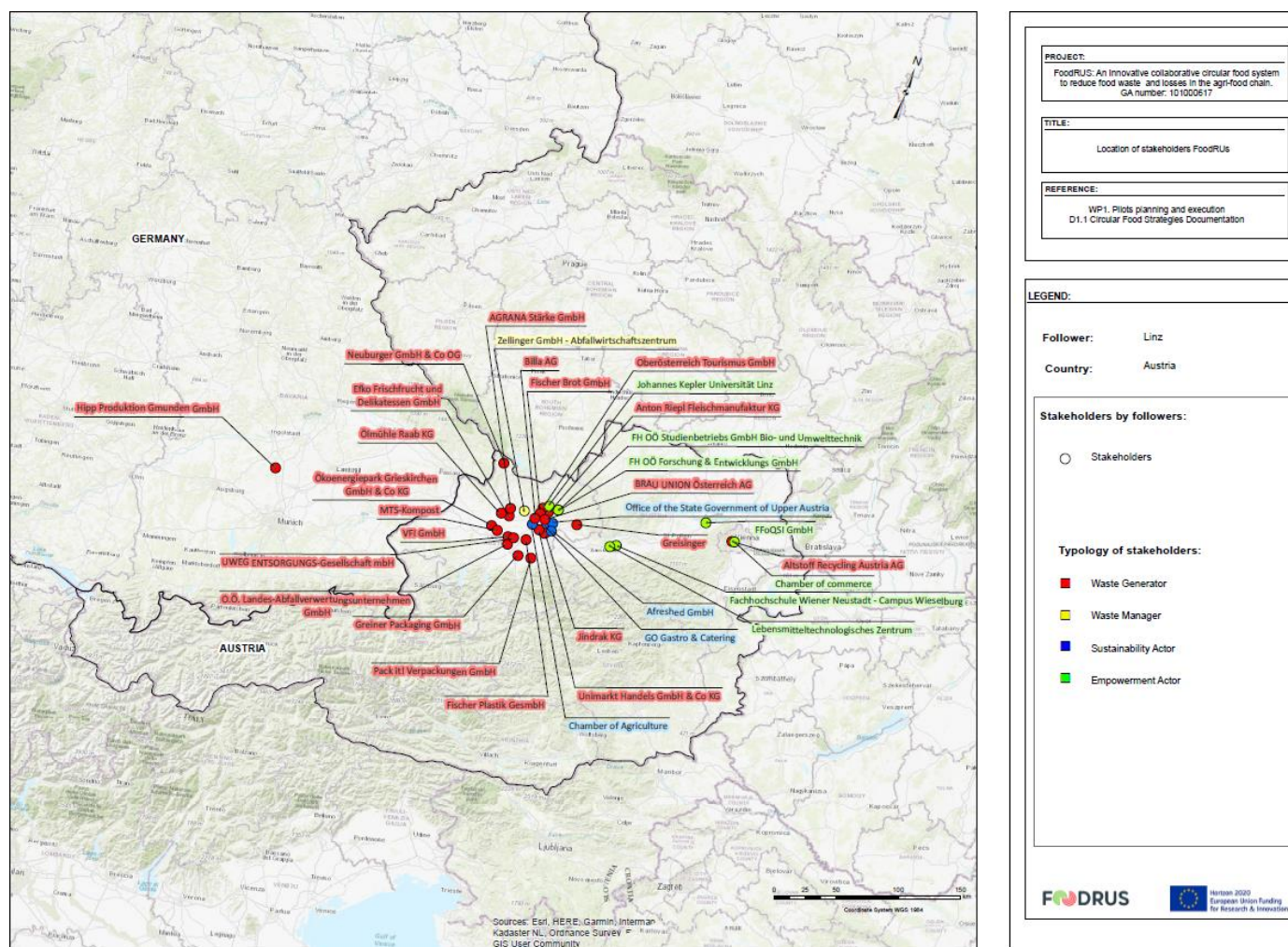


Figure 45. Linz AR's stakeholder map.

3.1.4.6. Plovdiv (Bulgaria) map

In the Bulgarian region 19 stakeholders from 12 different types of stakeholders have been identified but 11 types of stakeholders have not been identified as key agents.

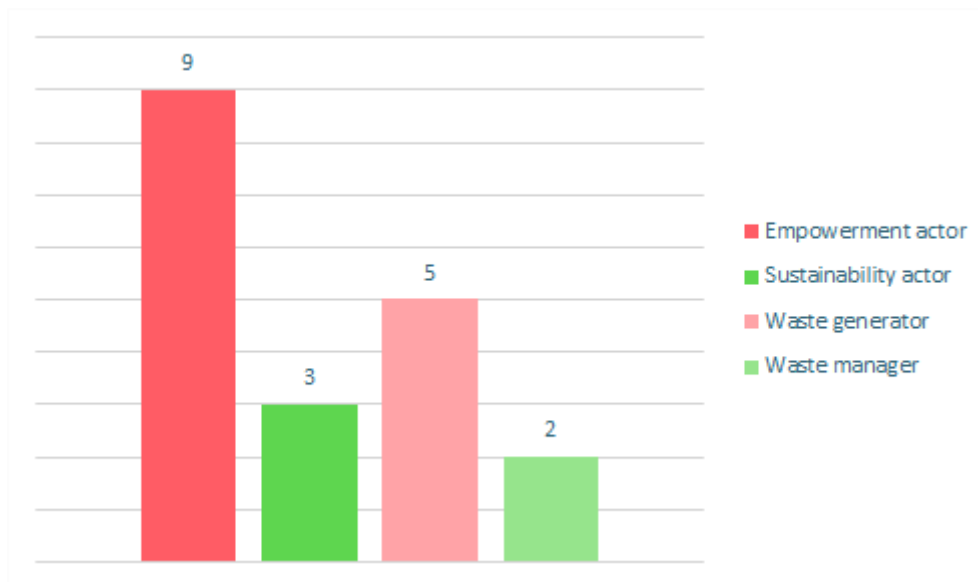


Figure 46. Number of stakeholders (4 main categories) in the Bulgarian region.

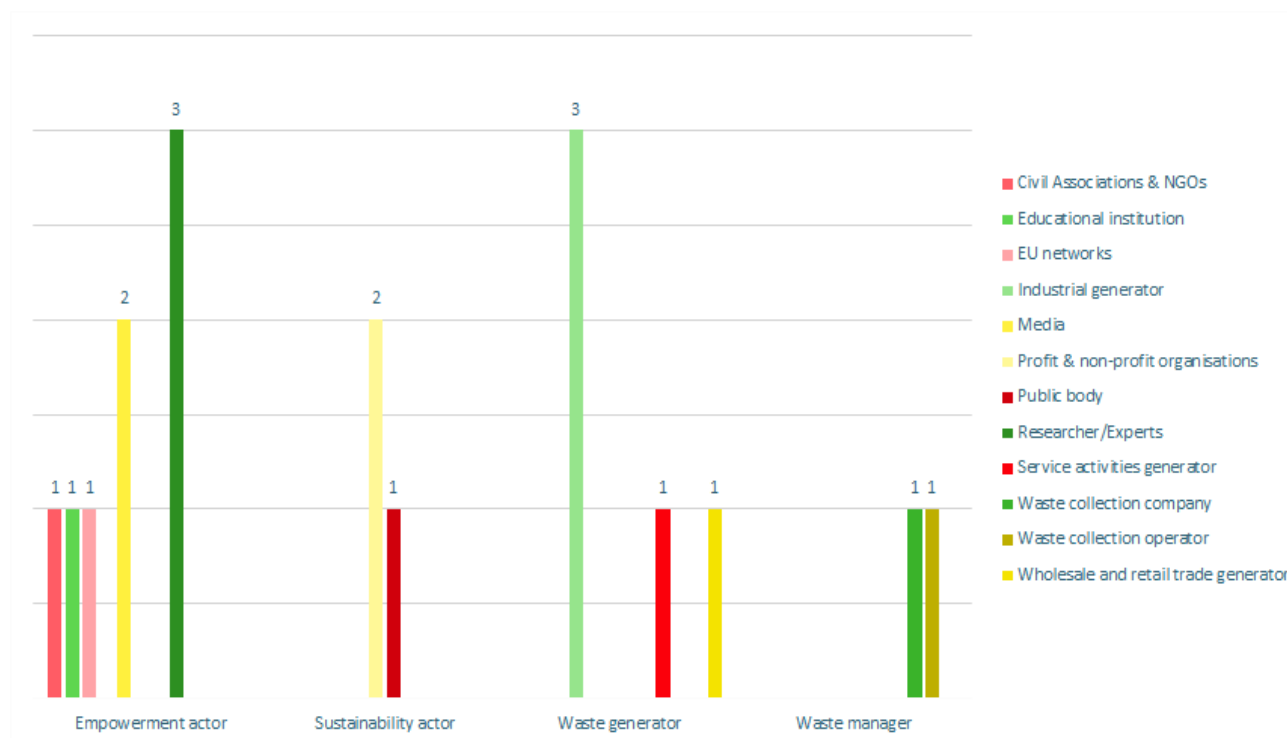


Figure 47. Number of stakeholders in the Bulgarian region classified by type.

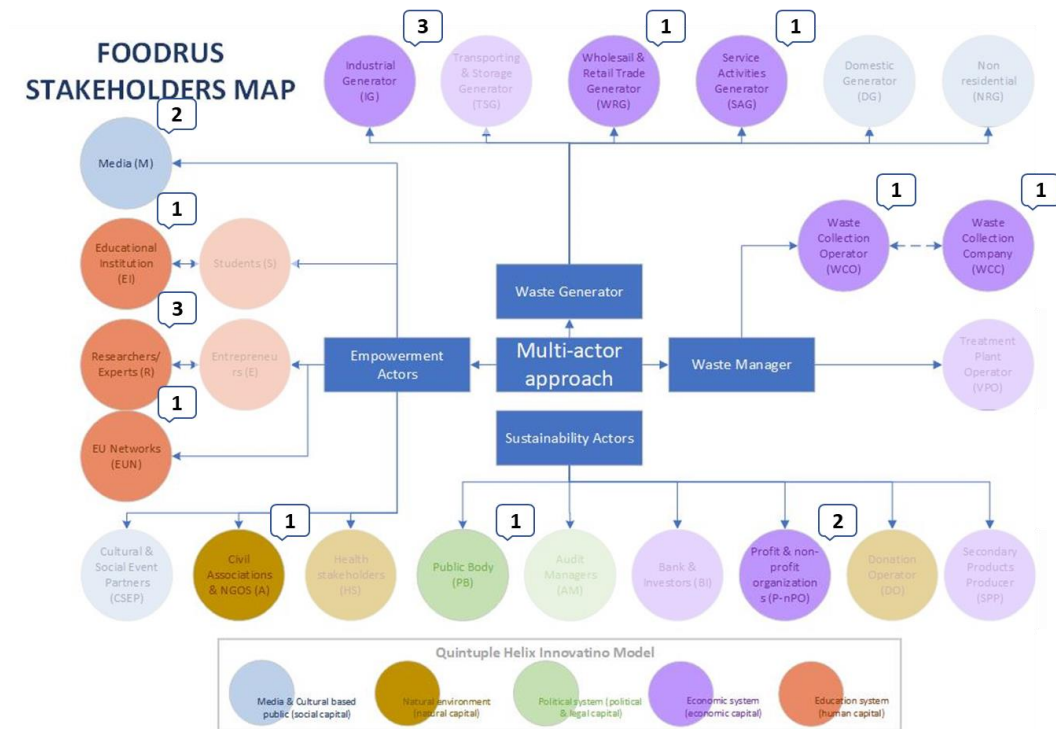


Figure 48. Summary of Bulgarian region's stakeholder map according to the classification established in Section 1.2.

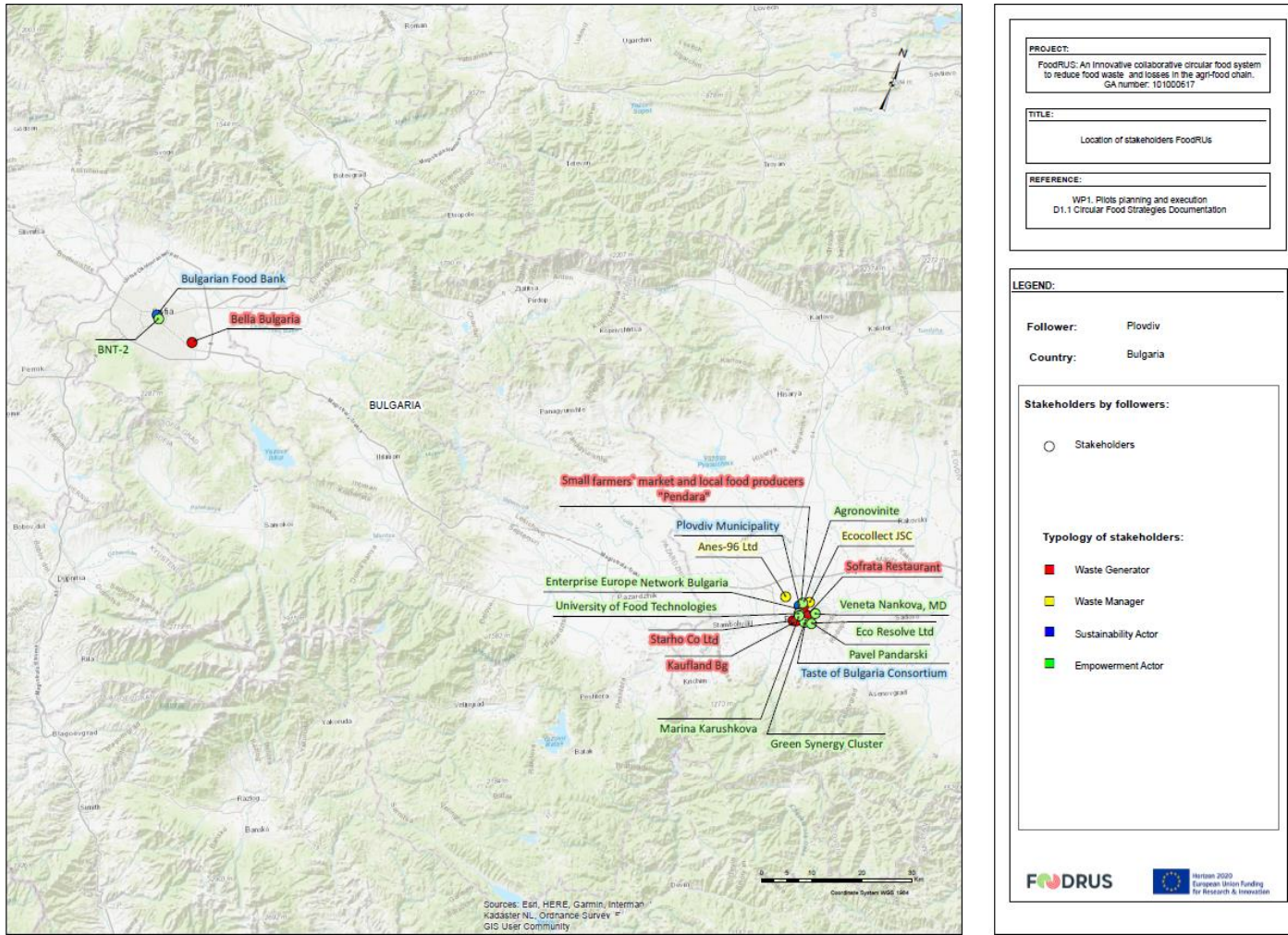


Figure 49. Plovdiv AR's stakeholder map.

3.1.4.7. Halandri (Greece) map

In the Greek region, 53 stakeholders from 11 different types of stakeholders have been identified but 12 types of stakeholders have not been identified as key agents.

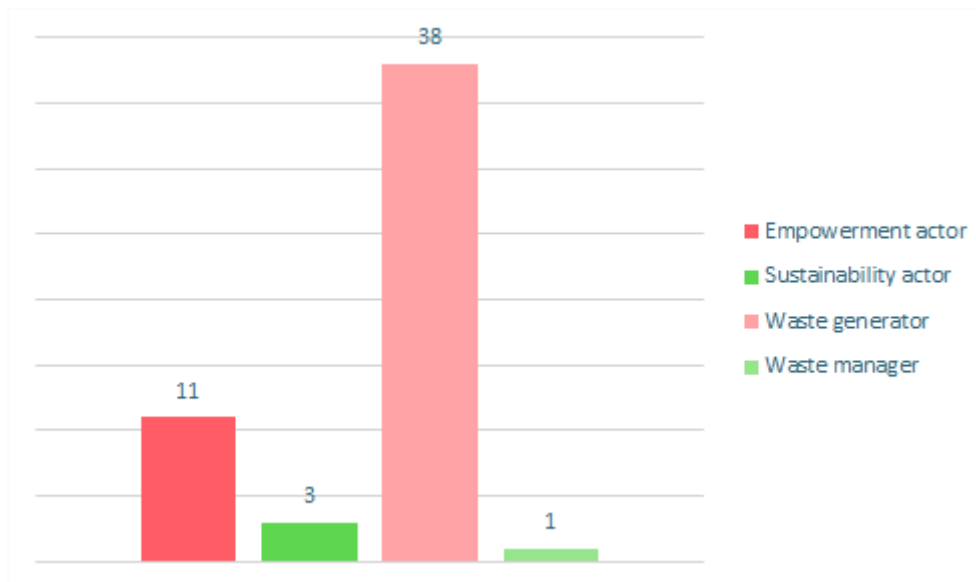


Figure 50. Number of stakeholders (4 main categories) in the Greek region.

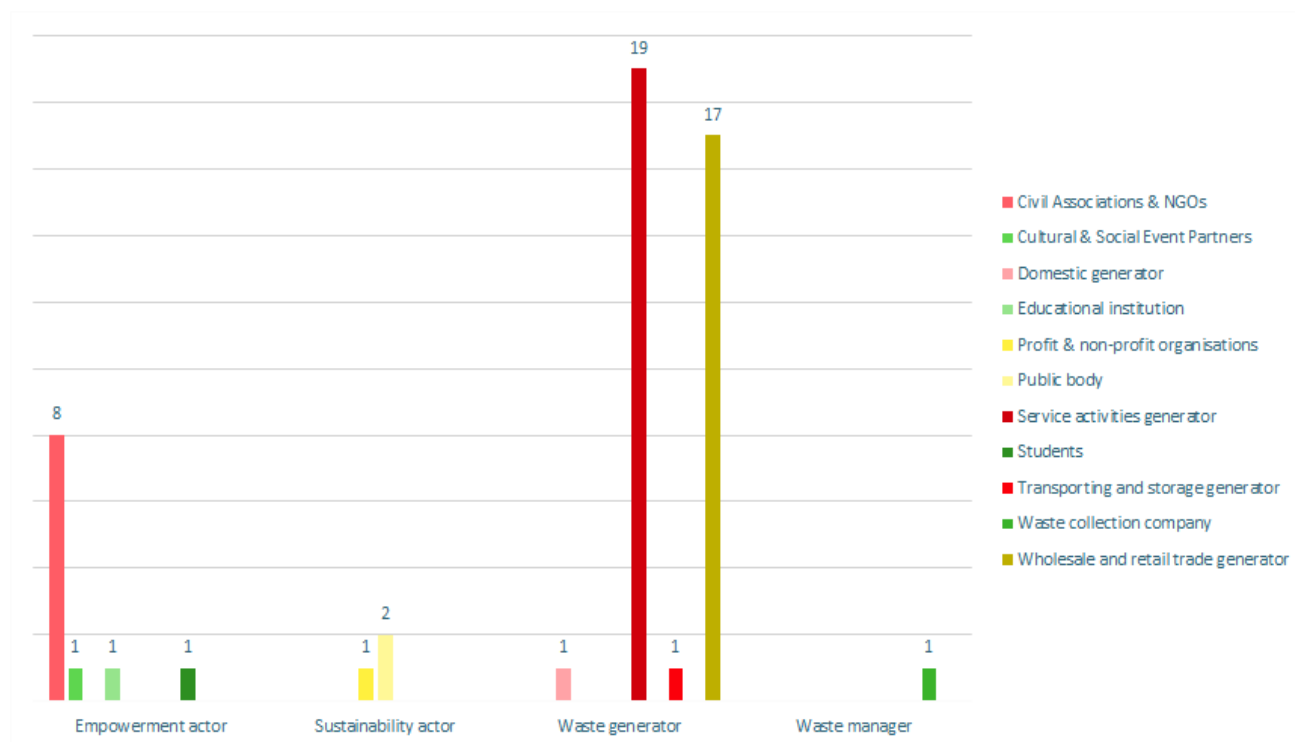


Figure 51. Number of stakeholders in the Greek region classified by type.

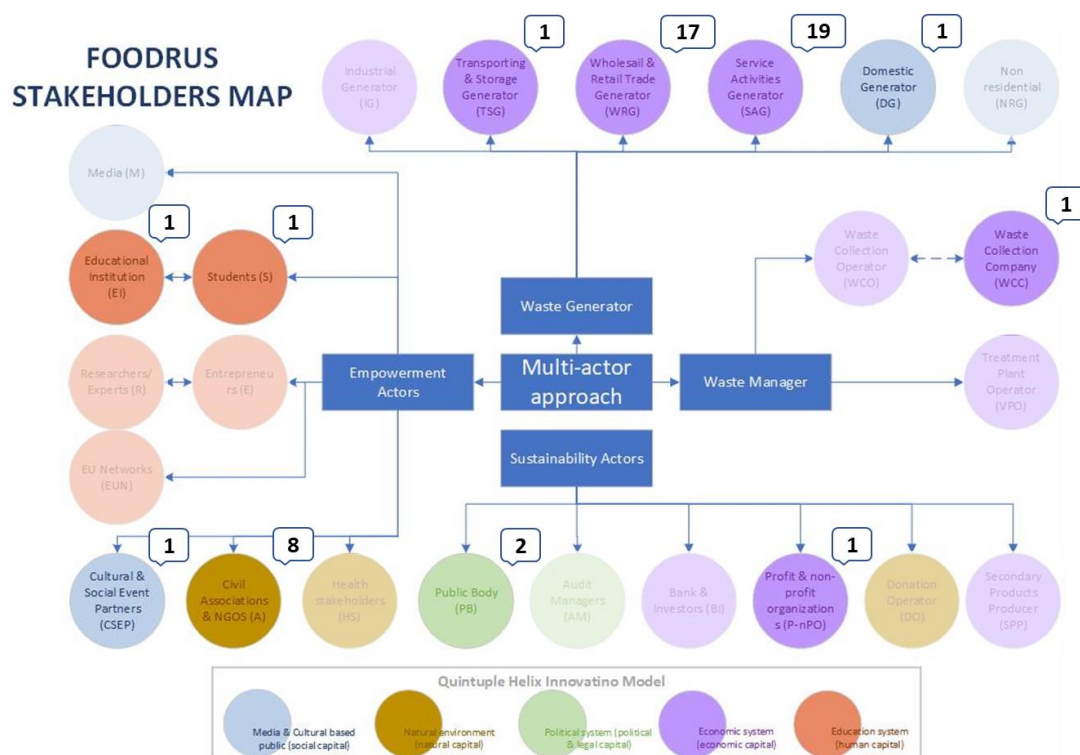


Figure 52. Summary of Greek region's stakeholder map according to the classification established in the point 3.6.1.

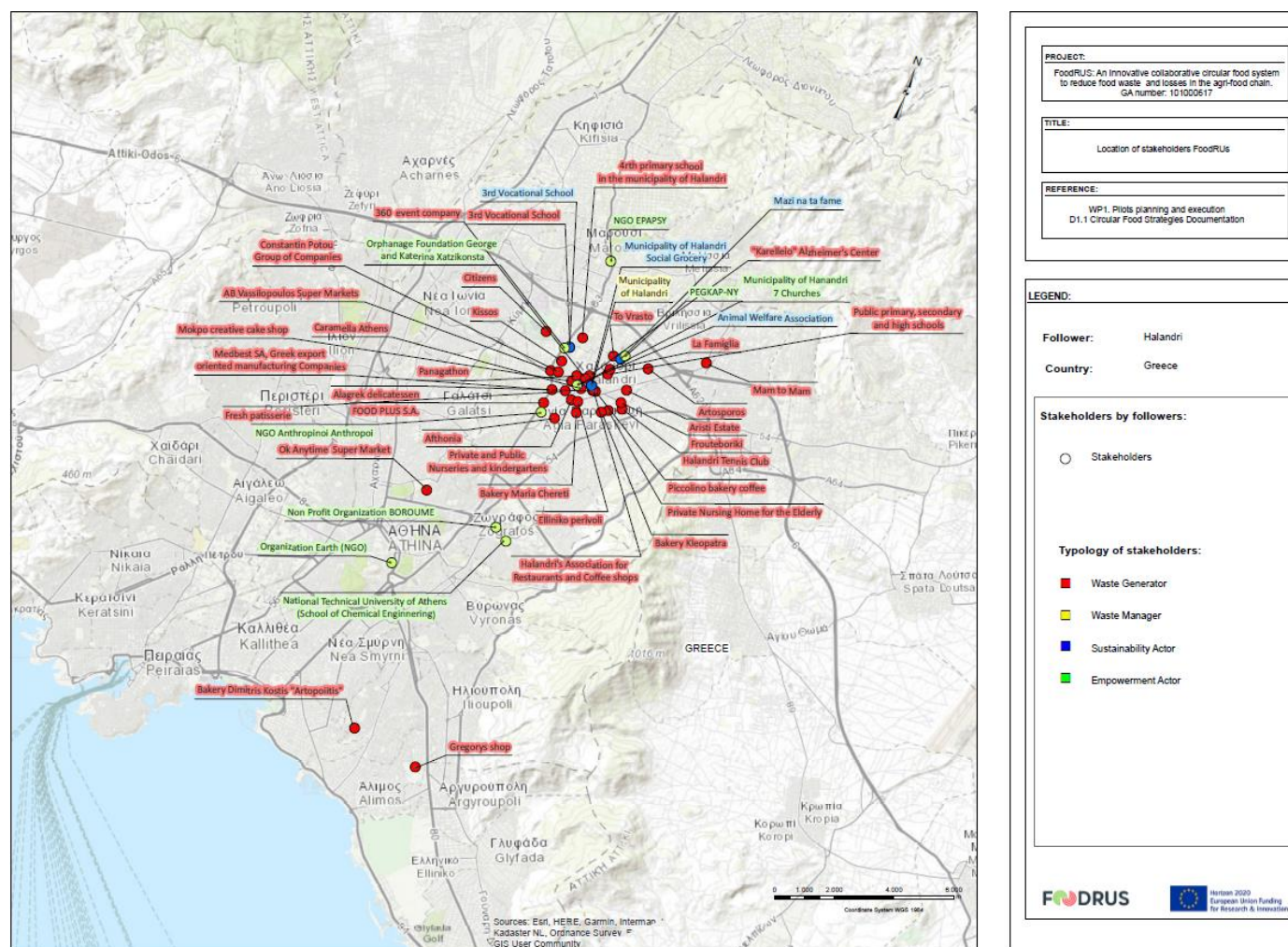


Figure 53. Halandri AR's stakeholder map.

3.1.4.8. Budapest (Hungary) map

In the Hungarian region, 18 stakeholders from 10 different types of stakeholders have been identified but 13 types of stakeholders have not been identified as key agents.

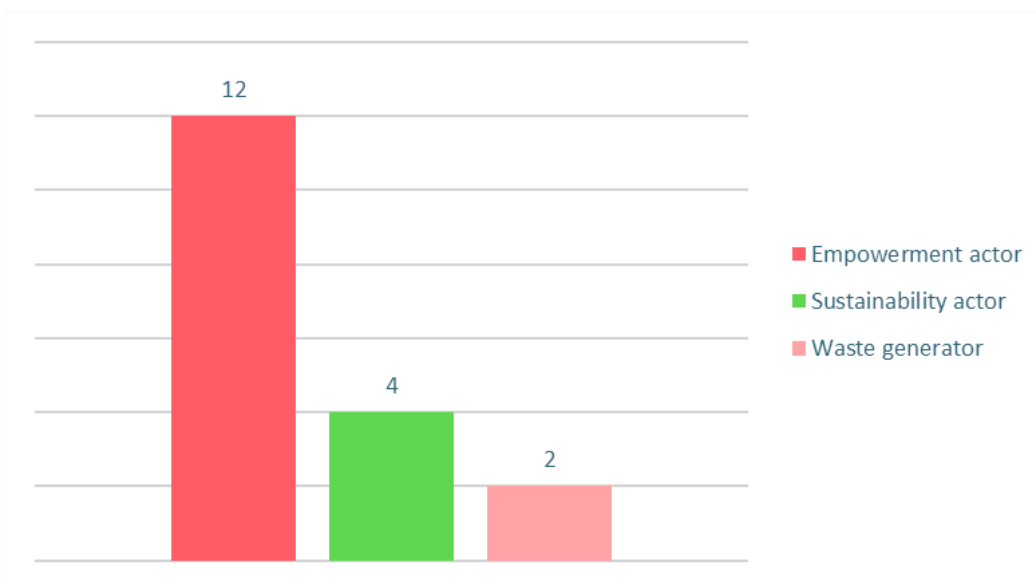


Figure 54. Number of stakeholders (4 main categories) in the Hungarian region.

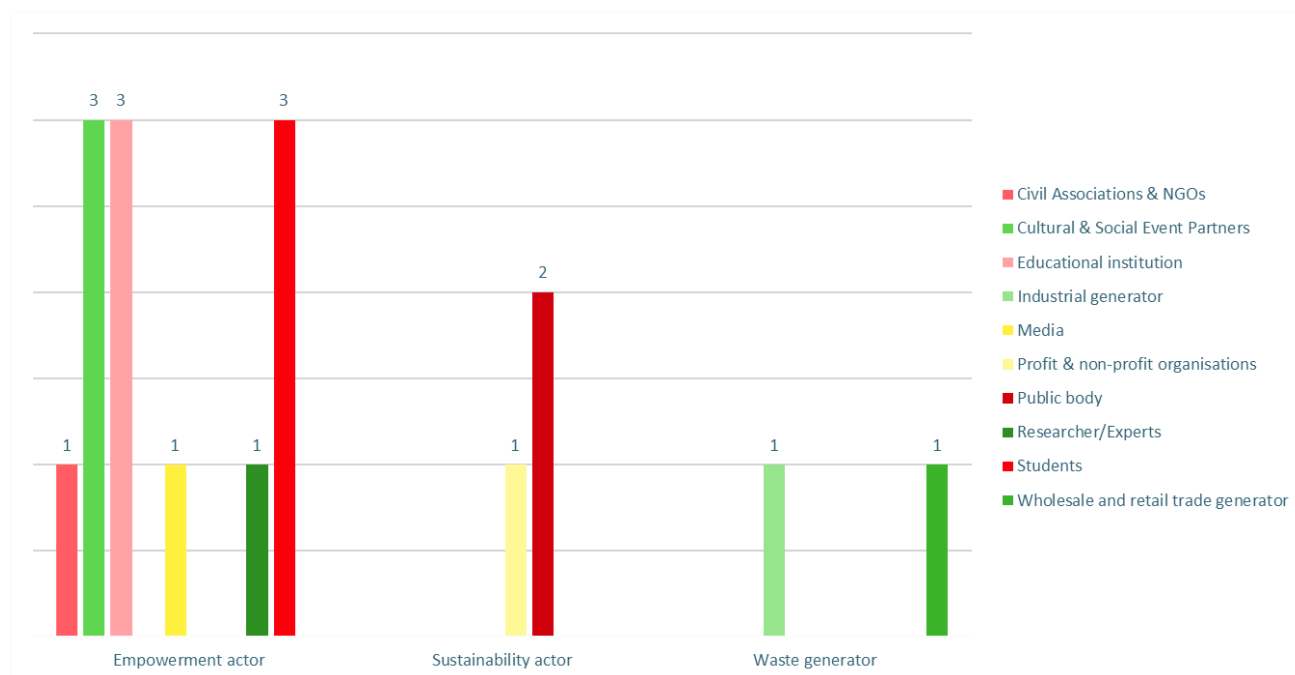


Figure 55. Number of stakeholders in the Hungarian region classified by type.

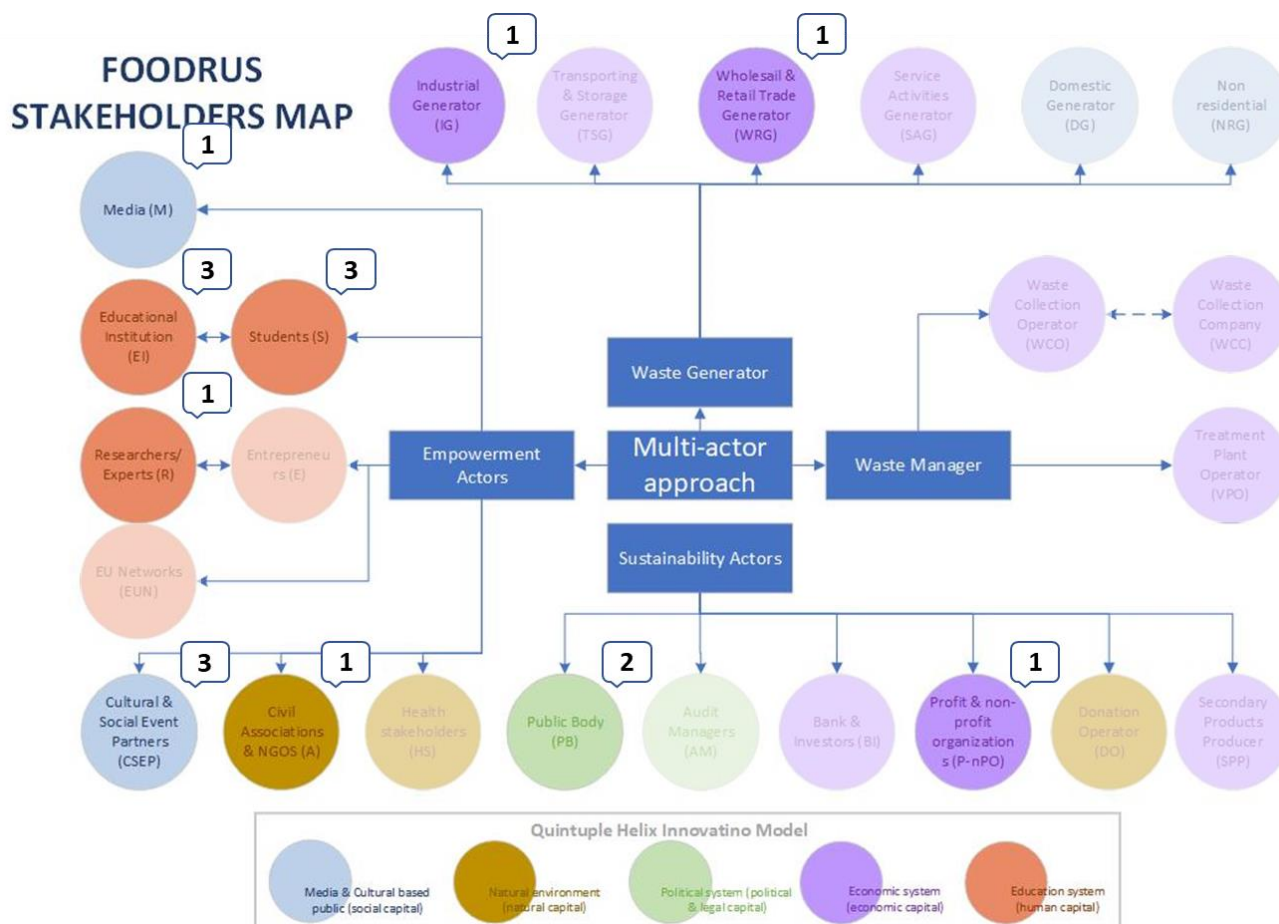


Figure 56. Summary of Hungarian region's stakeholder map according to the classification established in section 2.2.1.

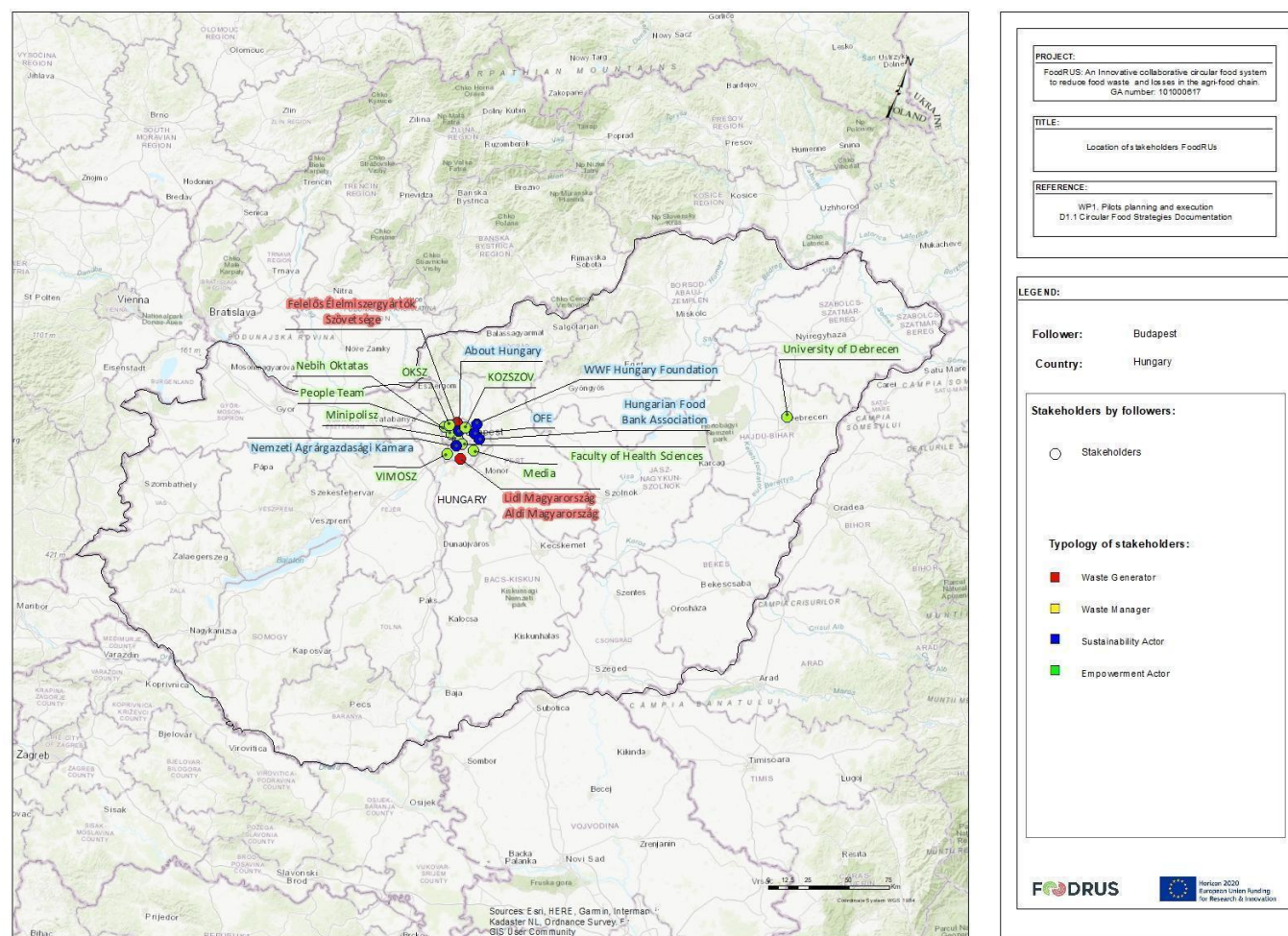


Figure 57. Plovdiv AR's stakeholder map.

3.1.4.9. General conclusions

Next, a map with the answers regarding the information flow with the stakeholders is presented. The average level per site (pilots and followers) has been calculated. This information allows us to see the level of cooperation with the stakeholders before starting any activity in the project and to identify those relationships that will need to be reinforced.

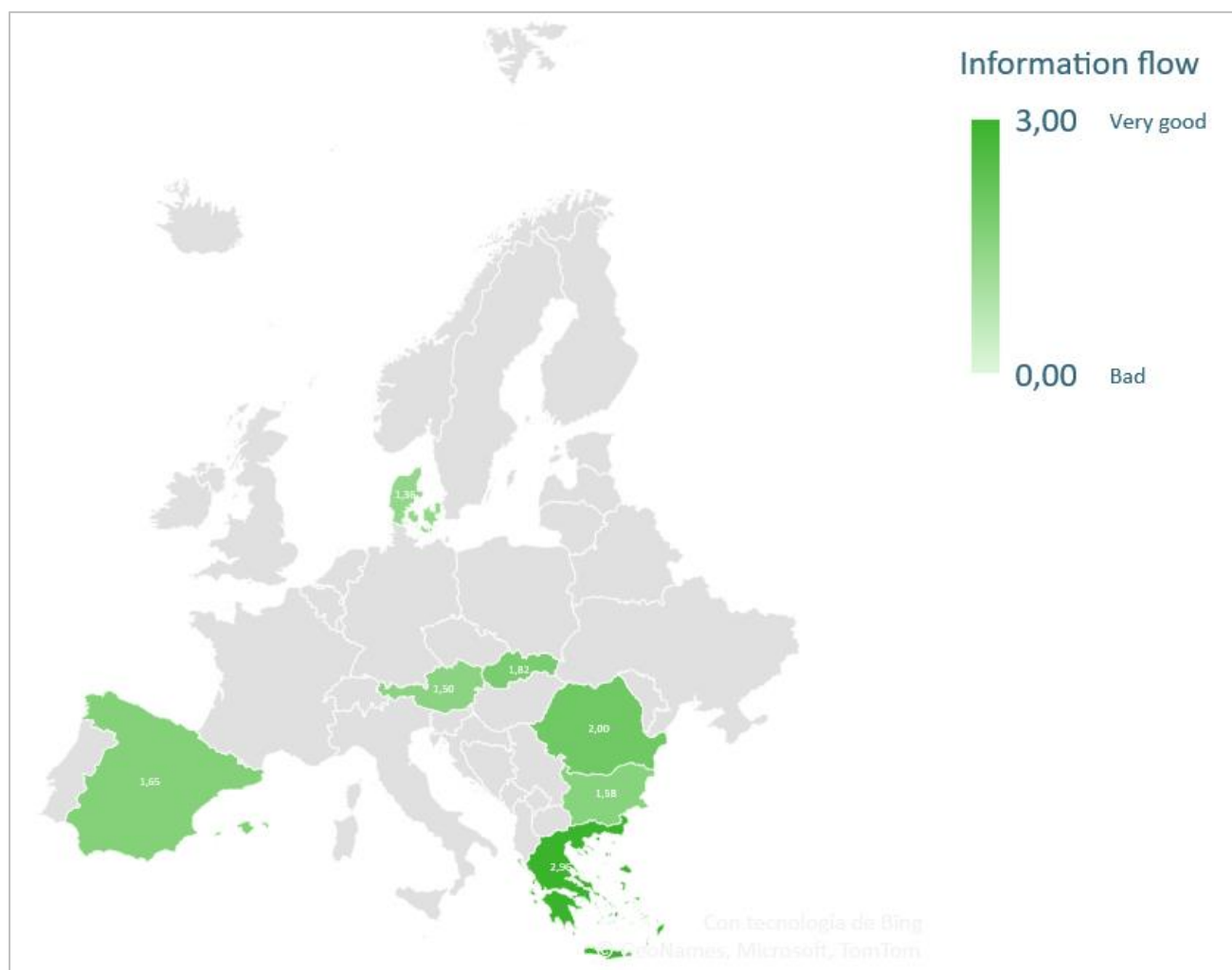


Figure 58. Average level of information flow from the stakeholders for every country.

4. Digital maturity

FOODRUS project is governed by a digital model. However, the 3 pilots start at different levels of digitalisation which will control the speed of the implementation of the ICT solutions. So, the first step to identify the needs in terms of digitalization is to understand the digital maturity level of all the agents involved in the food value chains. First, an analysis of the literature is presented to understand the global situation to assess in a second stage the particular status of each FOODRUS partner.

4.1. Status of the level of digitalization of the food supply chains (state of the art)

With the aim of getting an overview of the state of the art in terms of the level of the digitalisation of food supply chains, a literature review was performed accepting a total of 82 scientific articles (at the date of writing). In these papers different supply chains are studied, encompassing all kinds of animal and crop products concerning a huge range of parameters and communication technologies. These parameters are measured with several purposes: productivity, sustainability, food safety and quality, forecasting, traceability and food waste. The stages of the food supply chain in which these parameters are considered for each study are also pointed out in them. So a classification was made to rank parameters and communication technologies in terms of number of appearances according to these literature sources. A dashboard has been created (Figure 59) to periodically be updated with the latest studies and is available in the FOODRUS Community in Zenodo (DOI: 10.5281/zenodo.6797570).

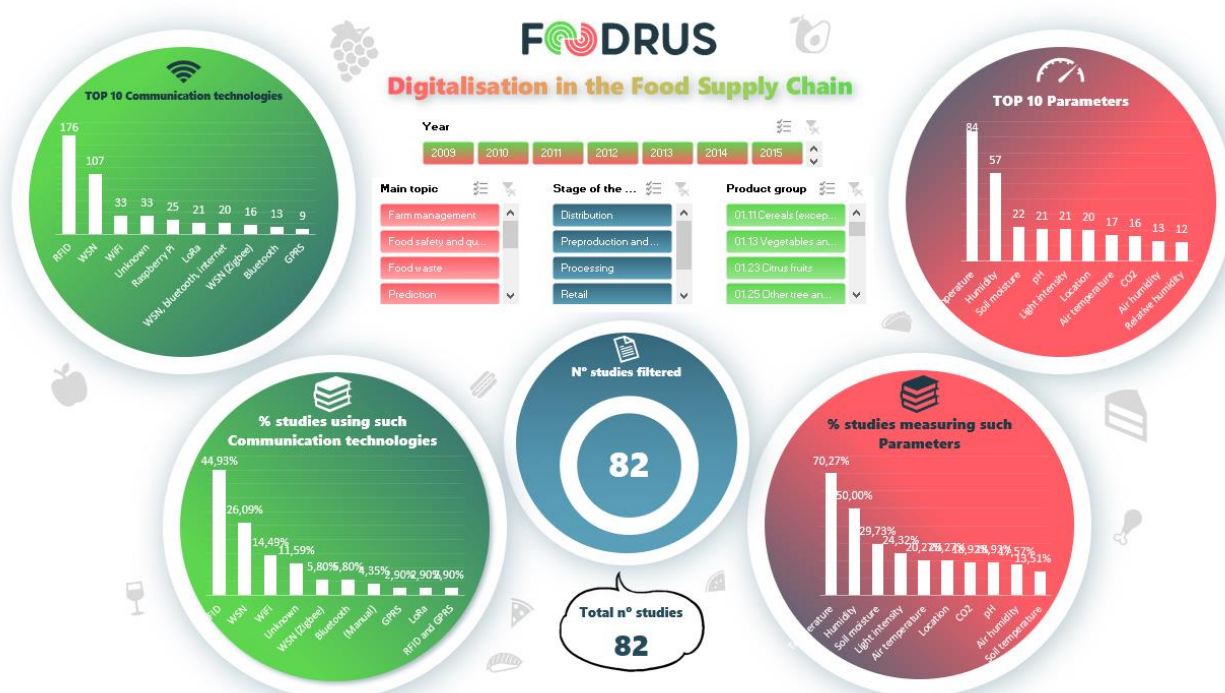


Figure 59. Digitalisation in the Food Supply Chain observatory.

The main conclusions abstracted from this review are outlined below:

- Food safety and quality, food loss and waste, sustainability, and traceability are quite related. Most of the studies framed in these categories mention each other repetitively and share a common ultimate goal: avoiding FLW. However, the studies whose main goal is focused on productivity, are usually linked to prediction as well. Although they also deal with sustainability and food safety and quality issues for example.
- There seems to be no common agreement on which terminology should be used and how to divide the FSC. When referring to the production in field, either agriculture or farming, it can be found as “production”, “preproduction”, “production in field”, or simply “agricultural stage” for example. It is important to highlight that in some cases the “production” term could be including the processing stage as well since it can be a misleading term. That could be the reason why this stage of the FSC is the one for which fewer studies were found (23). Although it is also true that some food products do not need to be processed, therefore this processing stage is not present in every FSC. Something similar happens with the distribution stage and the retail stage. For some studies the distribution stage may be including the retail point, which would explain why only 25 studies were found for this stage. This makes sense since the retail point is indeed part of the distribution of the food.
- When it comes to the topics covered, the main findings entail:
Food safety and quality is the topic with the highest number of studies (30). They are mainly focused on the distribution stage (25) and also in the retail stage (19). Temperature and humidity are by far the most commonly measured parameters, and RFID the most commonly used communication technology. The studies which main topic is food waste are dated only from 2017 onwards. Out of the 9 studies included in this category, 7 include the distribution stage in them.
Regarding the studies classified in the traceability category, temperature and humidity (13 appearances each) are the most commonly measured variables as well as in the case of food safety and quality due

to their obvious connection. With the difference that for this topic the parameter “location” is in third position with 10 appearances, being measured in more than half of these studies.

- From the perspective of the FSC stages:

For the preproduction and production stage, productivity is the most discussed topic (15 out of 46 studies = 32,6%).

For the processing stage, food safety and quality is the most discussed topic (11 out of 23 studies = 47,8%).

For the distribution stage, food safety and quality is the most discussed topic (25 out of 43 studies = 58,1%).

For the retail stage, food safety and quality is the most discussed topic (19 out of 25 studies = 76%).

4.2. Supply chain digitization diagnosis

In order to assess the level of the digital development of the food supply chain companies a tool based on a questionnaire has been designed to measure the level of digital development of food supply chain companies. This questionnaire has been articulated on two basic questions: What? and How?.

The first question, the What?, raises identifying the processes that the organization has, in order to subsequently determine the level of digitization in them. In this sense, a review of the main supply chain management models has been carried out: SCOR model, GSCF model, Betchel and Jayaram (1997), Bowersox et al. (1999), Srivastava et al. (1999), Mentzer et al. (2001), Sahay (2003), Bagchi et al. (2005) and Hilletoft et al. (2009). Given the framework of the project, a model is adopted that goes beyond the processes related to the physical flow of food in the chain to also contemplate relational processes (with customers, with suppliers) and creation (product development and marketing).

The second question, the How?, allows to better structure the questions related to each process. Thus, the analysis of each process is proposed in 4 dimensions: (1) Management, (2) Resources -human, infrastructure, skills-, (3) core process or activity and (4) Measuring system.

- Management: This dimension captures the strategic level of the organisation about each one of the business processes.
- Resources: This dimension deals with the resource (machines, sensors, information systems...) capabilities that are at disposal of the organisation as well as the people's abilities and skills.
- Processes: This dimension is focused on how the company performs the process or activity.
- Measuring system: This dimension collects how the company takes into account the KPIs for each one of the analysed processes.

This structure allows an analysis of the results by dimension, allowing to identify the level of digitization at the level of presence in the organisation's own strategy (management), at the level of availability of hardware / software resources and skills, at the operational-functional level (core activity) and at the level of data availability for evaluation and monitoring (Measuring system). In addition, a specific section is included for food loss and waste.

Who is it for?

The digital maturity diagnostic tool is designed to respond to those organisations that are part of the food supply chain. In this way, it covers the set of links that make it up both at the level of product and service: supplier of a food processor company, Food processor company, Distributor (wholesaler), Transport / Logistics operator, Retailer (point of sale to end customer), Services provider (Food donation company, Food loss and waste

management company). A first diagnosis will be carried out with the companies that take part in the project as partners. Once the main stakeholders are identified an invitation to fulfil the questionnaire will be sent to complete the analysis in the three whole value chains.

It is a flexible tool that adjusts to the characteristics of each organisation. Thus, if a company does not carry out any of the processes that are included in the survey, when indicating it, the questions related to it are not asked.

4.2.1. Supply chain digitization diagnosis: the survey

The questionnaire is structured into 4 parts:

1. Firm characterization: allows the organisation that answers the questionnaire to be categorised according to its sector, its size (in terms of number of people and turnover), the position it occupies in the food supply chain.
2. Food loss and waste: raises specific questions about food loss and waste. The questions are answered based on a scale of 1 to 5 and for which stage 1 and stage 5 have been defined (Figure 60).

Figure 60. Example of question about food loss and waste.

3. Processes: allows to identify, in the first place, the existence or not of said process in the company and its level of development. This part begins with a definition of what the process is. Then, they are shown 4 possible answers that range from that the company does not carry out that process until the company has a high level of development.

Figure 61. Example of question related to a specific process.

4. Questions for each process: Items that will allow to determine the level of digital maturity of the organisation by process. The survey asks a total of 124 questions (Figure 62) distributed by processes and by the four dimensions of analysis.

	Demand management	Product development	Commercialization/ Marketing	Purchase management	Manufacturing	Warehouse management	Customer Relationship management	Reverse logistic	Total per dimension
Management	4	2	2	4	5	2	5	5	29
Resources	5	7	4	3	7	11	2	3	42
Core process	3	3	3	5	10	3	3	3	33
Measurement system	3	3	2	2	4	3	1	2	20
Total per process	15	15	11	14	26	19	11	13	124

Figure 62. Items per process and dimension.

For each process, a first question arises regarding the level of importance of the process for the company. This aspect will allow the data analysis process to weigh its scores in the calculation of the organisation's global maturity level. The questions organised in the four dimensions explained above are then posed (see Figure 63).

Figure 63. Example of questions related to Demand management process.

The answers are made according to a scale of 1 to 5 points. For each question, 3 scenarios related to a low level of digitization (1 point), a medium level of digitization (3 points) or a high level (5 points) are posed (see Figure 64). The maximum level of digitization represents an “ideal” situation of a connected company.

Figure 64. Example of question of Management dimension for Demand management process.

The level of digital maturity of the company is calculated based on the scores obtained in each item, weighted according to the importance of the process for the organisation.

The questionnaire can be completed through a [Google form](#) (Figure 65) or through an Excel file.



Figure 65. FOODRUS Maturity survey in Google forms.

4.2.2. Results analysis

For each response, a report has been prepared that will be shared and explained to the participating organisation (Figure 66).



Figure 66. Example of digital maturity diagnosis report prepared for each respondent.

This report will be very useful for the FOODRUS partners but also of great value for those external stakeholders that decide to collaborate in the project providing some feedback that will allow them to make progress in terms of digitalisation in particular, and competitiveness in general.

In total, seven questionnaires were received for the digital diagnosis of the company's supply chain. Two of them belong to the Danish pilot, three to the Slovak pilot and two belong to the Spanish pilot.

The results have been analysed based on different criteria:

- By company
- By pilots
- By position in the chain
- By company size

Figure 67 shows the results, by company, for the 8 supply chain processes analysed. Keep in mind that not all companies implement all processes. The zero scores are precisely those of the processes that are not developed by the companies. It should also be considered that the interpretation of the aggregated results of the digitization level, for example at the level of pilots, can be misleading since the calculation is made using the average values.

As a whole, it can be seen how the processes with the highest level of digitization are those of Inventory management, Commercialization and Purchase management. The processes with the lowest level of digitization would be Inverse Logistics and Manufacturing. A company whose activity is food distribution (SK3) stands out for its high level of digitization in practically all the processes analysed

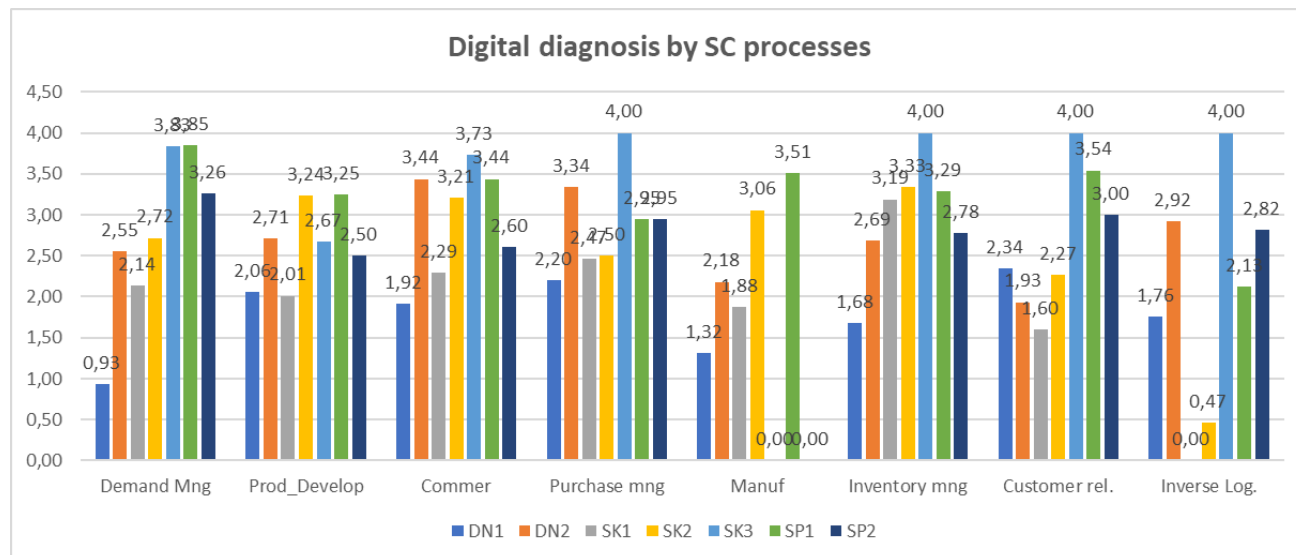


Figure 67. Scores for each respondent attending to its digital level for each SC process.

If we analyse the level of digitalization for each of the four dimensions analysed, it can be seen how the management dimension is the one that presents the greatest consideration towards digitalization, presenting its highest level in the following processes (Figure 68): Inventory management, Product development and Demand management. The measurement dimension appears as an area for improvement in practically all the processes of the supply chain.



Figure 68. Digital level by dimension in each SC process.

The integration of the supply chain, understood as the level of collaborative strategy developed both internally, between departments and with the external supply chain (customers and suppliers), presents a high level of development (Figure 69).

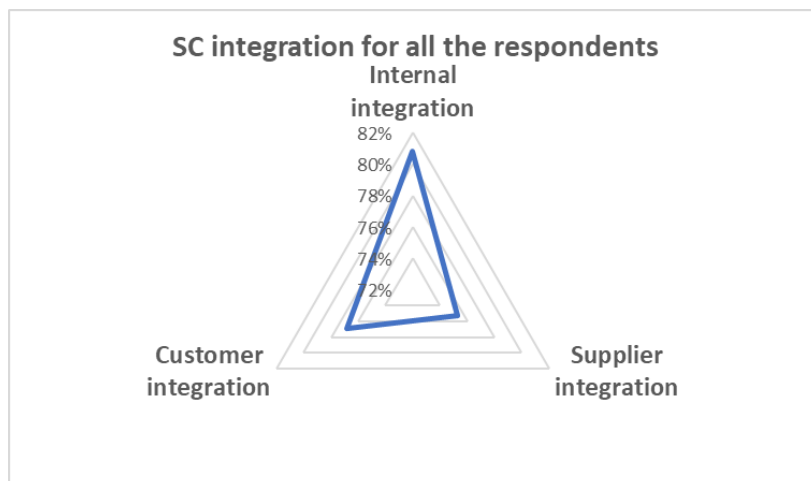


Figure 69. Integration level between the agents of the SC.

The risks for generating food loss and waste was also questioned. Overproduction and Logistic damages are the main reasons identified for the companies as the generators of food loss and waste (Figure 70).

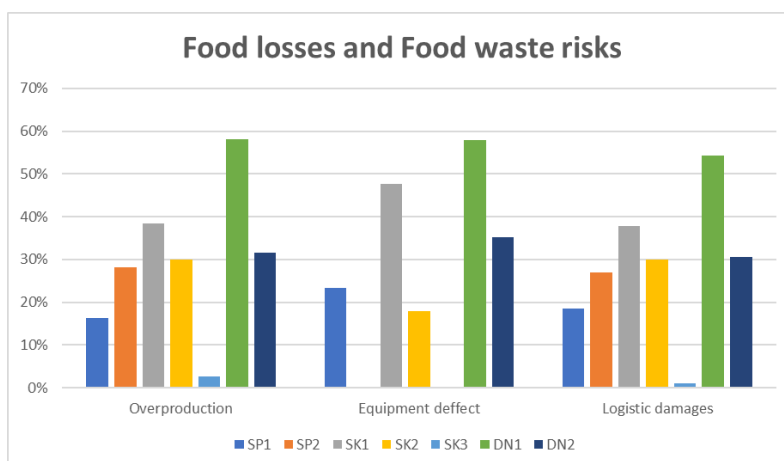


Figure 70. Food loss and waste risks.

Finally, the results were explained to each partner and a new survey will be carried out at the end of the project in order to assess the evolution in terms of digitalization and its impact over FLW.

5. Stakeholders engagement

5.1. Analysis of the causes and identification of solutions

We have designed a participatory activity so that food value chain stakeholders can contribute both their diagnosis of the causes of food loss/waste and the solutions they consider to be a priority, both in their field of action and in others, as well as their willingness to adopt them, considering the associated economic impacts.

The activity consists of 24 surveys that are differentiated by the type of agent to which they are addressed. We have started from the classification of stakeholders that has been done in the project and, based on their role in the generation and management of food loss and waste, we have designed questions in four categories. The first category focuses on the degree of knowledge of the problem, a second category asks about the causes of FLW generation, a third category asks about possible solutions related to FOODRUS solutions, and finally, the survey closes with the option to give open feedback and to join the FOODRUS community. In Figure 71 a scheme of these surveys is depicted. The questions highlighted in bold are present in all the questionnaires regardless of the type of stakeholder to which the questionnaire is intended. However, the proposed answers were adapted to the type of stakeholder according to their appropriateness. On the other hand, the rest of the questions show variations in their range of answers (and sometimes, they are not even applicable) depending on the type of stakeholder that is supposed to fill out the survey.

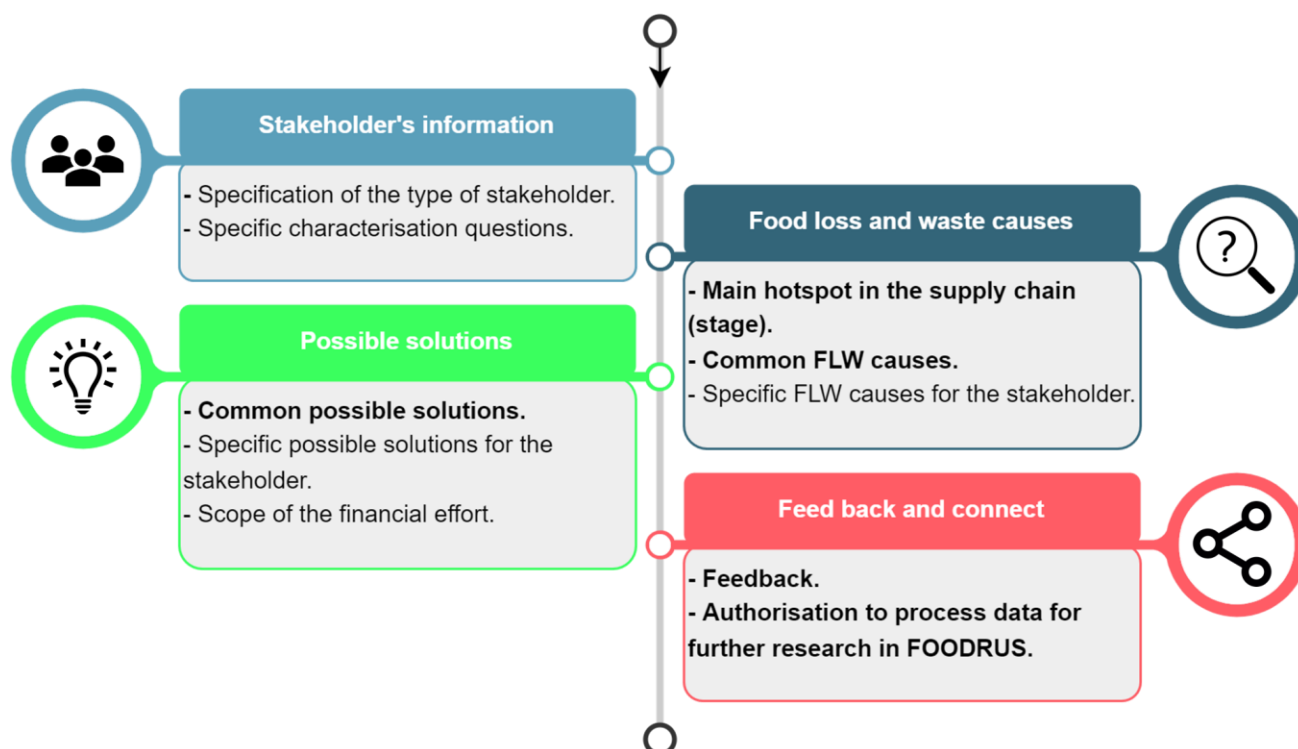


Figure 71. Scheme of the survey.

The surveys are complemented with a video that seeks to encourage participation¹. A video summarising the objective of the project and the importance of having the opinion of the different stakeholders involved in food value chains.

The invitation to participate will be made both through an email specifically prepared for this purpose, as well as a duly prepared section on the project's website². The communication channels of the whole consortium will be used to reach as many stakeholders as possible. The surveys will be opened during the whole project. In the case of the pilots they will be carried out by month 18 (before implementation of the FODRUS solutions) and at the end of the project in order to assess the perception change of the stakeholders.

5.2. Environmental programme implementation

In this section the status of the implementation of the Social Action Programmes in each pilot from month 1 to month 6 is described. The definition of the Pilots' Social Action Programmes can be consulted in Deliverable D2.1 Pilots' social programme. Additionally, the methodology of the CS activities is available in Deliverable D2.3 Citizen Science based methodology for FL and FW reduction and prevention.

The monitoring of the Social Programmes will be carried out using an updated version of the Social Action module developed in the previous Waste4Think project. However, some adaptations are needed prior to its use according to the needs of the project, mainly:

- Target groups: they have been updated according to the list of stakeholders defined in Section 1.2.
- Roles: 4 levels of security have been defined according to the roles expected in the project:
 - Administrator: Can create/modify/delete strategies, actions, implementations, target groups and KPIs and pilots.
 - Pilot Coordinator: Can create/modify/delete strategies, actions and implementations in their pilot.
 - Stakeholder: Can create/modify/delete actions and implementations in their pilot.
 - External associated region: Can create/modify/delete actions and implementations in their pilot whenever the content is accessible to them
- Security level:
 - Private only partner of the pilot
 - Private only members of the FOODRUS consortium
 - Public in an open dashboard
- Privacy of documentation: to guarantee confidentiality if necessary even in those cases where the strategy/action/implementation information is publicly available
- Pre-established list of social KPI (see section 6 for more details about KPIs)
- Consultation and reporting of results

In the meantime, as some time is required for these updates, the monitoring has been carried out using the excel monitoring file. Annex II. Summary of the Social Actions carried out in each pilot collects the summary sheets of the strategies that have been implemented in the period.

¹ [FOODRUS - Stakeholder Survey](#)

² <https://www.foodrus.eu/stakeholders-map/>

6. Food Loss and Waste

Methodology definition

In order to tackle and reduce the problem of food loss and waste (FLW) the establishment of a common methodology is required so that quantification of FLW will be carried out in the three pilots following the same specifications and considerations. This FLWQP methodology has been defined according to several documents:

- The Commission Delegated Decision (EU) 2019/1597 of 3 May 2019 (European Commission, 2019).
- The Joint Research Centre (JRC) technical report “Assessment of food waste prevention actions” (Joint Research Centre, 2019).
- The Solution KPIs of FOODRUS.
- The Multicriteria Environmental indicators of FOODRUS (Task 4.3).
- Indicators obtained from scientific bibliography used to measure sustainability along the value chain.

For the appropriate development of this methodology, a series of terms and indicators which constitute the adopted criteria will be outlined below.

6.1. Regulatory framework

European regulations and other official documents constitute the regulatory framework on which this FLWQP methodology is based. They were consulted to establish the definitions of food and food loss and waste (FLW) that will be referred to along this deliverable.

6.1.1. Literature review

Once FLW has been clearly defined in section 1.1, the appropriate selection of a FLW quantification methodology for a determined situation is the next step to take. When it comes to this issue, FOODRUS will follow the guidelines provided by the Commission Delegated Decision (EU) 2019/1597 (European Commission, 2019).

Additionally, a review of the most commonly used methods in the literature was carried out as well to have a reference point. In this regard it is worth mentioning the study conducted by Xue et al. (2017), where 202 publications reporting FLW were examined. The quantification methodologies used in such studies is summarised in Figure 72.

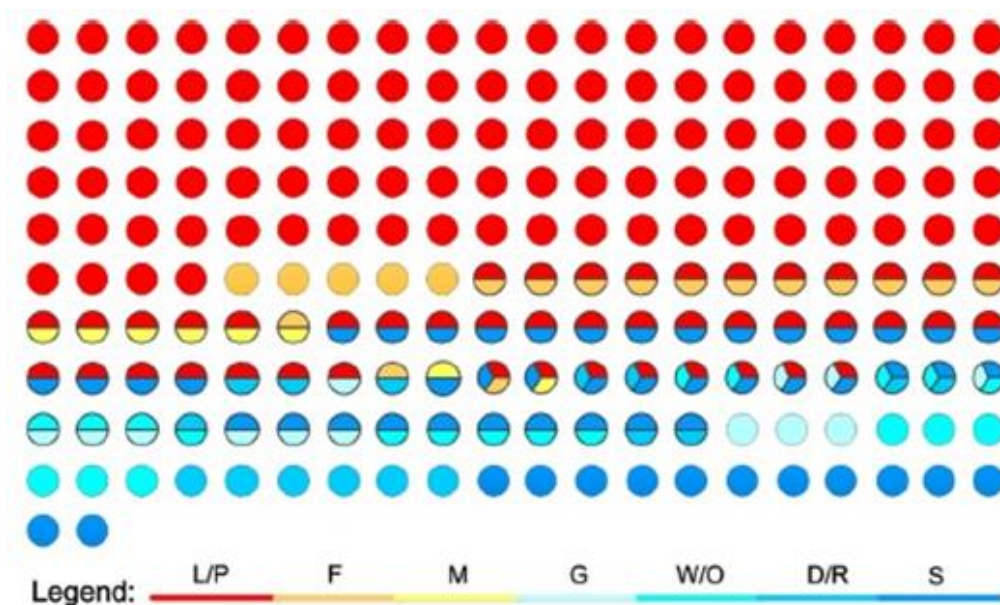


Figure 72. FLW quantification methods used in the literature (Xue et al., 2017).

Taking into account that some studies deploy a mix of more than one methodology, out of the 202 publications:

- 149 use literature data or proxy data (L/P).
- 53 use surveys (S).
- 20 use weighing/observation (W/O).
- 19 use food balance (mass balance) (F).
- 16 use diaries/records (D/R).
- 13 use garbage collection, separating food from the rest (G).
- 8 use modelling (M).

Another relevant aspect is the stages of the FSC that were covered by these quantification methods. Once again, some of them quantify FLW in more than one stage. Respecting the order of the stages within the FSC, out of the 202 publications:

- 26,7% cover production.
- 18,8% cover post-harvest and storage.
- 28,7% cover processing.
- 21,8% cover distribution.
- 35% cover retail.
- 49% cover consumption (Xue et al., 2017).

As a way to help discern which methodologies would be viable to quantify FLW in a given context, the FLW protocol ranking tool may be of assistance. It is freely available at the FLW protocol website (<http://www.flwprotocol.org>). Likewise, the website offers download of the FRESH FLW Value Calculator, a tool that can be used to estimate some environmental and nutritional impacts of FLW.

Furthermore, in FOODRUS a deeper analysis has been conducted to detect causes of FLW generation as well as to evaluate the impact of the FLW prevention strategies. With that intention, another literature review was conducted to collect and analyse key performance indicators (KPIs) that are used to measure sustainability along supply chains. After a screening process of these KPIs, the ones that are considered of importance for those purposes will become valid to be utilised for that goal in FOODRUS.

Initially, a total of 460 KPIs from the scientific literature have been assessed (Yontar and Ersöz, 2020; Al-Sheyadi et al., 2019; Çankaya and Sezen, 2019; Perera et al., 2013; Li et al., 2020; Saeed and Kersten, 2017; Neri et al., 2021; Haddach et al., 2017; Himanen and Martikainen 2019; Hristov and Chirico, 2019). In some cases, additional KPIs that are mentioned in these documents but were not used by the authors were included since they were regarded as interesting from a scientific point of view. All these indicators along with those present in the Commission Delegated Decision (European Commission, 2019) for food waste quantification, the JRC technical report (Joint Research Centre, 2019), and the FOODRUS Grant Agreement entered the screening process so that it could be concluded whether they are relevant enough to be finally used in FOODRUS or not. This screening process was based on their redundancy, their adequacy and applicability to achieve FOODRUS objectives, and their viability to infer food loss and waste supported by a review of causes of FLW generation that was presented in section 1.3.

Next, the co-creation procedure to define the final list of the KPIs is explained.

6.1.2. Co-creation methodology for KPIs definition

The overall objective of FOODRUS is to enhance the resilience and sustainability of local and regional European food systems by deploying and demonstrating the value of innovative solutions replicated in 3 complementary regions in Europe (Navarre-Basque Country in Spain, Copenhagen in Denmark, and Nitra and Bratislava in Slovakia). The latter will promote sustainable and cooperative models for prevention, reutilisation, recovery and valorisation of food losses and waste, paying special attention to perishable food, including cooked food.

To accomplish the aim mentioned above, it is needed to identify a set of KPIs (Key Performance Indicators) that monitors the impact of the FOODRUS project. To determine such KPIs, we designed an iterative methodology for co-creation and identification of KPIs. In the following subsections, we introduce crucial elements of the methodology. First, we present the participants and the main techniques considered for the deployment of the methodology. Afterward, we introduce the proposed methodology, and we end with a detailed description of its main steps.

This methodology involves experts and allows them to provide their professional points of view, especially in the fields in which they have knowledge and expertise. Besides, it also includes and motivates the participation of stakeholders from the value chains to guarantee the methodology's applicability in other chains different from the ones to be studied in the FOODRUS project.

Apart from the participants, the other relevant part of the methodology is the set of techniques that facilitates the co-creation process along with participants for the identification of KPIs. Within the main methods to be used are:

- **Phase 1. Literature review:** Here the aim is to identify and review scientific and academic literature regarding sustainability KPIs, along with the corresponding regulatory framework, paying special attention to their definition and use. A grouping, screening and adaptation process took place afterwards, which served as a way to remove redundant KPIs and adjust them to the FLW context. An initial long list of KPIs came as the output of this phase. This initial identification and classification of KPIs was done based on the FOODRUS objectives.
- **Phase 2A. Survey to experts:** In this phase a panel of experts coming from different areas of expertise (Advisory Board members included) were consulted about the importance of such KPIs to measure the impact of the FLW prevention strategies. They were provided with a Likert scale to do so, and the results were employed to filter and reduce the long list of KPIs to a consolidated short list.

- **Phase 2B. Survey to stakeholders:** The stakeholders from the different food value chains of the project were asked to qualitatively measure the performance of their institutions regarding the long list of KPIs. With the results of this phase the applicability of the KPIs to the different stages of the FVC and to the 3 food products (i.e. pilots' value chains) was analysed.
- **Phase 3. Analytic hierarchy process (AHP):** The AHP is a structured method for organizing and analyzing complex decisions in domains wherein there are no exact solutions. Specifically, the AHP seeks to quantify the weights of decision criteria and estimate their impact in a set of possible scenarios under consideration. To accomplish such an aim, a group of experts whose opinion is considered to weigh the mentioned decision criteria and scenarios is appointed. Each of the experts compares the relative importance of each decision criteria and scenario using a pairwise comparison approach. The final output are the weights of the decision criteria, and of the scenarios that were evaluated according to such criteria. In the case of the FOODRUS KPIs the SMART+ set of criteria was utilised, and the aforementioned scenarios were the KPIs included within the consolidated short list. Both partners from the pilots and experts from the Advisory Board worked as the participants. A workshop was organised to help experts understand and successfully complete this AHP exercise.
- **Phase 4. Sustainability index:** Once the relative weights of the KPIs were established, a single index was created to gather and synthesize all the information collected in the KPIs, being able to compare sustainability performances more easily.

A general outline of the methodology is depicted in Figure 73.

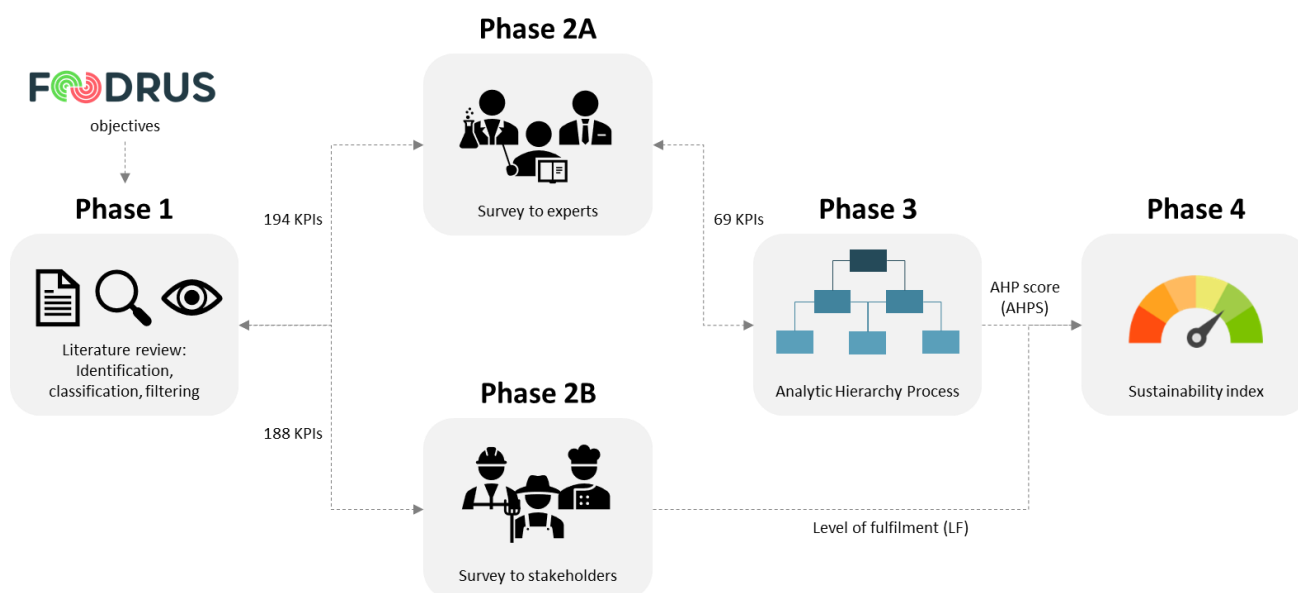


Figure 73. General methodology for the identification of FOODRUS' indicators.

Once the final list of KPIs was compiled, each of them was linked to the Specific Objectives (SO) of the project. In doing so, it was assessed which KPIs serve to measure the progress towards the achievement of a given objective. This relationship between indicators and objectives can be seen below (Table 8).

Finally, the adequacy of the application of each KPIs has been discussed individually with the 3 pilots completing a descriptive sheet for each KPI. The set of sheets for the final list of KPIs is included in Annex III. Complementary, Annex IV, V, VI and VII show the procedures defined for the specific quantification KPIs based on EC Delegated Decision 2019/1597:

- Annex IV: Diaries for final consumers as part of CS1 (citizens monitoring). Alternatively, a mobile app (the Food Loop App) has been defined for the same purpose
- Annex V: Guidelines for quantification using the Food Loop App
- Annex VI: Urban waste characterization protocol to quantify total biowaste generation from urban waste generation patterns (Spanish version for its use in the Spanish pilot). An English version is under preparation to guarantee the European open data policy.
- Annex VII: Pilots' quantification methodology with the specific procedure defined for each of the 3 supply chains (till retail)

Table 8. KPIs and Specific Objectives (SO).

Latent variable	Key Performance Indicator (KPI)	SO1: FLW reduction	SO2: FLW quantifica tion	SO3: Causes	SO4: Resources efficiency	SO5: Behavioural changes	SO6: Multicriteria assessment	SO7: Alliances	SO8: Living labs	SO9: Replica bility	SO10: Transfera bility	SO11: Dissemi nation
Cooperation	Integration with Food Supply Chain partners	✓		✓		✓		✓	✓			
	% purchasing budget spent in local providers	✓		✓	✓			✓	✓			
	Multifunctional cooperation between departments	✓				✓		✓	✓			
	Transport distance covered by third parties	✓		✓								
Economic performance	Total amount of food waste prevented/cost of the action implementation	✓	✓		✓				✓			
	Net economic benefits/cost of the action implementation	✓	✓		✓				✓			
	Total n° of businesses reporting a Food Waste reduction/cost of the action implementation	✓	✓		✓				✓			
	Total n° of businesses tracking Food Waste/cost of the action implementation	✓	✓		✓				✓			
	Total n° of people (end consumers) changing behaviour/cost of the action implementation	✓	✓		✓				✓			
	% increase of sales of local/seasonal/organic/ugly food	✓			✓	✓		✓	✓			
	% costs avoided	✓			✓		✓		✓			
Involvement performance	Total Number of Regional Roadmaps	✓					✓			✓		
	N° of banks and public entities involved	✓				✓		✓	✓			
	Certification entities and public administrations involved	✓				✓		✓	✓			
Quantification	Annual Food Waste generated per capita (end consumers)	✓	✓			✓	✓		✓			
	Total Food Waste (Tonnes) (Per stage of the FVC)	✓	✓			✓	✓		✓			
	Total Edible Food Waste (Tonnes) (Per stage of the FVC)	✓	✓			✓			✓			
	Total weight of food waste avoided per stage and final destination	✓	✓		✓	✓	✓		✓			
	Total weight of edible food waste avoided per stage and final destination	✓	✓		✓	✓			✓			

Environmental footprint	% packaging saved	✓			✓		✓		✓			
	Water footprint of Food Waste avoided	✓			✓		✓		✓			
	Carbon footprint of Food Waste avoided	✓					✓		✓			
	Carbon footprint of edible Food Waste avoided	✓					✓		✓			
	% water footprint avoided	✓			✓		✓		✓			
	% carbon footprint avoided	✓					✓		✓			
	% recycling of Food Waste for biogas and biofertilizer production	✓			✓		✓		✓			
Implementation impact	% actors of the entire FVC involved in each pilot tracking Food Waste	✓	✓				✓		✓			
	% actors involved in each pilot reporting a Food Waste reduction	✓	✓		✓	✓	✓		✓			
	New business for food waste reduction and prevention	✓					✓		✓		✓	
	Solutions developed	✓							✓		✓	
	New best practices adopted per pilot	✓			✓	✓	✓		✓			
Lack of awareness	Environmental awareness of consumers	✓		✓		✓			✓			
	Environmental awareness of chain employees	✓		✓		✓			✓			
Logistics and reverse logistics	Kg of returned products	✓		✓	✓	✓		✓	✓			
	Adopting just-in-time logistics system	✓		✓	✓							
	N° of products recovered by reverse logistics	✓		✓	✓	✓		✓	✓			
Packaging	Packaging reduction by eco-design	✓		✓	✓							
	Use of ecological, reusable, recyclable packaging	✓		✓	✓							
	Use of protective packaging	✓		✓								
Process operation efficiency	Demand forecast accuracy	✓		✓	✓			✓	✓			
	Effective shipment consolidation and full vehicle loading	✓			✓							
	N° of events (operational circumstances) that cause FLW	✓		✓					✓			
	Production flexibility	✓		✓	✓	✓						
	Inventory turnover rate (Cost of the goods sold/Average inventory)	✓		✓	✓				✓			

	Regular maintenance of the production equipment	✓		✓	✓							
Product quality	Tonnes of ugly food, defective or expired food discharged	✓	✓	✓	✓	✓			✓			
	Transport suitability according to the product	✓		✓	✓				✓			
	Food products traceability	✓		✓					✓			
	Supplier rejection rate	✓		✓		✓		✓				
	Order tracking	✓		✓				✓	✓			
	N° of food safety certifications	✓		✓	✓				✓			
Redesigning the product or the production processes	Additional information in the product for consumers to avoid FLW and improve biowaste and packaging separation rates	✓		✓		✓		✓	✓			
	Research & Development investments in circular economy	✓		✓					✓			
	Investments in new technologies	✓		✓					✓			
Social performance	% people (end consumers) reporting a change in behaviour	✓		✓		✓	✓		✓			
	% staff reporting a change in behaviour	✓		✓		✓	✓		✓			
	% people (end consumers) aware of the FLW prevention campaign	✓		✓		✓			✓			✓
	N° of people (end consumers) reached	✓					✓		✓			✓
	Outreach/behavioural change observed	✓		✓		✓			✓			
	% of people developing new skills	✓		✓		✓	✓		✓			
	N° of people in need with a better diet	✓					✓		✓			
	% nutritional value saved	✓			✓		✓		✓			
Social outcomes	Social new business models	✓				✓	✓		✓		✓	
	Maintenance and use of the platform beyond the duration of the project. Dissemination and exploitation of the results	✓							✓		✓	✓
	N° of replicated cases	✓								✓		
Technical performance	New secondary products created	✓			✓				✓			
	% Decrease of expired food wasted	✓	✓	✓	✓	✓			✓			
	Waste to landfill (Tonnes)	✓	✓		✓	✓			✓			
	Waste to incineration (Tonnes)	✓	✓		✓	✓			✓			

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Annex I. FOODRUS solutions: co-creation process (confidential)

Annex Ia. Phase I: Solutions and actors

Annex Ib. Phase II: Solutions whiteboards (Miro)

Annex Ic. Phase III: ICT Solutions description

Annex II. Summary of the Social Actions carried out in each pilot

In the following tables of this annex a colour code has been set for the column where the implementations are listed. It works as follows:

- The implementations that have not started yet (in the period M1-M6) are shown with a red background.
- The implementations that are in progress (in the period M1-M6) are shown with a yellow background.
- The implementations that have already been finished (in the period M1-M6) are shown with a green background.

Strategy

Name

Danish Pilot's Social Programme

Description

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Location

Denmark

Promoter

CPHU

Actions

Implementations

Food donation awareness campaign	Baseline: Planning of the awareness campaign. Selection of KPIs (2021/10/22 - 2021/10/22)
Heatlthy and sustainable diets	Internal course held throughout January. The main purpose of the course is to revisit the theory behind cooking, but this time we place vegetables in the leading role. (2022/01/31 - 2022/04/13)
	Baseline: Planning of the awareness campaign. Selection of KPIs (2021/10/22 - 2021/10/22)
	Internal course for 60 chefs in JTK learning about plant based food and nutritional values and combinations when working with vegetables and alternative proteins instead of animal based proteins (2022/02/23 - 2022/02/15)
Introducing "green tuesday" at AU canteens, which is a 100% plant based menu for all guests and students every tuesday	
Organisation of the pilot's activities	Meeting to have a schedule of activities to be developed during the pilot (2021/10/22 - 2021/10/22)
	Meeting with BCC to get information about the CS Activities (2021/10/22 - 2021/08/11)
Zero waste - Reduction	Food waste event with end users and consumers (cantines) (2021/10/09 - 2021/10/09)
	Baseline: Planning of the awareness campaign. Selection of KPIs (2021/10/22 - 2021/10/22)
Zero waste - Revalorization (e.g. compost)	Baseline: Planning of the awareness campaign. Selection of KPIs (2021/10/22 - 2021/10/22)

Strategy

Name

General Social Programme (All Pilots)

Description

General Social Programme (All Pilots).

Location

Denmark

Promoter

UD

Actions

Actions to improve food engagement at universities through knowledge sharing

Coordination of all activities from the different pilots, share of info and identification of common needs/solutions

Implementations

Lecture is to convey information on the work that is done in the project and inform on what Hørkram does in general to prevent FL/FW (2022/04/13 - 2022/03/22)

- WP2 meeting with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/07/22)
- WP2 meeting with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
- WP2 meeting with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/10/22)
- WP2 meeting with all the Pilot members for the coordination CS Activities (2021/10/22 - 2023/01/22)
- Meeting with BCC on Social Programme activities (2022/02/10 - 2022/02/10)

Strategy

Name

CS1. Citizenship groups to be monitored to identify shopping, cooking and waste generation habits

Description

Citizenship monitoring groups to be monitored to identify shopping, cooking and waste generation habits and quality assessment of the main causes of FW. To this end different mechanisms will be used: observational experimentation, surveys, monitoring through apps or diaries as well as specific waste characterizations. In the case of Zamudio waste generation habits will be monitored by the use of citizen e-cards that are used to open the waste containers.

Location

Denmark

Promoter

CPHU

Actions

Implementations

Collect information from cantina users and staff to find potential solutions for FW	Design of the questionnaire/method of data collection (2021/10/22 - 2021/10/22)
	Planning/schedule and launching of the activity (2021/10/22 - 2021/10/22)
	Completion of CS activity and conduct post-activity survey. KPI measurements/reporting (2021/10/22 - 2021/10/22)
Collect information from end users to find potential solutions for FW	Design of the methodology (Material, e.g. sureys provided by UD) (2021/10/22 - 2021/10/22)
	To schedule a meeting with Deusto to share the methodology and recieve information about the methodology proposed by UD (2021/10/22 - 2021/10/22)
KPIs identification and measurement	Baseline. KPIs Identification (2021/10/22 - 2021/10/22)
	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
Monitoring citizens eating habits and causes of food waste in JTK canteens using FOODOP	FOODOP installed in several JTK canteens to establish a baseline on food waste in the buffets in canteens (2020/01/12 - 2021/01/08)
CS1 update	CS1 update meeting (2022/03/01 - 2022/03/01)

Strategy

Name

CS2. Working groups to co-create specific contents to develop the e-learning materials of T2.2

Description

Working groups to co-create specific contents to develop the e-learning materials of T2.2.

Location

Denmark

Promoter

GEO

Actions

Creation of e-learning material

Implementations

Selection/Definition of e-learning materials for task 2.2 (2021/10/22 - 2022/02/04)

Paritipate in workshop with Geonardo to discuss selected e-learning material (2021/10/22 - 2022/02/04)

Strategy

Name

CS3. Gender dimension. Working groups involving women to assess the gender dimension

Description

Working groups involving women to assess the gender dimension. In order to assess gender dimension a qualitative methodological design (narrative productions) will be carried out from the feminist perspective.

Location

Denmark

Promoter

JTK

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Baseline. KPIs Identification. (2021/10/22 - 2021/10/22)
Create qualitative data using the Narrative production method to assess the gender dimension	Recruitment of participants (2021/10/22 - 2021/10/22)
	Completion of Workshops with women (using Narrative production methodology) (2021/10/22 - 2021/10/22)
CS3 update	CS3 update meeting (2022/03/07 - 2022/03/07)
Methodology to assess gender dimension	To adapt the methodology presented by DEUSTO to the SLVK pilot needs. (2022/03/07 - 2022/03/07)

Strategy

Name

CS4. Fiscal instruments and tax incentives

Description

Participatory processes to discuss the possible fiscal instruments proposed in T4.4 to test the real incidence of the tax incentives in individuals and families, commerce and industry. Also, the building strategies of T4.2 will be assessed with the FVCs. With those inputs the fiscal instrument proposals will be reviewed.

Location

Denmark

Promoter

JTK

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Create survey to establish the baseline for KPIs identification (2021/10/22 - 2021/10/22)
	CS4 Update meeting (2022/03/08 - 2022/03/08)
CS4 update	
Determine how this legislative change impacts the donations of fresh bread	Completion 1. Focus group /Workshop to discuss fiscal instruments proposed in T4.4 and measure KPIs (2021/10/22 - 2021/10/22)
	Completion 2. Focus group /Workshop to discussCapacity building strategies in T4.2 and measure KPIs (2021/10/22 - 2021/10/22)
Discuss impact of fiscal instruments (T4.4) and building strategies (T4.2)	Design of the methodology (2021/10/22 - 2021/10/22)
	Planning of the activity (2021/10/22 - 2021/10/22)
	Recruitment of participants (2021/10/22 - 2021/10/22)

Strategy

Name

CS5. Working groups to define the scope of the project and co-create the different solutions of the project

Description

Working groups to define the scope of the project and co-create the different solutions of the project: identification of the target groups to define the needs of the system, the identification of barriers (legal, data security, confidence...), the main functionalities, the usability requirements... and test the solutions.

Location

Denmark

Promoter

UD

Actions	Implementations
KPIs identification and measurement	Assesment of all the outcomes and KPIs measurement/reporting (2021/10/22 - 2021/10/22)
	Create survey to establish the baseline for KPIs identification (2021/10/22 - 2021/10/22)
Co-creation activity of Use Cases with partners and Associated Partners	Preparatory action with pilot coordinators, pilot partners and solution managers (2021/10/22 - 2021/10/22)
	Completion. Conduct 1 or 2 Workshop and co-design the different solutions of the project (2021/10/22 - 2021/10/22)
CS5 update	CS5 update meeting (2022/03/08 - 2022/03/08)
Define the scope of the project and co-create the different solutions of the project	Design the methodology (2021/10/22 - 2021/11/29)
	Planning of the activity (2021/10/22 - 2021/10/22)

Strategy

Name

CS6. Working groups to discuss about the methodology for the quantification of food losses and waste

Description

Working groups to discuss about the methodology for the quantification of food losses and waste and its environmental, social and economic impacts as well as the evaluation of prevention actions.

Location

Denmark

Promoter

UD

Actions

Implementations

Climate debate about future foods and what to do	
Create a short list of KPIs to quantify FW and FL	Phase 1. Expert consultation (2021/10/22 - 2021/06/11)
	Phase 2. Stakeholders consultation. Different survey (Need to analyse with them if KPIs are relevant) (2021/10/22 - 2021/11/06)
	Phase 3. Workshop for experts and stakeholders (2021/10/22 - 2021/10/22)
To have a common standard for FW and FL that companies can be certified within	Meeting with governmental stakeholder on food waste quantification (2021/12/01 - 2021/10/06)
Zero waste - Reduction	Webinars on food waste reduction (2021/11/26 - 2021/02/04)
	Conference held by the University of Roskilde Denmark as part of the Danish PhD study on reducing food waste generated by the public sector in the food service value chain (2021/11/26 - 2021/03/13)
	Lecture on wholesalers's opportunities for reducing food waste at the University of Copenhagen (2021/11/26 - 2021/09/03)
	Working group on sustainable public purchase organised by the Danish Environmental Protection Agency (2021/11/26 - 2021/04/11)
	Measuring foodwaste at Risø, including kitchen/production waste, buffet waste and plate waste (2021/12/01 - 2021/11/22)
	Internal course about how to identify and reduce food waste in production facility, producing more than 7000 meals a day. Webinar and live course under the name "Food For thought" (2021/12/01 - 2021/06/23)
	Lecture held by JTK why it is important to work with FW and FL (2021/12/01 - 2021/06/01)

Strategy

Name

CS7. Working groups to discuss the result of the baseline, assess the causes and the existing solutions to identify potential solutions and barriers to be implemented following the methodology described in T4.1

Description

Working groups to discuss the result of the baseline, assess the causes and the existing solutions to identify potential solutions and barriers to be implemented following the methodology described in T4.1. Entrepreneurs and Start-ups are also key players to address the main challenges in all the VC A methodology to scouting, attracting and implementing prototypes by all living labs will be developed. For those solutions that can be immediately implemented and with low cost the group will manage a specific budget to uptake them adapted to the pilot cases (this can be for example, solutions to improve food conservation at schools, logistics and storage solutions for food donation involving volunteers or associations as taxi drivers...). Those actions that requires large investments and collaboration among stakeholders will be proposed as part of the solutions portfolio to be assess in Task 4.2 to find building capacity strategies for the short-medium term.

Location

Denmark

Promoter

CPHU

Actions

KPIs identification and measurement

Identify causes of problems in value chain and possibles solutions
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Implementations

KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
Create survey to establish the baseline for KPIs identification. (2021/10/22 - 2021/10/22)
Design the methodology (2021/10/22 - 2021/10/22)
Planning of the activity (2021/10/22 - 2021/10/22)
Rectruitment/contact of participants (Start-up and entrepreneurs) (2021/10/22 - 2021/10/22)
Completion. Conduct workshop for start-ups and entrepreneurs. KPIs measurement (2021/10/22 - 2021/10/22)

Strategy

Name

CS8. A participatory process to define the municipal tax of the PAYT considering the impact of FW prevention

Description

A participatory process to define the municipal tax of the PAYT considering the impact of FW prevention (definition of the catalogue of FW prevention initiatives, the algorithm to calculate the tax, and the validation of the invoices or redefinition of the tax).

Location

Denmark

Promoter

CPHU

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Create survey to establish the baseline for KPIs identification. (2021/10/22 - 2021/10/22)
Define the municipal tax of PAYT	Meeting for the design the methodology (2021/10/22 - 2021/10/22)
	Planning of the activity (2021/10/22 - 2021/10/22)
	Recruitment of Workshop/participatory process participants (2021/10/22 - 2021/10/22)
	Conduct Workshop/Participatory process (2021/10/22 - 2021/10/22)

Strategy

Name

CS9. Actions to develop healthy and sustainable diets. Actions to develop and deploy a nutritionally balanced gastronomic and sustainable guideline in real context

Description

Actions to develop healthy and sustainable diets. Actions to develop and deploy a nutritionally balanced gastronomic and sustainable guideline in real context: - Study and analysis of the gastronomic and cultural profile of the area through Interviews / workshops led by experts in gastronomy from BCC to local actors in the restoration area: surveys focused on health professionals from the region to identify the most relevant public health problems; surveys to identify consumers’ profile (tastes, preferences, expectations) for menu adaptations/modifications. - Conferences to disseminate the principles of the guideline. - Workshops and training talks about discards management. - Actions to develop a culinary intervention program directed to train community (people in need) in the principles of nutrition (equilibrated diets) and culinary skills to reduce FW. - Culinary training workshops in kitchens and monitoring the impact on health and food consumption. - Actions to improve food engagement at schools through sensory strategies. - Actions to learn about the knowledge of marking date labels and food conservation.

Location

Denmark

Promoter

CPHU

Actions	Implementations
Actions to develop a culinary intervention program directed to train community (people in need) in the principles of nutrition (equilibrated diets) and culinary skills to reduce FW	Design methodology to study cultural and social value of bread and analyse retail and consumer behaviour towards bakery products (2021/10/22 - 2021/10/22)
Actions to improve food engagement at schools through sensory strategies and to learn about the knowledge of marking date labels and food conservation	Planning and design of actions (2021/10/22 - 2021/10/22)
KPIs identification and measurement	Measurement of KPIs of all the actions, using surveys designed at the beginning of action (2021/10/22 - 2021/10/22)
	Baseline. KPIs definition/identification of all the actions. E.g. Create surveys to establish baseline and select KPIs for all the actions (2021/10/22 - 2021/10/22)
Dissemination of the guideline's principles	Planning of conferences to disseminate the principles of the guideline (2021/10/22 - 2021/10/22)
Culinary training workshops in kitchens and monitoring the impact on health and food consumption	Planning and design of training workshops (2021/10/22 - 2021/10/22)
Develop a nutritionally balanced gastronomic and sustainable guideline	Design the methodology (2021/10/22 - 2021/10/22)
	General planning of the CS activity (2021/10/22 - 2021/10/22)
Internal chefs cause "Nourishment for the Brain"	
Workshops and training talks about discards management	Planning of workshops and training talks (2021/10/22 - 2021/10/22)
CO2 friendly cooking	Future days - CO2 friendly workshop and cooking event at AU (2022/03/22 - 2022/03/22)
Zero waste cooking	Future days - Zero waste cooking event at AU (2022/03/21 - 2022/03/21)
	Zero waste cooking event teaching students about circular economy in theory and in the kitchen (2021/10/27 - 2021/10/27)
	Zero waste cooking event with JTK clients and partners, teaching participants about using vegetables as primary ingredients and chicken in many ways instead of CO2 heavy meats (2021/10/10 - 2021/10/10)

Strategy

Name

CS10. Working groups to discuss innovative models with entrepreneurs (social and non-social) to develop new business

Description

Working groups to discuss innovative models with entrepreneurs (social and non-social) to develop new business as well as exosystemic alliances among stakeholders and volunteer agreements signature (i.e., for food donation, for the use of the existing logistics networks as taxis associations, postal service...).

Location

Denmark

Promoter

CPHU

Actions

Implementations

Develop new business and alliances among stakeholders and	Recruit participants for the discussion and planification (2021/10/22 - 2021/10/22)
	Completion. Conduct discussion on innovative models to develop new business as well as exosystemic alliances (2021/10/22 - 2021/10/22)
KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Baseline. KPIs definition/identification of all the actions. E.g. Create surveys to establish baseline and select KPIs for all the actions (2021/10/22 - 2021/10/22)

Strategy

Name

Slovak Pilot's Social Programme

Description

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Location

Slovakia

Promoter

SUA

Actions

Implementations

Food donation awareness campaign	Baseline: Designing the aims and general actions of the awareness campaign. Selection of some KPIs (2021/10/22 - 2021/10/22)
Healthy and sustainable diets promotion	Online workshop organised by Slovak Youth Institute to discusse issues behind food waste and to propose ideas how to avoid food waste and mitigate food losses by changes in consumer behaviour (2021/07/04 - 2021/07/04)
	Writing a recipes book using bread waste as ingredient (this recipes book will be included in CS2 as potential e-larnings material and also in CS9) (2021/10/22 - 2021/10/22)
	Gathering information about various recipes using dry/unused bread/pastry from the general public - mostly housewives, women targeted as well as through the interview with the Slovak well known ethnologist. (2021/01/09 - 2021/01/09)
	Degustorium artisan food conference (2021/10/17 - 2021/10/17)
	Attendance at the School conference Skutočne zdravá škola (2021/10/22 - 2021/10/22)
	Participation to a conference to help schools to adopt methodologies and solutions on how to incorporate healthy and sustainable eating culture at schools. (2022/04/13 - 2022/04/08)
	Baseline: Designing the aims and general actions of the awareness campaign. Selection of some KPIs. (2021/10/22 - 2021/10/22)
Organisation of the pilot's activities	Meeting with the different participants and project coordinator to draft, discuss, and validate a first schedule of activities (2021/09/16 - 2021/09/16)
	Meeting with BCC, WP2 leaders to get information about the CS Activities (2021/10/06 - 2021/10/06)
	Meeting with BCC, WP2 leaders to get information about the CS Activities (2021/09/23 - 2021/09/23)
Zero waste - Reduction	Series of videos addressing practical tips on not wasting food (bread and pastries, grains, etc.), cooking/baking from scratch, and using every tiny bit of the ingredient (2021/10/22 - 2021/10/22)
	Zero waste brunch with the renowned zero waste Slovak chef (2021/01/09 - 2021/01/09)
	Baseline: Designing the aims and general actions of the awareness campaign. Selection of some KPIs (2021/10/22 - 2021/10/22)
Zero waste - Revalorization (e.g. compost)	Baseline: Designing the aims and general actions of the awareness campaign. Selection of some KPIs (2021/10/22 - 2021/10/22)

Strategy

Name

General Social Programme (All Pilots)

Description

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Location

Slovakia

Promoter

AIN

Actions

Implementations

Coordination of all activities from the different pilots, share of info and identification of common needs/solutions	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/04/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/07/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/10/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2023/01/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
Identification of the responsible of each CS activity and proceed with planning	Meeting with BCC and PL to get information about the CS Activities (2022/01/05 - 2022/01/05)

Strategy

Name

CS1. Citizenship groups to be monitored to identify shopping, cooking and waste generation habits

Description

Citizenship monitoring groups to be monitored to identify shopping, cooking and waste generation habits and quality assessment of the main causes of FW. To this end different mechanisms will be used: observational experimentation, surveys, monitoring through apps or diaries as well as specific waste characterizations. In the case of Zamudio waste generation habits will be monitored by the use of citizen e-cards that are used to open the waste containers.

Location

Slovakia

Promoter

SUA

Actions

Implementations

Collect information from end users to find potential solutions for FW	Planning/schedule and launching of the activity (2021/10/22 - 2021/10/22)
	Recruit end-users (2021/10/22 - 2021/10/22)
	Completion of CS activity and conduct post-activity survey. KPI measurements/reporting (2021/10/22 - 2021/10/22)
	To schedule a meeting with Deusto to share the methodology and recieve information about the methodology proposed by DEUSTO (2021/10/22 - 2021/11/16)
	Design the diary / questionnaire / method of data collection (2021/10/22 - 2021/10/22)
CS1 update	Presentation of the new Application being developed for quantitive measurement and surveys for qualitative input of consumers (2022/03/02 - 2022/03/02)
	CS1 update meeting (2022/03/01 - 2022/03/01)
Households engagement in the research	Develop methodology for households (2021/10/14 - 2021/11/19)
	Prepare the public call for households (2021/11/19 - 2021/11/19)
	Procurement process for kitchen scales for households (2021/11/19 - 2021/11/19)
KPIs identification and measurement	Baseline. KPIs identification (2021/10/22 - 2021/10/15)
	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
Research in HORECA	Develop methodology for HORECA (2021/11/19 - 2021/11/19)

Strategy

Name

CS2. Working groups to co-create specific contents to develop the e-learning materials of T2.2

Description

Working groups to co-create specific contents to develop the e-learning materials of T2.2.

Location

Slovakia

Promoter

GEO

Actions	Implementations
Content specification for the development of 2 e-learning materials	Contribution workshop on co-creation of e-learning (2022/01/20 - 2021/11/10)
	Select/Define e-learning material for task 2.2 (2021/10/22 - 2022/04/02)
Development of Cooking Book as e-learning material	Develop methodology for co-creation (2021/11/19 - 2021/11/10)
	Contribution to T2.2. - specifications of responsible, overview, format, target groups, course content and title of lessons (2021/12/03 - 2021/12/03)
Development of e-learning material for schools "From seed to bread"	Contribution to T2.2. - specifications of responsible, overview, format, target groups, course content and title of lessons (2021/12/03 - 2021/12/03)
Preparation of presentations for the development of 2 e-learning materials	Participation in co-creation workshop as result magers responsible for 2 e-learning materials (schools and cook book) (2022/01/28 - 2022/04/02)

Strategy

Name

CS3. Gender dimension. Working groups involving women to assess the gender dimension

Description

Working groups involving women to assess the gender dimension. In order to assess gender dimension a qualitative methodological design (narrative productions) will be carried out from the feminist perspective.

Location

Slovakia

Promoter

SUA

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	KPIs Identification for the baseline (2021/10/22 - 2021/10/22)
Create qualitative data using the Narrative production method to assess the gender dimension	Presentation and discussion - online workshop for women - bread as a part of healthy lifestyle with a nutrition scientist showing the positive and negative aspects of eating various types of bread (2021/10/22 - 2021/10/22)
	Recruitment of participants (2021/10/22 - 2021/10/22)
	Completion of Workshops with women (Using Narrative production Methodology) (2021/10/22 - 2021/10/22)
CS3 update	CS3 first meeting (2022/04/03 - 2022/04/03)
	CS3 update meeting (2022/03/07 - 2022/03/07)
Methodology to assess gender dimension	To adapt the methodology presented by DEUSTO to the SLVK pilot needs. (2021/10/22 - 2021/10/22)

Strategy

Name

CS4. Fiscal instruments and tax incentives

Description

Participatory processes to discuss the possible fiscal instruments proposed in T4.4 to test the real incidence of the tax incentives in individuals and families, commerce and industry. Also, the building strategies of T4.2 will be assessed with the FVCs. With those inputs the fiscal instrument proposals will be reviewed.

Location

Slovakia

Promoter

SUA

Actions

KPIs identification and measurement

CS4 update

Determine how this legislative change impacts the donations of fresh bread

Implementations

KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)

Create survey to establish the baseline for KPIs identification (2021/10/22 - 2021/10/22)

CS4 update meeting (2022/03/08 - 2022/03/08)

Design the methodology (2021/10/22 - 2021/10/22)

Planning of the activity (2021/10/22 - 2021/10/22)

Recruitment of participants (2021/10/22 - 2021/10/22)

Completion 1. Focus group /Workshop to discuss fiscal instruments proposed in T4.4 and measure KPIs (2021/10/22 - 2021/10/22)

Completion 2. Focus group /Workshop to discuss Capacity building strategies in T4.2 and measure KPIs (2021/10/22 - 2021/10/22)

Strategy

Name

CS5. Working groups to define the scope of the project and co-create the different solutions of the project

Description

Working groups to define the scope of the project and co-create the different solutions of the project: identification of the target groups to define the needs of the system, the identification of barriers (legal, data security, confidence...), the main functionalities, the usability requirements... and test the solutions.

Location

Slovakia

Promoter

SUA

Actions

Implementations

KPIs identification and measurement	Assesment of all the outcomes and KPIs measurement/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Baseline and KPIs definition/identification (2021/10/22 - 2021/10/22)
	Participation in workshop (2021/09/30 - 2021/09/30)
	Each Slovak partner provided an assesment of KPIs in the excel files following the common methodology (2022/03/04 - 2022/03/04)
Co-creation activity of Use Cases with partners and Associated Partners	Preparatory action with pilot coordinators, pilot partners and solution managers (2021/10/22 - 2021/10/22)
	Completion. Conduct 1 or 2 workshop and co-design the different solutions of the project (2021/10/22 - 2021/10/22)
Co-creation activity of Use Cases with supermarket Tesco	Presentation of solutions and CSA (2022/12/03 - 2022/12/03)
CS5 update	CS5 update meeting (2022/03/08 - 2022/03/08)
Define the scope of the project and co-create the different solutions of the project	Design the methodology - Focus Group with Households to discuss and select solutions to be deployed (2021/10/22 - 2021/10/22)
	Meetings with Kaufland, Novart and Tesco to desing the methodology and needs (2021/02/11 - 2021/02/11)
	Planning of the activity (2021/10/22 - 2021/10/22)
Solution 1.1. Process optimization tool	Slovak version of document shared with bakery Senicke and co-creation meeting to be scheduled (2021/12/03 - 2021/12/03)

Strategy

Name

CS6. Working groups to discuss about the methodology for the quantification of food losses and waste

Description

Working groups to discuss about the methodology for the quantification of food losses and waste and its environmental, social and economic impacts as well as the evaluation of prevention actions.

Location

Slovakia

Promoter

UD

Actions

Implementations

Create a short list of KPIs to quantify FW and FL	Phase 1. Expert consultation (2021/10/22 - 2021/11/06)
	Phase 2. Stakeholders consultation. Different survey (Need to analyse with them if KPIs are relevant) (2021/10/22 - 2021/11/06)
	Phase 3. Workshop for experts and stakeholders (?) (2021/10/22 - 2021/10/22)
Data collection on FLW and improvement of very restrictive national legislation	Draft a joint letter of partners to the new minister of agriculture to show the interest to participate in the renewed activities of the National Platform on FLW (2021/12/03 - 2021/12/03)
Methodology for measurement of bread waste at household level	Meeting of SLP with UD and BCA to finalize the methodology for households (2021/11/16 - 2021/11/16)

Strategy

Name

CS7. Working groups to discuss the result of the baseline, assess the causes and the existing solutions to identify potential solutions and barriers to be implemented following the methodology described in T4.1

Description

Working groups to discuss the result of the baseline, assess the causes and the existing solutions to identify potential solutions and barriers to be implemented following the methodology described in T4.1. Entrepreneurs and Start-ups are also key players to address the main challenges in all the VC A methodology to scouting, attracting and implementing prototypes by all living labs will be developed. For those solutions that can be immediately implemented and with low cost the group will manage a specific budget to uptake them adapted to the pilot cases (this can be for example, solutions to improve food conservation at schools, logistics and storage solutions for food donation involving volunteers or associations as taxi drivers...). Those actions that requires large investments and collaboration among stakeholders will be proposed as part of the solutions portfolio to be assess in Task 4.2 to find building capacity strategies for the short-medium term.

Location

Slovakia

Promoter

SUA

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Create survey to establish the baseline for KPIs identification (2021/10/22 - 2021/10/22)
Identify causes of problems in value chain and possibles solutions	Design the methodology (2021/10/22 - 2021/10/22)
	Planning of the activity (2021/10/22 - 2021/10/22)
	Participant (Start-up and entrepreneurs) rectruiement/contact (2021/10/22 - 2021/10/22)
	Completion. Conduct workshop for start-ups and entrepreneurs. KPIs measurement (2021/10/22 - 2021/10/22)

Strategy

Name

CS8. A participatory process to define the municipal tax of the PAYT considering the impact of FW prevention

Description

A participatory process to define the municipal tax of the PAYT considering the impact of FW prevention (definition of the catalogue of FW prevention initiatives, the algorithm to calculate the tax, and the validation of the invoices or redefinition of the tax).

Location

Slovakia

Promoter

SUA

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Create survey to establish the baseline for KPIs identification (2021/10/22 - 2021/10/22)
Define the municipal tax of PAYT	Design the methodology (2021/10/22 - 2021/10/22)
	Planning of the activity (2021/10/22 - 2021/10/22)
	Recruitment of Workshop/participatory process participants (2021/10/22 - 2021/10/22)
	Conduct Workshop/Participatory process (2021/10/22 - 2021/10/22)

Strategy

Name

CS9. Actions to develop healthy and sustainable diets. Actions to develop and deploy a nutritionally balanced gastronomic and sustainable guideline in real context

Description

Actions to develop healthy and sustainable diets. Actions to develop and deploy a nutritionally balanced gastronomic and sustainable guideline in real context: - Study and analysis of the gastronomic and cultural profile of the area through Interviews / workshops led by experts in gastronomy from BCC to local actors in the restoration area: surveys focused on health professionals from the region to identify the most relevant public health problems; surveys to identify consumers’ profile (tastes, preferences, expectations) for menu adaptations/modifications. - Conferences to disseminate the principles of the guideline. - Workshops and training talks about discards management. - Actions to develop a culinary intervention program directed to train community (people in need) in the principles of nutrition (equilibrated diets) and culinary skills to reduce FW. - Culinary training workshops in kitchens and monitoring the impact on health and food consumption. - Actions to improve food engagement at schools through sensory strategies. - Actions to learn about the knowledge of marking date labels and food conservation.

Location

Slovakia

Promoter

SUA

Actions

Implementations

Actions to improve food engagement at schools through sensory strategies and to learn about the knowledge of marking date labels and food conservation.	Planning and design of actions (2021/10/22 - 2021/10/22)
KPIs identification and measurement	Measurement of KPIs of all the actions, using surveys designed at beginning of action (2021/10/22 - 2021/10/22)
	Baseline: KPIs definition/identification of all the actions. E.g. Create surveys to establish baseline and select KPIs for all the actions (2021/10/22 - 2021/10/22)
Dissemination of the guideline's principles	Planning of conferences to disseminate the principles of the guideline. Participate as partner in Really Healthy School Conference on 20 November 2021 (2021/10/22 - 2021/10/22)
Culinary training workshops in kitchens and monitoring the impact on health and food consumption	Planning and design of training workshops (2021/10/22 - 2021/10/22)
Develop a nutritionally balanced gastronomic and sustainable guideline	Design the methodology (2021/10/22 - 2021/10/22)
	General planning of the activity (2021/10/22 - 2021/10/22)
Co-create an awareness rising campaign for supermarkets for Christmas of 2022	
Raise awareness of parents, teachers and cooking personel on healthy and sustainable diet	Prepare and organize a workshop or a webinar (2021/11/19 - 2021/11/19)
Study and analysis of the gastronomic and cultural profile of the area	Design methodology to study cultural and social value of bread and analyse retail and consumer behaviour towards bakery products (2021/10/22 - 2021/10/22)
Workshops and training talks about discards management	Planning of workshops and training talks (2021/10/22 - 2021/10/22)
Zero Waste - Re-use and biodegradable waste composted	Zero Waste Brunch (2021/09/12 - 2021/09/12)

Strategy

Name

General Social Programme (All Pilots)

Description

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Location

Spain

Promoter

UD

Actions

Implementations

Coordination of all activities from the different pilots, share of info and identification of common needs/solutions	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/04/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/07/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2022/10/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2023/01/22)
Identification of the responsible of each CS activity and proceed with planning	Meeting with BCC and PL to get information about the CS Activities (2022/09/01 - 2022/09/01)

Strategy

Name

Spanish Pilot's Social Programme

Description

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Location

Spain

Promoter

UD

Actions

Implementations

Food donation awareness campaign	Workshop on Good Practices in the donation of food surpluses: A solidary solution that reduces food waste (2021/11/18 - 2021/11/18)
	Baseline: Planning of awareness campaign. Selection of KPIs. (2021/10/22 - 2021/10/22)
Healthy and sustainable diets	Baseline: Planning of awareness campaign. Selection of KPIs. (2021/10/22 - 2021/10/22)
Organisation of the pilot's activities	Meeting with the different participants and project coordinator to draft, discuss, and validate a first schedule of activities (2021/09/16 - 2021/09/16)
	Meeting with BCC, WP2 leaders to get information about the CS Activities (2021/10/06 - 2021/10/06)
	Meeting with BCC, WP2 leaders to get information about the CS Activities (2021/09/23 - 2021/09/23)
Zero waste - Reduction	Baseline: Planning of awareness campaign. Selection of KPIs. (2021/10/22 - 2021/10/22)
Zero waste - Revalorization (e.g. compost)	Baseline: Planning of awareness campaign. Selection of KPIs (2021/10/22 - 2021/10/22)

Strategy

Name

General Social Programme (All Pilots)

Description

.

Location

Spain

Promoter

UD

Actions

Implementations

Coordination of all activities from the different pilots, share of info and identification of common needs/solutions	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
	Meeting of WP2 with all the Pilot members for the coordination CS Activities (2021/10/22 - 2021/10/22)
Identification of the responsible of each CS activity and proceed with planning	Meeting with BCC and PL to get information about the CS Activities (2022/09/01 - 2022/09/01)

Strategy

Name

CS1. Citizenship groups to be monitored to identify shopping, cooking and waste generation habits

Description

Citizenship monitoring groups to be monitored to identify shopping, cooking and waste generation habits and quality assessment of the main causes of FW. To this end different mechanisms will be used: observational experimentation, surveys, monitoring through apps or diaries as well as specific waste characterizations. In the case of Zamudio waste generation habits will be monitored by the use of citizen e-cards that are used to open the waste containers.

Location

Spain

Promoter

UD

Actions

Implementations

Collect information from end users to find potential solutions for FW	Planning of the CS activity (2021/10/22 - 2022/03/15)
	Recruit end-users (2021/10/22 - 2021/10/22)
	Completion of CS activity and conduct post-activity survey. KPI measurements/reporting. Monitoring will be con (2021/10/22 - 2021/10/22)
	Design of the methodology (Material, e.g. sureys provided by UD). (2021/10/22 - 2022/03/15)
	Design of the methodology (Material, e.g. surveys provided by UD) for developing the cooking book of recipes for households (2021/10/22 - 2021/10/15)
KPIs identification and measurement	Baseline. Design survey to collect information from end-users (families/citizens) and KPIs definition (Surveys provided by UD) (2021/10/22 - 2022/03/15)
	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
CS1 update	CS1 update meeting (2022/03/01 - 2022/03/01)

Strategy

Name

CS2. Working groups to co-create specific contents to develop the e-learning materials of T2.2

Description

Working groups to co-create specific contents to develop the e-learning materials of T2.2.

Location

Spain

Promoter

GEO

Actions

Implementations

Create e-learning material	Select/Define e-learning material for task 2.2 (2021/10/22 - 2022/02/04)
	Participate in workshop with Geonardo to discuss selected e-learning material (2021/10/22 - 2022/02/04)

Strategy

Name

CS3. Gender dimension.
Working groups involving women to assess the gender dimension

Description

Working groups involving women to assess the gender dimension. In order to assess gender dimension a qualitative methodological design (narrative productions) will be carried out from the feminist perspective.

Location

Spain

Promoter

UD

Actions

Implementations

Create qualitative data using the Narrative production method to assess the gender dimension	Planning of the activity (2021/10/22 - 2022/07/02)
	Recruit working group and define KPIs of the activity (2021/10/22 - 2022/11/19)
	Completion of Workshops with women (Using Narrative production methodology) (2021/10/22 - 2021/11/19)
CS3 update	CS3 update meeting (2022/03/07 - 2022/03/07)
	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2022/03/07)
KPIs identification and measurement	Create survey to establish the baseline for KPIs identification (2021/10/22 - 2022/02/07)
Methodology to assess gender dimension	Design the methodology to assess gender dimension (2021/10/22 - 2021/09/07)

Strategy

Name

CS4. Fiscal instruments and tax incentives

Description

Participatory processes to discuss the possible fiscal instruments proposed in T4.4 to test the real incidence of the tax incentives in individuals and families, commerce and industry. Also, the building strategies of T4.2 will be assessed with the FVCs. With those inputs the fiscal instrument proposals will be reviewed.

Location

Spain

Promoter

FEBEA

Actions

KPIs identification and measurement

CS4 update

Determine how this legislative change impacts the donations of fresh bread

Implementations

KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)

Create survey to establish the baseline for KPIs identification (2021/10/22 - 2021/10/22)

CS4 Update meeting (2022/03/08 - 2022/03/08)

Planning of the activity (2021/10/22 - 2021/10/22)

Design the methodology (2021/10/22 - 2021/10/22)

Recruit working group and define KPIs of the activity (2021/10/22 - 2021/10/22)

Completion 1. Focus group /Workshop to discuss fiscal instruments proposed in T4.4 and measure KPIs (2021/10/22 - 2021/10/22)

Completion 2. Focus group /Workshop to discuss Capacity building strategies in T4.2 and measure KPIs (2021/10/22 - 2021/10/22)

Strategy

Name

CS5. Working groups to define the scope of the project and co-create the different solutions of the project

Description

Working groups to define the scope of the project and co-create the different solutions of the project: identification of the target groups to define the needs of the system, the identification of barriers (legal, data security, confidence...), the main functionalities, the usability requirements... and test the solutions.

Location

Spain

Promoter

UD

Actions

Implementations

KPIs identification and measurement	Assesment of all the outcomes and KPIs measurement/reporting (2021/10/22 - 2021/10/22)
	Create survey to establish baseline for KPIs identification (2021/10/22 - 2021/01/07)
Co-creation activity of Use Cases with partners and Associated Partners	Preparatory action with pilot coordinators, pilot partners and solution managers (2021/10/22 - 2021/09/01)
	Completion. Conduct 1 or 2 workshop and co-design the different solutions of the project (2021/10/22 - 2021/10/06)
CS5 update	CS5 update meeting (2022/03/08 - 2022/03/08)
Define the scope of the project and co-create the different solutions of the project	Design the methodology (2021/07/01 - 2021/07/01)
	Planning of the activity (2021/07/01 - 2021/07/01)

Strategy

Name

CS6. Working groups to discuss about the methodology for the quantification of food losses and waste

Description

Working groups to discuss about the methodology for the quantification of food losses and waste and its environmental, social and economic impacts as well as the evaluation of prevention actions.

Location

Spain

Promoter

UD

Actions

Implementations

Create a short list of KPIs to quantify FW and FL	Phase 1. Expert consultation (2021/10/22 - 2021/11/06)
	Phase 2. Stakeholders consultation. Different survey (Need to analyse with them if KPIs are relevant) (2021/10/22 - 2021/11/06)
	Phase 3. Workshop for experts and stakeholders (2021/10/22 - 2021/10/22)

Strategy

Name

CS7. Working groups to discuss the result of the baseline, assess the causes and the existing solutions to identify potential solutions and barriers to be implemented following the methodology described in T4.1

Description

Working groups to discuss the result of the baseline, assess the causes and the existing solutions to identify potential solutions and barriers to be implemented following the methodology described in T4.1. Entrepreneurs and Start-ups are also key players to address the main challenges in all the VC A methodology to scouting, attracting and implementing prototypes by all living labs will be developed. For those solutions that can be immediately implemented and with low cost the group will manage a specific budget to uptake them adapted to the pilot cases (this can be for example, solutions to improve food conservation at schools, logistics and storage solutions for food donation involving volunteers or associations as taxi drivers...). Those actions that requires large investments and collaboration among stakeholders will be proposed as part of the solutions portfolio to be assess in Task 4.2 to find building capacity strategies for the short-medium term.

Location

Spain

Promoter

AIN

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting (2021/10/22 - 2021/10/22)
	Create survey to establish baseline for KPIs identification (2021/10/22 - 2021/10/22)
Identify causes of problems in value chain and possibles solutions	Design the methodology (2021/10/22 - 2021/10/22)
	Planning of the activity (2021/10/22 - 2021/10/22)
	Participant (Start-up and entrepreneurs) rectruitment/contact (2021/10/22 - 2021/10/22)
	Completion. Conduct workshop for start-ups and entrepreneurs . KPIs measurement (2021/10/22 - 2021/10/22)

Strategy

Name

CS8. A participatory process to define the municipal tax of the PAYT considering the impact of FW prevention

Description

A participatory process to define the municipal tax of the PAYT considering the impact of FW prevention (definition of the catalogue of FW prevention initiatives, the algorithm to calculate the tax, and the validation of the invoices or redefinition of the tax).

Location

Spain

Promoter

Zamudio

Actions

Implementations

KPIs identification and measurement	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
	Create survey to establish baseline for KPIs identification (2021/10/22 - 2021/10/22)
Define the municipal tax of PAYT	Design the methodology (2021/10/22 - 2021/10/22)
	Planning of the activity (2021/10/22 - 2021/10/22)
	Recruitment of Workshop/participatory process participants (2021/10/22 - 2021/10/22)
	Conduct workshop/participatory process (2021/10/22 - 2021/10/22)

Strategy

Name

CS9. Actions to develop healthy and sustainable diets. Actions to develop and deploy a nutritionally balanced gastronomic and sustainable guideline in real context

Description

Actions to develop healthy and sustainable diets. Actions to develop and deploy a nutritionally balanced gastronomic and sustainable guideline in real context: - Study and analysis of the gastronomic and cultural profile of the area through Interviews / workshops led by experts in gastronomy from BCC to local actors in the restoration area: surveys focused on health professionals from the region to identify the most relevant public health problems; surveys to identify consumers’ profile (tastes, preferences, expectations) for menu adaptations/modifications. - Conferences to disseminate the principles of the guideline. - Workshops and training talks about discards management. - Actions to develop a culinary intervention program directed to train community (people in need) in the principles of nutrition (equilibrated diets) and culinary skills to reduce FW. - Culinary training workshops in kitchens and monitoring the impact on health and food consumption. - Actions to improve food engagement at schools through sensory strategies. - Actions to learn about the knowledge of marking date labels and food conservation.

Location

Spain

Promoter

BCC

Actions

Implementations

Actions to improve food engagement at schools through sensory strategies and to learn about the knowledge of marking date labels and food conservation	Planning and design of actions (2021/10/22 - 2021/10/22)
	Completion of all actions (2021/10/22 - 2021/10/22)
KPIs identification and measurement	Measurement of KPIs of all the actions, using surveys designed at beginning of action (2021/10/22 - 2021/10/22)
	E.g. Create surveys to establish baseline and select KPIs for all the actions (2021/10/22 - 2021/10/22)
Dissemination of the guideline's principles	Planning of conferences to disseminate the principles of the guideline (2021/10/22 - 2021/10/22)
Culinary training workshops in kitchens and monitoring the impact on health and food consumption	Planning and design of training workshops (2021/10/22 - 2021/10/22)
Develop a nutritionally balanced gastronomic and sustainable guideline	Design the methodology (2021/10/22 - 2021/10/22)
	General planning of the CS activity (2021/10/22 - 2021/10/22)
Study and analysis of the gastronomic and cultural profile of the area	Design methodology to study cultural and social value of bread and analyse retail and consumer behaviour towards bakery products (2021/10/22 - 2021/10/22)
Workshops and training talks about discards management	Planning of workshops and training talks (2021/10/22 - 2021/10/22)

Strategy

Name

CS10. Working groups to discuss innovative models with entrepreneurs (social and non-social) to develop new business

Description

Working groups to discuss innovative models with entrepreneurs (social and non-social) to develop new business as well as exosystemic alliances among stakeholders and volunteer agreements signature (i.e., for food donation, for the use of the existing logistics networks as taxis associations, postal service...).

Location

Spain

Promoter

Correos

Actions

Implementations

KPIs identification and measurement	Baseline: KPIs Identification of all the actions. E.g. Create surveys to establish baseline and select KPIs for all the actions (2021/10/22 - 2021/10/22)
	KPI measurements/reporting to assess the impact of the activity (2021/10/22 - 2021/10/22)
Develop alliance among supermarkets dedicated to FW prevention and reduction	Recruit participants for the discussion and planification (2021/10/22 - 2021/10/22)
	Completion. Conduct discussion on innovative models to develop new business as well as exosystemic alliances (2021/10/22 - 2021/10/22)

Annex III. KPIs sheets

Name of the indicator		Indicator code	
1. General description			
Variable	Latent variable		
Stage	Production, processing, distribution, retail or consumption		
Type	Direct or indirect		
2. Calculation methodology			
Definition	Detailed description		
Standardised methodology	Indicate whether it comes from a standardised methodology and which is it		
Formula	Indicate the formula to calculate it and the parameters needed to do it		
Unit of measurement	Unit of measurement		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Identify for primary data: information source, alternative source, and measurement location. And for secondary data: reference source and alternative sources.		
Accounting periodicity	Frequency of calculation (daily, monthly, yearly)		
Data source	Data source (public administration, X database...)		
3. Observations			
Preliminary indicators	Required indicators to calculate it		
Subsequently indicators	Indicators for which calculation this indicator is used		
Related causes of FLW	Cause of FLW generation for which this KPI also works as an indicator		
FOODRUS objectives	FOODRUS objectives whose achievement this KPI helps measure.		

Integration with Food Supply Chain partners		Priority level 2 (Recommended)	CO1
1. General description			
Variable	Cooperation		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	It measures the level and extent of collaboration and partnership along the entire supply chain. Measured as nº initiatives (events, projects, activities...) related with FLW prevention with other partners of the FSC.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the number of social actions deployed in the pilot. Automatic calculation from social actions module.		
Accounting periodicity	M18, M30, M40.		
Data source	Social actions database		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of/inefficient coordination and communication between actors.		
FOODRUS objectives	SO1, SO3, SO5, SO7, SO8.		

% purchasing budget spent in local providers		Priority level 2 (Recommended)	CO2
1. General description			
Variable	Cooperation		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	It will quantify the financial resources that are assigned to local services/products. It is measured as percentage of purchasing budget spent in local providers in relation to the total amount of money spent in providers.		
Standardised methodology	Non-standardised.		
Formula	$CO2 = \frac{\text{Purchasing budget spent in local providers (€)}}{\text{Total purchasing budget spent (€)}}$		
Unit of measurement	%		
Spanish pilot		Slovak pilot	Danish pilot
Calculation procedure	Not applicable. Florette: All the lettuces are produced in Spain. Eroski: The provider is always Florette.	It could be done but measured in tonnes of local food purchased (supermarkets). They already have historical data for its baseline calculation.	<i>Under definition.</i>
Accounting periodicity		Yearly.	<i>Under definition.</i>
Data source		Supermarkets databases.	<i>Under definition.</i>
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Shelf life losses due to logistics obstacles: Traffic congestion, hostile weather, long distances...		
FOODRUS objectives	SO1, SO3, SO4, SO7, SO8.		

Multifunctional cooperation between departments		Priority level 2 (Recommended)	CO3
1. General description			
Variable	Cooperation		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Cooperation between departments within the same company involving a group of people with different technical expertise who work together towards a common goal. Measured as n ^o active cooperations against FLW between departments.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		

Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the number of social actions deployed in the pilot where the number of departments involved is more than 1. Automatic calculation from social actions module.		
Accounting periodicity	Continuos monitoring, after every action.		
Data source	Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO5, SO7, SO8.		

Transport distance covered by third parties		Priority level 2 (Recommended)	CO4
1. General description			
Variable	Cooperation		
Stage	Distribution		
Type	Direct		
2. Calculation methodology			
Definition	It will define the part of the distribution carried out by a third party. Measured as transport distances (km) covered by an external company to carry out your products' distribution.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	km		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure		Not applicable due to the short distances and to the fact that bakeries are within the	<i>Under definition.</i>
Accounting periodicity	Not applicable.	supermarkets.	<i>Under definition.</i>
Data source			<i>Under definition.</i>
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of/inefficient coordination and communication between actors.		
FOODRUS objectives	SO1, SO3.		

Total amount of FLW prevented/cost of the action implementation		Priority level 2 (Recommended)	EC1
1. General description			
Variable	Economic performance		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio to measure the amount of FW prevented per cost of the reduction action implemented (tonnes FLW/€).		
Standardised methodology	Non-standardised.		
Formula	$EC1 = \frac{\text{Total tonnes of FLW prevented (QU4)}}{\text{Cost of the action implementation (€) (RE2)}}$		
Unit of measurement	Tonnes FLW/€		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Sum of the QU4 results for all the hotspots involved in the action divided into the cost of the corresponding action implementation.		
Accounting periodicity	Continuous monitoring, after every action.		
Data source	Measurement of the FLW quantification KPI (QU4) + economic reports of the project.		
3. Observations			
Previous indicators	RE2, QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO8.		

Net economic benefits/cost of the action implementation		Priority level 2 (Recommended)	EC2
1. General description			
Variable	Economic performance		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio to measure the benefits per cost of the reduction action implemented (€/€).		
Standardised methodology	Non-standardised.		
Formula	$EC2 = \frac{\sum \text{Costs avoided per stage of the FVC (€)}}{\text{Cost of the action implementation (€) (RE2)}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	An estimated cost per stage of the FVC will be associated to the amount of FLW avoided (€/kg) * QU4 (kg). This will be calculated for each stage of the FVC and the total sum for a given pilot will be the numerator of the KPI. The denominator will be extracted from the economic reports of the project per pilot.		
Accounting periodicity	M18, M40.		
Data source	Pilots' data estimations.		
3. Observations			
Previous indicators	RE2, QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO8.		

Total nº of businesses reporting a FLW reduction/cost of the action implementation		Priority level 2 (Recommended)	EC3
1. General description			
Variable	Economic performance		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio to measure the level of involvement of businesses in the FLW reduction per cost of the action implemented (nº businesses/€).		
Standardised methodology	Non-standardised.		
Formula	$EC3 = \frac{n^{\circ} \text{ businesses reporting FLW reduction}}{\text{Cost of the action implementation (€) (RE2)}}$		
Unit of measurement	nº businesses/€		

	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the nº businesses reducing FLW divided into the cost of the action implementation.		
Accounting periodicity	M18, M40.		
Data source	The numerator will be extracted from the FOODRUS suite (R12) and the denominator will be extracted from the economic reports of the project.		
3. Observations			
Previous indicators	IM2, RE2.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO8.		

Total nº of businesses tracking FLW/cost of the action implementation		Priority level 2 (Recommended)	EC4
1. General description			
Variable	Economic performance		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio to measure the level of involvement of businesses in the FLW tracking per cost of the action implemented (nº businesses/€).		
Standardised methodology	Non-standardised.		
Formula	$EC4 = \frac{n^{\circ} \text{ businesses tracking FLW}}{\text{Cost of the action implementation (€) (RE2)}}$		
Unit of measurement	nº businesses/€		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the nº businesses tracking FLW divided into the cost of the action implementation.		
Accounting periodicity	M18, M40.		
Data source	The numerator will be extracted from the FOODRUS suite (R12) and the denominator will be extracted from the economic reports of the project.		
3. Observations			
Previous indicators	IM1, RE2.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO8.		

Total nº of people (end consumers) changing behaviour/cost of the action implementation		Priority level 2 (Recommended)	EC5
1. General description			
Variable	Economic performance		
Stage	Consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio to measure the behavioural change in end consumers per cost of the action implemented (nº end consumers/€).		
Standardised methodology	Non-standardised.		
Formula	$EC5 = \frac{n^{\circ} \text{ end consumers changing behaviour}}{\text{Cost of the action implementation (€) (RE2)}}$		
Unit of measurement	nº end consumers/€		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	The nº families that are reducing their FLW will be measured. For the behavioural change happening in another initiatives, specific KPIs from the CSA will be included (to be defined with the BCC).	Possible approach: To monitor the nº of families that are reducing the FLW (we will measure it with the food app/diaries) or creating a new survey for the supermarkets.	<i>Under definition.</i>
Accounting periodicity	M18, M30, M40.		
Data source	The numerator will be extracted from the data collected for other KPI (SP1) and the denominator will be extracted from the economic reports of the project.		
3. Observations			

Previous indicators	SP1, RE2.
Subsequently indicators	-
Related causes of FLW	-
FOODRUS objectives	SO1, SO2, SO4, SO8.

% increase of sales of local/seasonal/organic/ugly food		Priority level 2 (Recommended)	EC6
1. General description			
Variable	Economic performance		
Stage	Retail		
Type	Indirect		
2. Calculation methodology			
Definition	Increase of sales of local/seasonal/organic/ugly food in comparison to total sales in a period of time.		
Standardised methodology	Non-standardised.		
Formula	$EC6 = \frac{Sales\ of\ local, organic, seasonal, or\ ugly\ food\ products\ (€)}{Total\ sales\ (€)}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Ugly food interventions were already being conducted before the project (labelling the ugly vegetables to promote their sale). The impact of the new draft law could be analysed here since it states the obligation to have an ugly food sale point. Since Eroski is not reporting cases of food wasted as ugly food in the case of salads, the impact of such new draft law will be studied for carrots instead. It will be measured at the end of the project when the draft law is already effective, and compared with the historical data.		Under definition.
	Not applicable.		
Accounting periodicity	M18, M40.		Under definition.
Data source	Pilots' data systems.		Under definition.
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO5, SO7, SO8.		

% costs avoided		Priority level 1 (Mandatory - Grant Agreement)	EC7
1. General description			
Variable	Economic performance		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of costs, related to FLW, that are avoided after the project is ended with respect to FLW costs before the project started. The investment in the technologies or solutions that are being implemented to avoid FLW have to be counted as well.		
Standardised methodology	Non-standardised.		
Formula	$EC7 = \frac{\text{Costs related to FLW avoided (QU4) after the project ends (€)}}{\text{Costs related to FLW generated (QU2) before the project started (€)}}$		
Unit of measurement	%		
Spanish pilot		Slovak pilot	Danish pilot

Calculation procedure	An estimated cost per stage of the FVC will be associated to the amount of FLW avoided (€/kg) * QU4 (kg). This will be calculated for each stage of the FVC and the total sum for a given pilot will be the numerator of the KPI. The denominator will be calculated as an estimated cost per stage of the FVC associated to the amount of FLW generated (€/kg) * (QU2) (kg).
Accounting periodicity	M18, M40.
Data source	Pilots' data estimation.
3. Observations	
Previous indicators	QU2, QU4.
Subsequently indicators	-
Related causes of FLW	-
FOODRUS objectives	SO1, SO4, SO6, SO8.

Total number of regional roadmaps		Priority level 1 (Mandatory - Grant Agreement)	IN1
1. General description			
Variable	Involvement performance		
Stage	Project level		
Type	Direct		
2. Calculation methodology			
Definition	Total Number of Regional Roadmaps defined for new regions (collaborating as associated regions) from the transfer of results achieved in the project.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
Followers			
Calculation procedure	Counting.		
Accounting periodicity	M40.		
Data source	Results of the project.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO6, SO9.		

Number of banks and public entities involved		Priority level 1 (Mandatory - Grant Agreement)	IN2
1. General description			
Variable	Involvement performance		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Number of banks and public entities involved in any activity carried out in the pilots.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the number of banks and public entities involved in the social actions. Automatic calculation from social actions module. This KPI will be measured in every social action.		
Accounting periodicity	M18, M30, M40.		
Data source	Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO5, SO7, SO8.		

Certification entities and public administrations involved		Priority level 1 (Mandatory - Grant Agreement)	IN3
1. General description			
Variable	Involvement performance		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Number of certification entities and public administrations involved in any activity carried out in the pilots.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the nº entities with which there has been a collaboration.	Counting the nº entities with which there has been a collaboration.	<i>Under definition.</i>
Accounting periodicity	M40.		

Data source	Social actions database.
3. Observations	
Previous indicators	-
Subsequently indicators	-
Related causes of FLW	-
FOODRUS objectives	SO1, SO5, SO7, SO8.

Annual FLW generated per capita (end consumers)		Priority level 2 (Recommended)	QU1
1. General description			
Variable	Quantification		
Stage	Retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Annual weight of FLW generated per capita (end consumers).		
Standardised methodology	Standardised in the Delegated Decision (EU) 2019/1597 of 3 May 2019.		
Formula	$QU1 = \frac{\text{Tonnes of FLW generated}}{n^{\circ} \text{ end consumers generating the FLW}}$		
Unit of measurement	Tonnes FLW/consumer and year		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	This KPI will be calculated with the data gathered in the CS1. The data about FLW generated will be first collected through: either the Food loop app (S8.1) and the diaries (Annex IV) directly for consumers and HORECA employees for the 3 FVCs; and the urban waste characterization protocol for the total urban biowaste generated at the municipal level (Annex VI). For the denominator, in the case of the data collected via Food loop app or diaries, it will be the n° users providing data. And at municipal level, the denominator of this KPI will be the population in which the measurement is taking place.		
	There is a study carried out by Elika that may be of interest to extract historical data for the baseline.	It will be measured in kgs instead. They already have data for its baseline calculation. The data will be collected at the beginning and at the end of the week (per family).	<i>Under definition.</i>
Accounting periodicity	M18, M40.		
Data source	Public research (data input through the Food app, diaries and R12). Food app: https://foodapp.apps.foodrus.eu/		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1. SO2. SO5. SO6. SO8.		

Total Food Waste (Tonnes) (Per stage of the FVC)		Priority level 1 (Mandatory - Delegated decision)	QU2
1. General description			
Variable	Quantification		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Total weight of FLW generated in each stage of the Food Value Chain.		
Standardised methodology	Standardised in the Delegated Decision (EU) 2019/1597 of 3 May 2019.		
Formula	Direct measurement.		
Unit of measurement	Tonnes FLW		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	As indicated in the corresponding table for the SPP in the column "Measurement method" (Annex VII).	As indicated in the corresponding table for the SLP in the column "Measurement method" (Annex VII).	As indicated in the corresponding table for the DP in the column "Measurement method" (Annex VII).
Accounting periodicity	M18, M40.		
Data source	FOODRUS suite (R12).		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO5, SO6, SO8.		

Total Edible Food Waste (Tonnes) (Per stage of the FVC)	Priority level 1 (Mandatory - Delegated decision)	QU3
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1. General description			
Variable	Quantification		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Total weight of edible FLW generated in each stage of the Food Value Chain.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Tonnes edible FLW		
Calculation procedure	Spanish pilot	Slovak pilot	Danish pilot
	As indicated in the corresponding table for the SPP in the column "Measurement method" (Annex VII) only for the cases where the food is edible.	As indicated in the corresponding table for the SLP in the column "Measurement method" (Annex VII) only for the cases where the food is edible.	As indicated in the corresponding table for the DP in the column "Measurement method" (Annex VII) only for the cases where the food is edible.
Accounting periodicity	M18, M40.		
Data source	FOODRUS suite (R12).		
3. Observations			
Previous indicators	QU2.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO5, SO8.		

Total weight of food waste avoided per stage and final destination		Priority level 2 (Recommended)	QU4
1. General description			
Variable	Quantification		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Total weight of FLW avoided in each stage of the FVC, and for each final destination. Example: 3 tonnes of avoided FLW in the processing stage because it is sent to animal feeding.		
Standardised methodology	Standardised in the Delegated Decision (EU) 2019/1597 of 3 May 2019.		
Formula	$QU4 = \frac{\left(\frac{FLW\ generated}{Food\ produced}\right)_{Previous\ year} - \left(\frac{FLW\ generated}{Food\ produced}\right)_{Reference\ year}}{\left(\frac{FLW\ generated}{Food\ produced}\right)_{Previous\ year}} * 100$		
Unit of measurement	Tonnes FLW avoided		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	As indicated in the corresponding table for the SPP in the column "Measurement method" (Annex VII) only for the cases where the food is sent to a prevention destination.	As indicated in the corresponding table for the SLP in the column "Measurement method" (Annex VII) only for the cases where the food is sent to a prevention destination.	As indicated in the corresponding table for the DP in the column "Measurement method" (Annex VII) only for the cases where the food is sent to a prevention destination.
Accounting periodicity	M18, M40.		
Data source	FOODRUS suite (R12).		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO5, SO6, SO8.		

Total weight of edible food waste avoided per stage and final destination		Priority level 2 (Recommended)	QU5
1. General description			
Variable	Quantification		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			

Definition	Total weight of edible FLW avoided in each stage of the Food Value Chain and for each final destination.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Tonnes edible FLW avoided		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	As indicated in the corresponding table for the SPP in the column "Measurement method" (Annex VII) only for the cases where the food is edible and was sent to a prevention destination.	As indicated in the corresponding table for the SLP in the column "Measurement method" (Annex VII) only for the cases where the food is edible and was sent to a prevention destination.	As indicated in the corresponding table for the DP in the column "Measurement method" (Annex VII) only for the cases where the food is edible and was sent to a prevention destination.
Accounting periodicity	M18, M40.		
Data source	FOODRUS suite (R12).		
3. Observations			
Previous indicators	QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO5, SO8.		

% packaging saved		Priority level 1 (Mandatory - Grant Agreement)	EF1
1. General description			
Variable	Environmental footprint		
Stage	?		
Type	Indirect		
2. Calculation methodology			
Definition	Evolution of the ratio of packaging units produced with respect to the total amount of packaging units sold (between the current year and the year of reference).		
Standardised methodology	Non-standardised.		
Formula	$EF1 = \frac{n^{\circ} \text{ packaging units produced in the current year}}{n^{\circ} \text{ packaging units produced in the year of reference}} / \frac{n^{\circ} \text{ packaging units sold in the current year}}{n^{\circ} \text{ packaging units sold in the year of reference}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition in WP4.		
Data source			
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO6, SO8.		

Water footprint of FLW avoided		Priority level 2 (Recommended)	EF2
1. General description			
Variable	Environmental footprint		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Cubic meters of water consumed by the FLW avoided.		
Standardised methodology	Under definition in WP4.		
Formula	Under definition in WP4.		
Unit of measurement	m ³ of water		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition in WP4.		
Data source			
3. Observations			
Previous indicators	QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO6, SO8.		

Carbon footprint of FLW avoided		Priority level 2 (Recommended)	EF3
1. General description			
Variable	Environmental footprint		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Kilograms of CO ₂ equivalent produced by the FLW avoided.		
Standardised methodology	Standardised in the ISO 14067:2018.		
Formula	$EF3 = \sum_n^i kg\ GHG_i \times GWP_{GHGi}$		
Unit of measurement	Kg of CO ₂ equivalent		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition in WP4.		
Data source			
3. Observations			
Previous indicators	QU4.		

Subsequently indicators	-
Related causes of FLW	-
FOODRUS objectives	SO1, SO6, SO8.

Carbon footprint of edible FLW avoided		Priority level 2 (Recommended)	EF4
1. General description			
Variable	Environmental footprint		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Kilograms of CO ₂ equivalent produced by the edible FLW avoided.		
Standardised methodology	Standardised in the ISO 14067:2018.		
Formula	$EF4 = \sum_n^i kg\ GHG_i \times GWP_{GHGi}$		
Unit of measurement	Kg of CO ₂ equivalent		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition in WP4.		
Data source			
3. Observations			
Previous indicators	QU5.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO6, SO8.		

% water footprint avoided		Priority level 1 (Mandatory - Grant Agreement)	EF5
1. General description			
Variable	Environmental footprint		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of water footprint (m ³ of water) derived from the FLW avoided with respect to the water footprint associated to the FLW before the project started.		
Standardised methodology	Non-standardised.		
Formula	$EF5 = \frac{\text{Water consumed by the FLW avoided (m}^3\text{)}}{\text{Water consumed by the FLW before the project started (m}^3\text{)}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition in WP4.		
Data source			
3. Observations			
Previous indicators	QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO6, SO8.		

% carbon footprint avoided		Priority level 1 (Mandatory - Grant Agreement)	EF6
1. General description			
Variable	Environmental footprint		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of carbon footprint (kg CO ₂ eq) derived from the FLW avoided with respect to the carbon footprint associated to the FLW before the project started.		
Standardised methodology	Non-standardised.		
Formula	$EF6 = \frac{CO_2 \text{ produced by the FLW avoided (Kg CO}_2\text{eq)}}{CO_2 \text{ produced by the FLW before the project started (Kg CO}_2\text{eq)}}$		
Unit of measurement	%		

	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition in WP4.		
Data source			
3. Observations			
Previous indicators	QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO6, SO8.		

% recycling of FLW for biogas and biofertilizer production		Priority level 1 (Mandatory - Grant Agreement)	EF7
1. General description			
Variable	Environmental footprint		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of FLW heading recycling for the generation of biogas and biofertilizer in relation to the total amount of FLW generated.		
Standardised methodology	Non-standardised.		
Formula	$EF7 = \frac{\textit{Tonnes of FLW sent to recycling for the generation of biogas and biofertiliser}}{\textit{Tonnes of FLW generated}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition in WP4.		
Data source			
3. Observations			
Previous indicators	QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO6, SO8.		

% actors of the entire FVC involved in each pilot tracking FLW		Priority level 1 (Mandatory - Grant Agreement)	IM1
1. General description			
Variable	Implementation impact		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of actors in each pilot tracking FLW with respect to the total number of actors involved in the FVC.		
Standardised methodology	Non-standardised.		
Formula	$IM1 = \frac{n^{\circ} \text{ actors tracking FLW in the pilot}}{n^{\circ} \text{ actors involved in the FVC of the pilot}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Automatically calculated from the actors measuring the QU2.		
Accounting periodicity	M18, M40.		
Data source	FOODRUS suite (R12).		
3. Observations			
Previous indicators	-		
Subsequently indicators	EC4.		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO6, SO8.		

% actors involved in each pilot reporting a FLW reduction		Priority level 1 (Mandatory - Grant Agreement)	IM2
1. General description			
Variable	Implementation impact		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of actors in each pilot reporting a FLW reduction with respect to the total number of actors involved in the FVC.		
Standardised methodology	Non-standardised.		
Formula	$IM2 = \frac{n^{\circ} \text{ actors reporting a FLW reduction in the pilot (} n^{\circ} \text{ actors for which } QU2(t2) < QU2(t1))}{n^{\circ} \text{ actors involved in the FVC of the pilot}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Automatically calculated from the actors measuring the QU2.		
Accounting periodicity	M18, M40.		
Data source	FOODRUS suite (R12).		
3. Observations			
Previous indicators	-		
Subsequently indicators	EC3.		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO5, SO6, SO8.		

New business for FLW reduction and prevention		Priority level 1 (Mandatory - Grant Agreement)	IM3
1. General description			
Variable	Implementation impact		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Number of new businesses created whose main activity is the prevention and reduction of FLW.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting.		
Accounting periodicity	M40.		

Data source	Results of the project.
3. Observations	
Previous indicators	-
Subsequently indicators	SC1.
Related causes of FLW	-
FOODRUS objectives	SO1, SO6, SO8, SO10.

Solutions developed		Priority level 1 (Mandatory - Grant Agreement)	IM4
1. General description			
Variable	Implementation impact		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of achievement of the 23 solutions defined in the project.		
Standardised methodology	Non-standardised.		
Formula	$IM4 = \frac{n^{\circ} \text{ solutions achieved}}{\text{Total } n^{\circ} \text{ solutions defined in the project}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be calculated from the results achieved in the project.		
Accounting periodicity	M40.		
Data source	Results of the project.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO8, SO10.		

New best practices adopted per pilot		Priority level 1 (Mandatory - Grant Agreement)	IM5
1. General description			
Variable	Implementation impact		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Number of new best practices whose objective is to prevent and reduce FLW in each pilot.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the number of social actions considered as best practices deployed in the pilot. Automatic calculation from social actions module. This KPI will be measured in every social action.		
Accounting periodicity	M18, M30, M40.		
Data source	Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO5, SO6, SO8.		

Environmental awareness of consumers		Priority level 2 (Recommended)	LA1
1. General description			
Variable	Lack of awareness		
Stage	Consumption		
Type	Direct		
2. Calculation methodology			
Definition	Level of awareness among consumers regarding FW. It is measured with a survey at the beginning of the project, and another one after the project finishes.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Nº answers.		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It is measured with a survey at the beginning of the project, and another one after the project finishes. Automatic calculation from social actions module.		
Accounting periodicity	At the beginning of the social program deployment and after the social program deployment.		
Data source	Zamudio citizens (Spain), Canteen Users (Denmark), Families (Slovakia). Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of awareness concerning FLW.		
FOODRUS objectives	SO1, SO3, SO5, SO8.		

Environmental awareness of chain employees		Priority level 2 (Recommended)	LA2
1. General description			
Variable	Lack of awareness		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Level of awareness among the chain employees related to their activities that cause FW.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Nº answers.		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It is measured with a survey at the beginning of the awareness campaign deployed in each one of the companies project, and after this deployment. Automatic calculation from social actions module.		
Accounting periodicity	At the beginning of the social program deployment and after the social program deployment.		
Data source	Companies participating in the project. Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of awareness concerning FLW.		
FOODRUS objectives	SO1, SO3, SO5, SO8.		

Kg of returned products		Priority level 2 (Recommended)	LO1
1. General description			
Variable	Logistics and reverse logistics		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Amount of products returned by downstream stakeholders of the supply chain.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Kg		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Not applicable.	Not applicable.	<i>Under definition.</i>
Data source			
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of/inaccurate demand forecasting; Food aspect requirements self-imposed by stakeholders; Cold chain interruptions; Shelf life losses due to logistics obstacles: Traffic congestion, hostile weather, long distances...; Take-back agreements (TBAs).		
FOODRUS objectives	SO1, SO3, SO4, SO5, SO7, SO8.		

Adopting just-in-time logistics system		Priority level 2 (Recommended)	LO2
1. General description			
Variable	Logistics and reverse logistics		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	A “Just-in-time” system is a production model where food products are produced in order to meet actual demands and avoid overstocking and push strategies. Measured as % of the food distributed using just-in-time logistics systems.		
Standardised methodology	Non-standardised.		
Formula	$LO2 = \frac{\textit{Tonnes of food distributed using just-in-time logistics systems}}{\textit{Total tonnes of food distributed}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Not applicable.	Not applicable.	<i>Under definition.</i>
Data source			
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of/inaccurate demand forecasting.		
FOODRUS objectives	SO1, SO3, SO4.		

Number of products recovered by reverse logistics		Priority level 2 (Recommended)	LO3
1. General description			
Variable	Logistics and reverse logistics		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Number of products recovered by reverse logistics.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Not applicable. Correos' solution will address the distribution of non-marketable products that can be consumed		
Accounting periodicity	Not applicable.	Under definition.	

Data source	by humans, but they don't expect return of products.
3. Observations	
Previous indicators	-
Subsequently indicators	-
Related causes of FLW	Lack of/inaccurate demand forecasting; Food aspect requirements self-imposed by stakeholders; Cold chain interruptions; Shelf life losses due to logistics obstacles: Traffic congestion, hostile weather, long distances...; Take-back agreements (TBAs).
FOODRUS objectives	SO1, SO3, SO4, SO5, SO7, SO8.

Packaging reduction by eco-design		Priority level 2 (Recommended)	PA1
1. General description			
Variable	Packaging		
Stage	Production, processing		
Type	Direct		
2. Calculation methodology			
Definition	Amount of packaging material that is reduced due to ecodesign criteria.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Grams		
Calculation procedure	Spanish pilot	Slovak pilot	Danish pilot
		The pilot is aiming at reducing the packaging in households by 30%. They will teach households to prefer unpackaged bread. They will work directly with families to measure this improvement.	<i>Under definition.</i>
	Not applicable.		
Accounting periodicity	M40.		
Data source	Survey.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Bad roads conditions and lack of a protector packaging.		
FOODRUS objectives	SO1, SO3, SO4.		

Use of ecological, reusable, recyclable packaging		Priority level 2 (Recommended)	PA2
1. General description			
Variable	Packaging		
Stage	Production, processing		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of packaging used in the product that is recyclable, reusable or ecological.		
Standardised methodology	Non-standardised.		
Formula	$PA2 = \frac{\textit{Weight of recyclable, reusable, or ecological packaging}}{\textit{Total weight of the packaging}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Thanks to the use of waste separation technologies the potential of the packaging to be recyclable will be explored. The value of this KPI in the baseline is zero.	The pilot will encourage households to buy more ecological/reusable packaging for bread. They will work directly with families to measure this improvement.	<i>Under definition.</i>
Accounting periodicity	M40.		
Data source	EDER's nº 1 use case.	Survey.	
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Packaging design favouring food spoilage.		
FOODRUS objectives	SO1, SO3, SO4.		

Use of protective packaging		Priority level 2 (Recommended)	PA3
1. General description			
Variable	Packaging		
Stage	Production, processing		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of protective packaging with respect to the total amount of packaging.		
Standardised methodology	No standardised.		
Formula	$PA3 = \frac{\textit{Weight of the packaging that protects the product from being damaged}}{\textit{Total weight of the packaging}}$		

Unit of measurement	%		
		Spanish pilot	Slovak pilot
			Danish pilot
Calculation procedure			
Accounting periodicity	Not applicable.	Not applicable.	<i>Under definition.</i>
Data source			
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Bad roads conditions and lack of a protector packaging; Packaging design favouring food spoilage.		
FOODRUS objectives	SO1, SO3.		

Additional information in the product for consumers to avoid FLW and improve biowaste and packaging separation rates		Priority level 2 (Recommended)	RE1
1. General description			
Variable	Redesigning the product or the production processes		
Stage	Production, processing, retail		
Type	Direct		
2. Calculation methodology			
Definition	Nº criteria added to the label to raise consumers awareness about FLW and improve biowaste and packaging separation rates.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the nº criteria or items added to the dashboard (S8.4) to raise consumer awareness and improve separation rates.		
Accounting periodicity	M40.		
Data source	Solution S8.4.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Confusion between "use by" and "best before" date.		
FOODRUS objectives	SO1, SO3, SO5, SO7, SO8.		

R&D investments in Circular Economy		Priority level 2 (Recommended)	RE2
1. General description			
Variable	Redesigning the product or the production processes		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	It represents the amount of investments allocated to R&D related to Circular Economy (€). It equals the cost of the action implementation since in this case all the investment corresponds to research.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	€		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be extracted from the economic reports of the project.		
Accounting periodicity	M18, M30, M40.		
Data source	Economic reports of the project.		
3. Observations			
Previous indicators	-		
Subsequently indicators	EC1, EC2, EC3, EC4, EC5.		
Related causes of FLW	Poor investment in FLW prevention innovations and technical specialisation.		
FOODRUS objectives	SO1, SO3, SO8.		

Investments in new technologies		Priority level 2 (Recommended)	RE3
1. General description			
Variable	Redesigning the product or the production processes		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Amount of money invested in acquiring/developing new technologies to reduce FW (€).		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	€		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be extracted from the economic reports of the project.		
Accounting periodicity	M18, M30, M40.		
Data source	Economic reports of the project.		
3. Observations			

Previous indicators	-
Subsequently indicators	EC7.
Related causes of FLW	Poor investment in FLW prevention innovations and technical specialisation.
FOODRUS objectives	SO1, SO3, SO8.

Demand forecast accuracy		Priority level 2 (Recommended)	PO1
1. General description			
Variable	Process operation efficiency		
Stage	Production, processing, retail		
Type	Indirect		
2. Calculation methodology			
Definition	It indicates how well a company is predicting its upcoming demand. Measured as ratio of n° products foretold with respect to n° products sold.		
Standardised methodology	Non-standardised.		
Formula	$PO1 = \frac{n^{\circ} \text{ products foretold to be sold}}{n^{\circ} \text{ products sold}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Florette: n° units foretold to be sold with respect to n° units finally sold. It could be done at the retail level. Eroski: It will be calculated for a specific store. <i>Under definition.</i>		
Accounting periodicity	M18, M40.		
Data source	Pilots' data systems.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of/inaccurate demand forecasting.		
FOODRUS objectives	SO1, SO3, SO4, SO7, SO8.		

Effective shipment consolidation and full vehicle loading		Priority level 2 (Recommended)	PO2
1. General description			
Variable	Process operation efficiency		
Stage	Distribution		
Type	Indirect		
2. Calculation methodology			
Definition	Transport vehicles seize all possible loading space and share it with other products if necessary/possible. Measured as % of occupation in the vehicles.		
Standardised methodology	Non-standardised.		
Formula	$PO2 = \frac{Volume\ of\ the\ vehicle\ occupied\ by\ the\ load}{Total\ volumetric\ capacity\ of\ the\ vehicle}$		
Unit of measurement	%		
Spanish pilot		Slovak pilot	Danish pilot
Calculation procedure	It will be calculated as the % of occupation in the refrigerated trucks that will be tested in the pilot.	Not applicable, the pilot doesn't work with the transport.	<i>Under definition.</i>
Accounting periodicity	M18, M40.		
Data source	Pilots' data systems.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4.		

Number of events (operational circumstances) that cause FLW		Priority level 2 (Recommended)	PO3
1. General description			
Variable	Process operation efficiency		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			

Definition	Nº of operational circumstances (for example when picking, sorting, cleaning...) that cause FLW.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Florette: It is already being measured.	It could be applied to bakeries, supermarkets and households (still pending).	Under definition.
	Eroski: It will be determined by the quality department.		
Accounting periodicity	M18, M40.		
Data source	Pilots' data systems.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Products are damaged due to bad practices in some process (harvesting, cleaning, screening, processing...).		
FOODRUS objectives	SO1. SO3. SO8.		

Production flexibility		Priority level 2 (Recommended)	PO4
1. General description			
Variable	Process operation efficiency		
Stage	Production, processing		
Type	Indirect		
2. Calculation methodology			
Definition	Production adaptability to changes in the demand. Ratio of nº product changes addressed with respect to the total nº of product changes requested.		
Standardised methodology	Non-standardised.		
Formula	$PO4 = \frac{n^{\circ} \text{ products changes made}}{n^{\circ} \text{ product changes requested}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Pending to be defined by Florette.	It could be applied to bakeries. It would leverage an improved communication with supermarkets. <i>Under definition.</i>	
Accounting periodicity	M18, M40.		
Data source	Pilots' data systems.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of/inaccurate demand forecasting; Poor investment in FLW prevention innocations and technical specialisation.		
FOODRUS objectives	SO1, SO3, SO4, SO5.		

Inventory turnover rate		Priority level 2 (Recommended)	PO5
1. General description			
Variable	Process operation efficiency		
Stage	Production, processing, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of costs associated to goods sold with respect to the average number of items in inventory. It is calculated to see if a business has overstocking in comparison to its sales level.		
Standardised methodology	Non-standardised.		
Formula	$PO5 = \frac{n^{\circ} \text{ products sold in a period of time}}{\text{Average } n^{\circ} \text{ products in inventory in a period of time}}$		
Unit of measurement	€/nº items		
Spanish pilot		Slovak pilot	Danish pilot

Calculation procedure	Florette: Not applicable. Short shelf life product with high rotation rate. Eroski: It will be applied to a specific store.	Not applicable. Fresh bread is not supposed to be in the inventory.	<i>Under definition.</i>
Accounting periodicity	M18, M40.		
Data source	Pilots' data systems.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Offering a wide variety of products, which leads to overstocking.		
FOODRUS objectives	SO1, SO3, SO4, SO8.		

Regular maintenance of the production equipment		Priority level 2 (Recommended)	PO6
1. General description			
Variable	Process operation efficiency		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Maintenance tasks are performed regularly to keep the production equipment working adequately.		
	Measured as € invested.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement		
Unit of measurement	€		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Not applicable.	Not applicable.	<i>Under definition.</i>
Data source			
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Equipment and systems breakdowns.		
FOODRUS objectives	SO1, SO3, SO4.		

Tonnes of ugly food, defective or expired food discharged		Priority level 2 (Recommended)	PQ1
1. General description			
Variable	Product quality		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Tonnes of ugly food, defective or expired food discharged.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Tonnes		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be measured from QU2 along with the identification of the causes.	It will be measured from QU2 along with the identification of the causes. In the case of bread only expired product would be applicable.	It will be measured from QU2 along with the identification of the causes.
	The expired product can be measured in Florette's plant. For Eroski it may be measured as the defective product that is ruled out due to broken packaging, etc		
Accounting periodicity	M18, M40.		
Data source	QU2.		
3. Observations			
Previous indicators	QU2.		
Subsequently indicators	-		
Related causes of FLW	Food quality and aspect standards requirements; Food aspect requirements self-imposed by stakeholders.		
FOODRUS objectives	SO1, SO2, SO3, SO4, SO5, SO8.		

Transport suitability according to the product		Priority level 2 (Recommended)	PQ2
1. General description			
Variable	Product quality		
Stage	Distribution		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of nº of food safety & quality transportation-based requirements fulfilled with respect to the total nº of food safety & quality transportation-based requirements for the food product under consideration.		
Standardised methodology	Non-standardised.		
Formula	$PQ2 = \frac{n^{\circ} \text{ food safety \& quality transportation-based requirements fulfilled}}{\text{Total } n^{\circ} \text{ food safety \& quality transportation-based requirements}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Not applicable. Correos indicates that all the requirements are always fulfilled.	Not applicable, the pilot doesn't work with the transport.	<i>Under definition.</i>
Accounting periodicity			<i>Under definition.</i>
Data source			<i>Under definition.</i>
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Cold chain interruptions; Shelf life losses due to logistics obstacles: Traffic congestion, hostile weather, long distances...		
FOODRUS objectives	SO1, SO3, SO4, SO8.		

Food products traceability		Priority level 2 (Recommended)	PQ3
1. General description			
Variable	Product quality		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			

Definition	Controlling the progress of the product from the manufacturer to the consumer through various production steps. Measured as Nº stages monitored in the FSC.		
Standardised methodology	Non-standardised.		
Formula	$PQ3 = \frac{n^{\circ} \text{ processes monitored}}{\text{Total } n^{\circ} \text{ processes}}$		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be measured as the nº processes that are being monitored divided by the total nº processes.		
Accounting periodicity	M18, M40.		
Data source	Pilots' data systems compared with R12.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Cold chain interruptions.		
FOODRUS objectives	SO1, SO3, SO8.		

Supplier rejection rate		Priority level 2 (Recommended)	PQ4
1. General description			
Variable	Product quality		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Ratio of suppliers rejected due to non-compliance of sustainability criteria with respect to the total number of suppliers.		
Standardised methodology	Non-standardised.		
Formula	$PQ4 = \frac{n^{\circ} \text{ suppliers rejected due to non-compliance FLW criteria}}{\text{Total } n^{\circ} \text{ suppliers}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Not applicable. However, the future impact of the label	Not applicable.	<i>Under definition.</i>
Accounting periodicity	scheme that will be developed		<i>Under definition.</i>
Data source	by HAZI could be analysed.		<i>Under definition.</i>
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Inappropriate food sourcing strategies.		
FOODRUS objectives	SO1, SO3, SO5, SO7.		

Order tracking		Priority level 2 (Recommended)	PQ5
1. General description			
Variable	Product quality		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Consumers have access to the delivery information of the product ordered at any time. Measured as N° delivery status tracked.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			Under definition.
Accounting periodicity	Not applicable.	Not applicable.	Under definition.
Data source			Under definition.
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of/inefficient coordination and communication between actors.		
FOODRUS objectives	SO1, SO3, SO7, SO8.		

Number of food safety certifications		Priority level 2 (Recommended)	PQ6
1. General description			
Variable	Product quality		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Number of food safety certifications along the supply chain.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting.		
Accounting periodicity	M18, M40.		
Data source	Results of the project.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Cold chain interruptions; Absence of a corporate social responsibility policy.		
FOODRUS objectives	SO1, SO3, SO4, SO8.		

% people (end consumers) reporting a change in behaviour		Priority level 2 (Recommended)	SP1
1. General description			
Variable	Social performance		
Stage	Retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of end consumers reporting a change in behaviour regarding avoidance of FLW generation.		
Standardised methodology	Non-standardised.		
Formula	$SP1 = \frac{n^{\circ} \text{ end consumers reporting a change in behaviour regarding avoidance of FLW generation}}{\text{Total } n^{\circ} \text{ end consumers participating}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be measured through a survey to the participants who took part in the pilots' social activities. Automatic calculation from social actions module.		
Accounting periodicity	M18, M40.		
Data source	Zamudio citizens (Spain); Canteens' Users (Denmark); Families (Slovakia). Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	EC5.		
Related causes of FLW	Lack of awareness concerning FLW.		
FOODRUS objectives	SO1, SO3, SO5, SO6, SO8.		

% staff reporting a change in behaviour		Priority level 2 (Recommended)	SP2
1. General description			
Variable	Social performance		
Stage	Production, processing, distribution, retail		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of employees reporting a change in behaviour regarding avoidance of FLW generation.		
Standardised methodology	Non-standardised.		
Formula	$SP2 = \frac{n^{\circ} \text{ employees reporting a change in behaviour regarding avoidance of FLW generation}}{\text{Total } n^{\circ} \text{ employees participating}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It is measured with a survey at the beginning of the activities deployed in each one of the companies project, and after this deployment. Automatic calculation from social actions module.		
Accounting periodicity	M18, M40.		
Data source	Companies participating in the pilot. Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of awareness concerning FLW.		
FOODRUS objectives	SO1, SO3, SO5, SO6, SO8.		

% people (end consumers) aware of the FLW prevention campaign		Priority level 2 (Recommended)	SP3
1. General description			
Variable	Social performance		
Stage	Retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Percentage of end consumers aware of the existence of the campaign.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be measured by counting the number of followers of FOODRUS social network. The KPI would be the periodic increment of followers.		
Accounting periodicity	Six-monthly.		
Data source	FOODRUS social networks.		

3. Observations	
Previous indicators	-
Subsequently indicators	-
Related causes of FLW	Lack of awareness concerning FLW.
FOODRUS objectives	SO1, SO3, SO5, SO8, SO11.

Number of people (end consumers) reached		Priority level 1 (Mandatory - Grant Agreement)	SP4
1. General description			
Variable	Social performance		
Stage	Retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Number of end consumers reached with the actions undertaken in the project.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the number of social actions deployed in the pilot. Automatic calculation from social actions module. This KPI will be measured in every social action.		
Accounting periodicity	M18, M30, M40.		
Data source	Social actions database.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Lack of awareness concerning FLW.		
FOODRUS objectives	SO1, SO6, SO8, SO11.		

Outreach/behavioural change observed		Priority level 1 (Mandatory - Grant Agreement)	SP5
1. General description			
Variable	Social performance		
Stage	Retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Behavioural change observed in the entire FVCs (It will depend on the specific objectives of each campaign).		
Standardised methodology	Non-standardised.		
Formula	$SP5 = \frac{QU2 \text{ at the end of the project} - QU2 \text{ at the beginning of the project}}{QU2 \text{ at the beginning of the project}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be measured from the results of QU2 and QU4, evaluating how actors are reducing the FLW generated.		
Accounting periodicity	M18, M40.		
Data source	QU2, QU4.		
3. Observations			
Previous indicators	QU2, QU4.		
Subsequently indicators	-		
Related causes of FLW	Lack of awareness concerning FLW.		
FOODRUS objectives	SO1, SO3, SO5, SO8.		

% of people developing new skills		Priority level 1 (Mandatory - Grant Agreement)	SP6
1. General description			
Variable	Social performance		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of people developing new skills (that help prevent FLW) in relation to the total number of people reached.		
Standardised methodology	Non-standardised.		

Formula	$SP6 = \frac{n^o \text{ people giving a positive answer to the question}}{n^o \text{ people reached answering the question}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be measured on the e-learning platform with a self-assessment questionnaire at the end of a learning activity.		
Accounting periodicity	M40.		
Data source	E-learning platform.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	Limited cooking abilities; Not using up leftovers due to lack of knowledge.		
FOODRUS objectives	SO1, SO3, SO5, SO6, SO8.		

Number of people in need with a better diet		Priority level 1 (Mandatory - Grant Agreement)	SP7
1. General description			
Variable	Social performance		
Stage	Retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Number of people in need helped by the project through the provision of a better diet.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure			
Accounting periodicity	Under definition.		
Data source			
3. Observations			
Previous indicators	SP4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO6, SO8.		

% nutritional value saved		Priority level 1 (Mandatory - Grant Agreement)	SP8
1. General description			
Variable	Social performance		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Percentage of food nutritional value (kcal) associated to FW avoided with respect to FW nutritional value before the project started.		
Standardised methodology	Non-standardised.		
Formula	$SP8 = \frac{\text{kcal of food nutritional value associated to the FLW avoided (QU4)}}{\text{kcal of food nutritional value associated to the FLW avoided (QU4) before the project started}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will measured from the amount of FLW avoided sent to donation (QU4) and the corresponding nutritional factors included in the FRESH calculator.		
Accounting periodicity	M18, M40.		
Data source	QU4.		
3. Observations			
Previous indicators	QU4.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO6, SO8.		

Social new business models		Priority level 1 (Mandatory - Grant Agreement)	SC1
1. General description			
Variable	Social outcomes		
Stage	Production, processing, distribution, retail		
Type	Direct		
2. Calculation methodology			
Definition	Number of new social businesses created whose main activity is the prevention and reduction of food waste.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting.		
Accounting periodicity	M40.		
Data source	Results of the project.		
3. Observations			
Previous indicators	IM3.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1. SO5. SO6. SO8. SO10.		

Number of exploitation and dissemination activities beyond the duration of the project		Priority level 1 (Mandatory - Grant Agreement)	SC2
1. General description			
Variable	Social outcomes		
Stage	Project level		
Type	Direct		
2. Calculation methodology			
Definition	Number of exploitation and dissemination activities beyond the duration of the project.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	D&C: Data collected through common google form report. Exploitation: Data collected through a google form.		
Accounting periodicity	D&C: Every six months. Exploitation: Annual.		
Data source	D&C: Google forms. Exploitation: Google forms.		
3. Observations			
Previous indicators	-		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO8, SO10, SO11.		

Number of replicated cases		Priority level 1 (Mandatory - Grant Agreement)	SC3
1. General description			
Variable	Social outcomes		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Nº of replicated cases based on the project's best practices.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	nº		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	Counting the number of social actions deployed in the pilot. Automatic calculation from social actions module. This KPI will be measured in every social action.		
Accounting periodicity	M18, M30, M40.		

Data source	Social actions database.
3. Observations	
Previous indicators	-
Subsequently indicators	-
Related causes of FLW	-
FOODRUS objectives	SO1, SO9.

New secondary products created		Priority level 2 (Recommended)	TE1
1. General description			
Variable	Technical performance		
Stage	Production, processing		
Type	Indirect		
2. Calculation methodology			
Definition	New products created from FLW. Measured as percentage of FLW recovered as new products (tonnes/tonnes).		
Standardised methodology	Non-standardised.		
Formula	$TE1 = \frac{\text{Tonnes of FLW recovered as a new product}}{\text{Tonnes of FLW generated}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be calculated automatically from the QU2 (whose destination is to revalorise food waste into new food products).		
Accounting periodicity	M40.		
Data source	QU2.		
3. Observations			
Previous indicators	QU2.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO4, SO8.		

% decrease of expired food wasted		Priority level 2 (Recommended)	TE2
1. General description			
Variable	Technical performance		
Stage	Production, processing, distribution, retail, consumption		
Type	Indirect		
2. Calculation methodology			
Definition	Decrease in the percentage of food wasted as a consequence of reaching its expiration date.		
Standardised methodology	Non-standardised.		
Formula	$TE2 = \frac{\textit{Tonnes of food wasted as a consequence of reaching its expiration date}}{\textit{Tonnes of FLW generated}}$		
Unit of measurement	%		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be calculated from the FLW quantified in QU1 and QU2 that is related with the cause(s) that lead to expired food.		
Accounting periodicity	M18, M40.		
Data source	QU1, QU2.		
3. Observations			
Previous indicators	QU1, QU2.		
Subsequently indicators	-		
Related causes of FLW	Shelf life losses due to logistics obstacles: Traffic congestion, hostile weather, long distances...; Bad purchasing planning.		
FOODRUS objectives	SO1, SO2, SO3, SO4, SO5, SO8.		

Tonnes of waste to landfill		Priority level 2 (Recommended)	TE3
1. General description			
Variable	Technical performance		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Amount of FLW that heads landfill.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Tonnes		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be calculated from QU1 and QU2 (sent to landfill).		
Accounting periodicity	M18, M40.		
Data source	QU1, QU2.		
3. Observations			

Previous indicators	QU1, QU2.
Subsequently indicators	-
Related causes of FLW	-
FOODRUS objectives	SO1, SO2, SO4, SO5, SO8.



Tonnes of waste to incineration		Priority level 2 (Recommended)	TE4
1. General description			
Variable	Technical performance		
Stage	Production, processing, distribution, retail, consumption		
Type	Direct		
2. Calculation methodology			
Definition	Amount of FLW that heads incineration.		
Standardised methodology	Non-standardised.		
Formula	Direct measurement.		
Unit of measurement	Tonnes		
	Spanish pilot	Slovak pilot	Danish pilot
Calculation procedure	It will be calculated from QU1 and QU2 (sent to incineration).		
Accounting periodicity	M18, M40.		
Data source	QU1, QU2.		
3. Observations			
Previous indicators	QU1, QU2.		
Subsequently indicators	-		
Related causes of FLW	-		
FOODRUS objectives	SO1, SO2, SO4, SO5, SO8.		

Annex IV. Diaries

[illegible][illegible]

[illegible]

Types	Unit	Weight (g)			
poultry	Chicken bone(s)	442			
poultry	Chicken fillet(s)	75			
poultry	Chicken leg(s)	111			
poultry	Nugget(s)	16			
poultry	Wing(s)	74			
other	Sausage(s)	35			
beef	Beef fillet(s)	57.5			
other	Meatball(s)	30			
other	Chop(s)	150			
other	Hamburger patty(s)	42			
poultry	Chicken(s)	1000			
other	Cutlet(s)	134			
rice	Tablespoon(s)	50			
other	Cereal bowl(s)	300			
other	Cereal cup(s)	236			
other	Tablespoon(s) of cereals	14			
other	Tablespoon(s) of pasta	50			
other	Bowl(s) of pasta	300			
other	Plate(s) of pasta	180			
apple	Piece	200			
banana	Piece	200			
carrot	Carrot(s)	50			
grape	Grape(s)	4.6			
lettuce	Unit(s)	250			
lettuce	Leaf(s)	6			
lettuce	Caesar salad(s)	205			
tomato	Unit(s)	100			
soybean	Unit(s)	55			
potato	Unit(s)	170			
palm oil	Cup(s)	225			
milk	Cup(s)	240			
yogurt	Yogurt(s)	285			






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[illegible]

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poultry	Chicken bone(s)	442			
poultry	Chicken fillet(s)	75			
poultry	Chicken leg(s)	111			
poultry	Nugget(s)	16			
poultry	Wing(s)	74			
other	Sausage(s)	35			
beef	Beef fillet(s)	57.5			
other	Meatball(s)	30			
other	Chop(s)	150			
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other	Tablespoon(s) of pasta	50			
other	Bowl(s) of pasta	300			
other	Plate(s) of pasta	180			
apple	Piece	200			
banana	Piece	200			
carrot	Carrot(s)	50			
grape	Grape(s)	4.6			
lettuce	Unit(s)	250			
lettuce	Leaf(s)	6			
lettuce	Caesar salad(s)	205			
tomato	Unit(s)	100			
soybean	Unit(s)	55			
potato	Unit(s)	170			
palm oil	Cup(s)	225			
milk	Cup(s)	240			
yogurt	Yogurt(s)	285			






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Meal	Reason	Parts	State	Destination	Expiration	Applicable NACE codes		
1 Breakfast	1 Lack of/inaccurate demand forecasting.	1 Edible part	1 Cooked	1 Organic waste bin	1 Expired	I Accommodation and food service activities		
2 Brunch	2 Equipment and systems breakdowns.	2 Inedible part	2 Not cooked	2 Remaining fraction bin	2 Not Expired	I55 Accommodation		
3 Lunch	3 To create by-products is not profitable	3 Both parts		3 Animal feeding		55.1 Hotels and similar accommodation		
4 Snack	4 Poor investment in food waste prevention innovations and technical specialisation.			4 Landspreading		55.1 Hotels and similar accommodation		
5 Dinner	5 Food quality and aspect requirements in standards and policies.			5 Own compost		55.2 Holiday and other short-stay accommodation		
6 Supper	6 Food aspect requirements self-imposed by stakeholders (clients, consumers...).			6 Drained with wastewaters		55.2 Holiday and other short-stay accommodation		
	7 Lack of/insufficient standards, policies or regulations for food surplus management.			7 Other		55.3 Camping grounds, recreational vehicle parks and trailer parks		
	8 Rigid standards, policies or regulations to manage surpluses.					55.3 Camping grounds, recreational vehicle parks and trailer parks		
	9 Uncertainty and misinterpretation of standards.					55.9 Other accommodation		
	10 Cold chain interruptions.					55.9 Other accommodation		
	11 Political changes hampering international trades.					I56 Food and beverage service activities		
	12 Absence of a corporate social responsibility policy.					56.1 Restaurants and mobile food service activities		
	13 Lack of awareness.					56.1 Restaurants and mobile food service activities		
	14 Lack of/inefficient coordination and communication between actors.					56.2 Event catering and other food service activities		
	15 Premature withdrawn due to an excessive delay.					56.21 Event catering activities		
	16 Packaging design favouring food spoilage.					56.29 Other food service activities		
	17 Packaging design inadequate for preservation once opened.					56.3 Beverage serving activities		
	18 Stocking policy favouring overstock.					56.3 Beverage serving activities		
	19 Oversized orders to get discounts.					P Education		
	20 Overstocking because of the wide variety of products offered.					P85 Education		
	21 We have no responsibility for food surplus generation (take-back agreements).					85.1 Pre-primary education		
	22 Weather fluctuations changing expected consumers' orders.					85.1 Pre-primary education		
	23 Spills and other mishandling.					85.2 Primary education		
	24 Inadequate purchasing planning.					85.2 Primary education		
	25 Confusion between use by and best before date.					85.3 Secondary education		
	26 Inefficient cooking.					85.31 General secondary education		
	27 Not using up leftovers due to lack of knowledge.					85.32 Technical and vocational secondary education		
	28 Inefficient food preservation.					85.4 Higher education		
	29 Limited cooking abilities.					85.41 Post-secondary non-tertiary education		
	30 Lack of time to cook more efficiently.					85.42 Tertiary education		
	31 The packaging size leads to buy more than needed.					85.5 Other education		
	32 Expired food due to an inefficient food management in the fridge/pantry.					85.51 Sports and recreation education		
						Q Human health and social work activities		
						Q86 Human health activities		
						86.1 Hospital activities		
						86.1 Hospital activities		
						86.9 Other human health activities		
						86.9 Other human health activities		
						Q87 Residential care activities		
						87.1 Residential nursing care activities		
						87.1 Residential nursing care activities		
						87.2 Residential care activities for mental retardation, mental health and substance abuse		
						87.2 Residential care activities for mental retardation, mental health and substance abuse		
						87.3 Residential care activities for the elderly and disabled		
						87.3 Residential care activities for the elderly and disabled		
						87.9 Other residential care activities		
						87.9 Other residential care activities		
						Q88 Social work activities without accommodation		
						88.9 Other social work activities without accommodation		
						88.91 Child day-care activities		
						88.99 Other social work activities without accommodation n.e.c.		
						R Arts, entertainment and recreation		
						R93 Sports activities and amusement and recreation activities		
						93.1 Sports activities		
						93.11 Operation of sports facilities		
						93.12 Activities of sport clubs		
						93.19 Other sports activities		
						93.2 Amusement and recreation activities		
						93.21 Activities of amusement parks and theme parks		
						93.29 Other amusement and recreation activities		
						S Other service activities		
						S94 Activities of membership organisations		
						94.9 Activities of other membership organisations		
						94.92 Activities of political organisations		
						94.99 Activities of other membership organisations n.e.c.		

Types	Unit	Weight (g)			
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lettuce	Caesar salad(s)	205			
tomato	Unit(s)	100			
soybean	Unit(s)	55			
potato	Unit(s)	170			
palm oil	Cup(s)	225			
milk	Cup(s)	240			
yogurt	Yogurt(s)	285			

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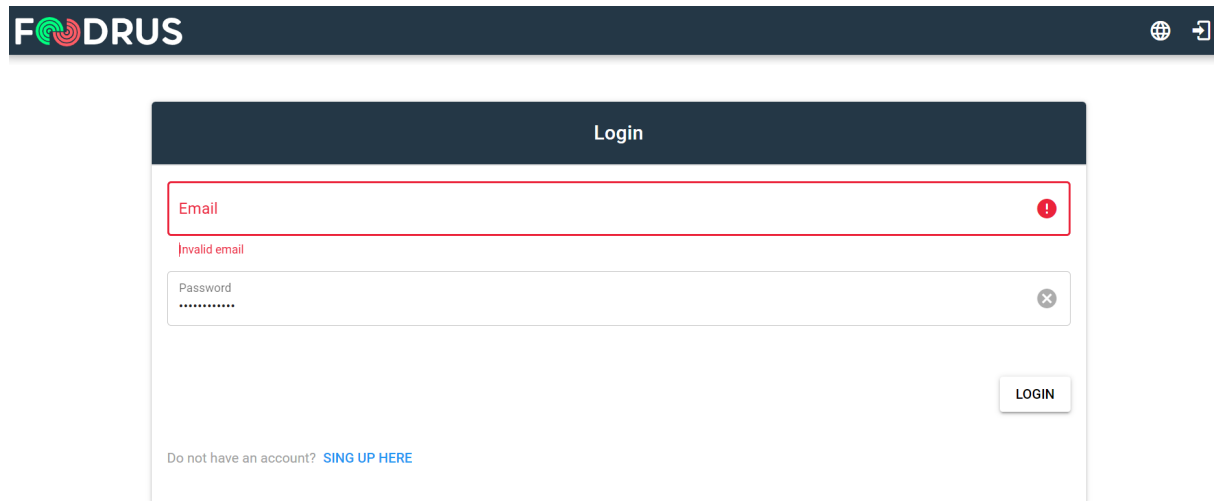
Annex V. Quantification guidelines using the Food Loop App

FOOD LOSS AND WASTE (FLW) QUANTIFICATION PROCEDURE USING THE FOOD LOOP APP - USER MANUAL

The FoodRus application (app) can be reached in the following link:

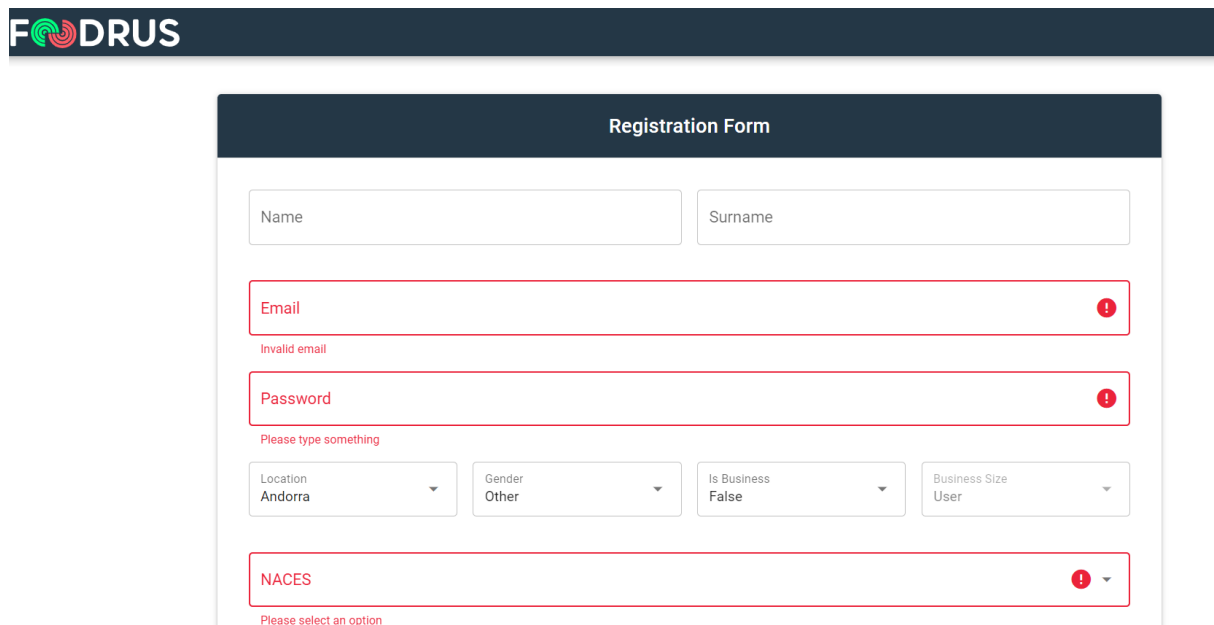
<https://foodapp.apps.foodrus.eu/>

In order to use the application, first of all, a user needs to create an account:



The screenshot shows the FoodRus application interface. At the top is a dark blue header with the FOODRUS logo on the left and a globe icon on the right. Below the header is a white login form with a dark blue title bar that says 'Login'. The form contains two input fields: 'Email' and 'Password'. The 'Email' field has a red border and a red exclamation mark icon, with the text 'Invalid email' below it. The 'Password' field has a red border and a red exclamation mark icon. Below the password field is a link that says 'Do not have an account? SIGN UP HERE'. To the right of the password field is a 'LOGIN' button.

Please, click: [SIGN UP HERE](#), the following screen will appear:



The screenshot shows the FoodRus application interface. At the top is a dark blue header with the FOODRUS logo on the left. Below the header is a white registration form with a dark blue title bar that says 'Registration Form'. The form contains several input fields: 'Name', 'Surname', 'Email', 'Password', 'Location', 'Gender', 'Is Business', 'Business Size', and 'NACES'. The 'Email', 'Password', and 'NACES' fields have red borders and red exclamation mark icons, indicating errors. The 'Email' field has the text 'Invalid email' below it. The 'Password' field has the text 'Please type something' below it. The 'NACES' field has the text 'Please select an option' below it. The 'Location' field has a dropdown menu with 'Andorra' selected. The 'Gender' field has a dropdown menu with 'Other' selected. The 'Is Business' field has a dropdown menu with 'False' selected. The 'Business Size' field has a dropdown menu with 'User' selected.

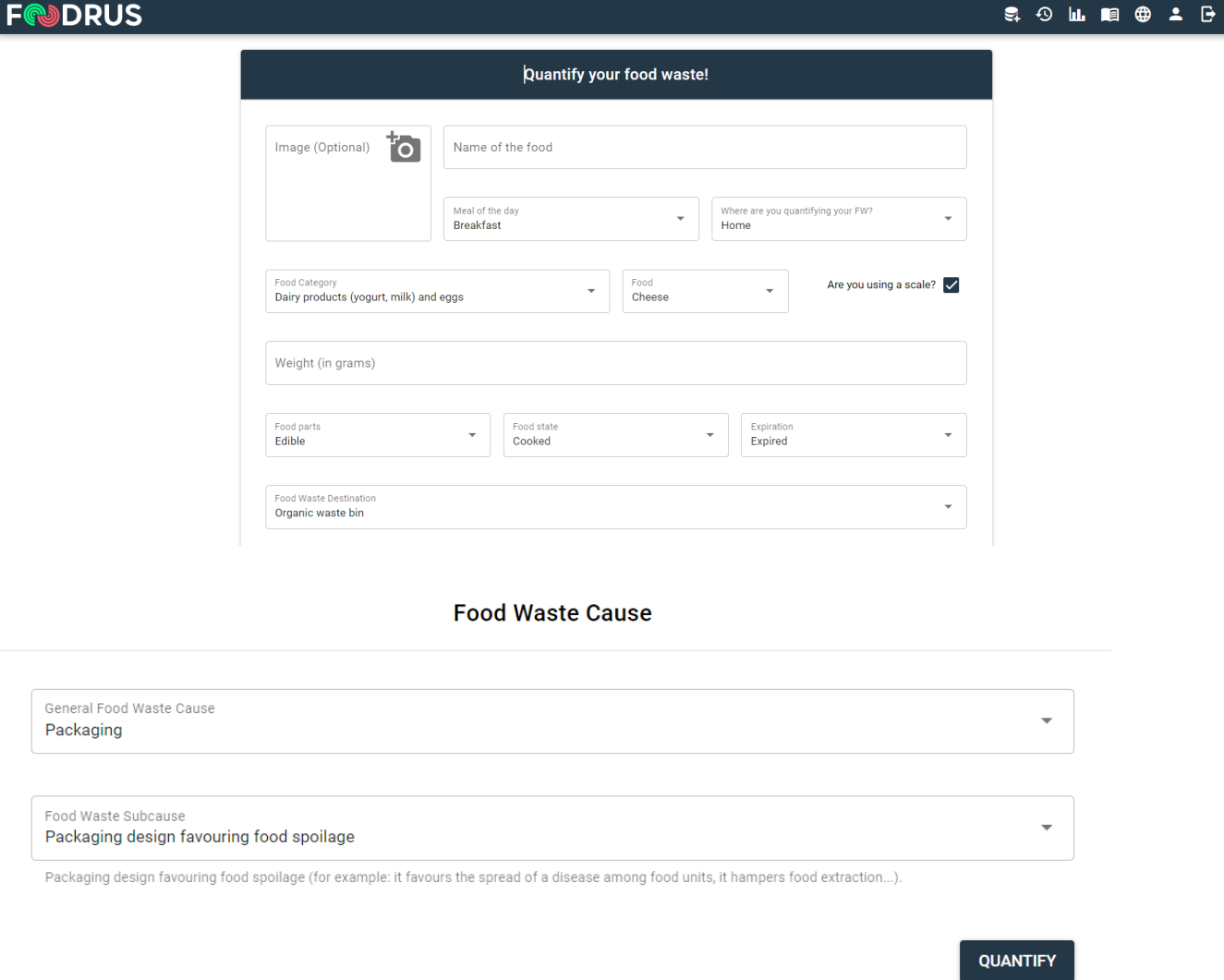
Enter an email address and a password.

Note: NACES - for household consumers, there is only one option.

Registration is immediate.

If you make a mistake, please click the  button on the right side of the item.

Once registered, the user logs in, the following screen is displayed:



The screenshot shows the FOODRUS app interface. At the top is a dark blue header with the FOODRUS logo and several icons. Below the header is a white box titled 'Quantify your food waste!'. Inside this box is a form with the following fields:

- Image (Optional)**: A camera icon and a text input field.
- Name of the food**: A text input field.
- Meal of the day**: A dropdown menu with 'Breakfast' selected.
- Where are you quantifying your FW?**: A dropdown menu with 'Home' selected.
- Food Category**: A dropdown menu with 'Dairy products (yogurt, milk) and eggs' selected.
- Food**: A dropdown menu with 'Cheese' selected.
- Are you using a scale?**: A checkbox that is checked.
- Weight (in grams)**: A text input field.
- Food parts**: A dropdown menu with 'Edible' selected.
- Food state**: A dropdown menu with 'Cooked' selected.
- Expiration**: A dropdown menu with 'Expired' selected.
- Food Waste Destination**: A dropdown menu with 'Organic waste bin' selected.

Below the form is a section titled 'Food Waste Cause'. It contains two dropdown menus:

- General Food Waste Cause**: A dropdown menu with 'Packaging' selected.
- Food Waste Subcause**: A dropdown menu with 'Packaging design favouring food spoilage' selected.

Below the subcause dropdown is a text description: 'Packaging design favouring food spoilage (for example: it favours the spread of a disease among food units, it hampers food extraction...)'.

At the bottom right of the form is a dark blue button labeled 'QUANTIFY'.

The user will fill in the following fields:

Quantify your food waste:

- **Image (optional)** - an image of the food waste can be taken and be uploaded
- **Name of food** - enter a name to describe what was consumed
- **Meal of the day** - identify when it was consumed, choosing from the drop down menu list:

Meal of the day
Breakfast ▲

Breakfast

Brunch

Lunch

Snack

Dinner

Supper

Review fridge/pantry

- **Where are you consuming the food at?**

Where are you quantifying your FW?
Home ▲

Home

Food service establishment

Food service establishment (self-service)

using a tupper prepared by oneself

- **Food category** - choose the main ingredient

Dairy products (yogurt, milk) and eggs

Cereal

Fruits & Vegetables

Meat & Fish

Pulses & Oilseeds

Other

Roots & Tubers

Food Category
Dairy products (yogurt, milk) and eggs ▲

- **Food** - choose the actual food

Food
Cheese ▲

Other

Cheese

Milk

Yogurt

- **Are you using a scale?** - if you measure the amount of food waste, please tick.

Are you using a scale? ☐

- **Number** - enter a number, if possible

Number
1

- **Measurement** - choose an option

Measurement
Unit(s) ~ 100 g

- **Food parts** - choose an option

Food parts
Edible

Edible

Not edible

Both (Edible & not edible)

- **Food state** - choose an option

Food state
Cooked

Cooked

Not cooked

- **Expired**

Expiration
Expired

Expired

Not expired

- **Food waste destination** - choose one

Organic waste bin

Animal feeding

Landspreading

Drained with wastewaters

Remainder fraction bin

Composting

Food Waste Destination
Organic waste bin

Food waste cause

- **General food waste cause:** choose one

General Food Waste Cause

Packaging

Packaging

Product image

Food Preservation

Cooking/Consuming

- **Food waste subcause:** choose one

Food Waste Subcause

Packaging design favouring food spoilage

Packaging design favouring food spoilage

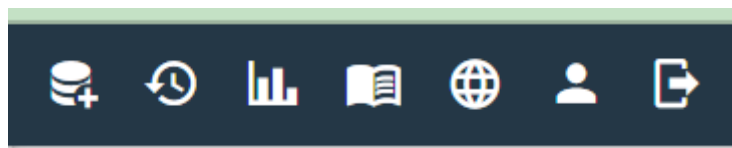
Packaging design inadequate for preservation once opened

The packaging size leads to buy more than needed

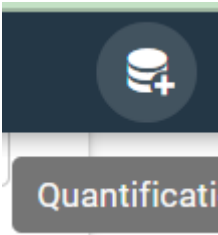
When all items have been entered, please click the **Quantity** button at the bottom of the page.

QUANTIFY

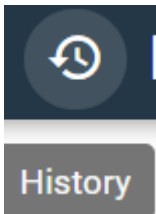
Then, the user can access the following item from the top right menu:



Quantification - to make a new entry

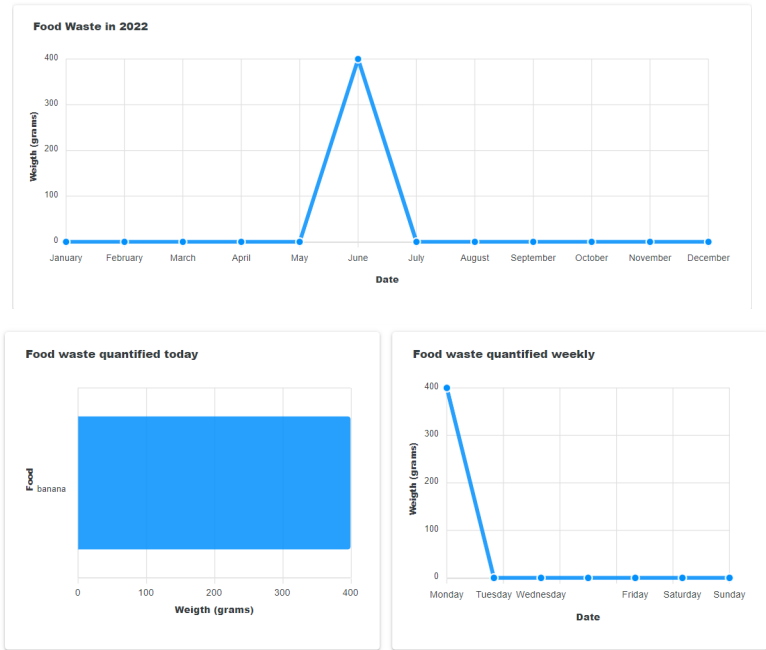


History - to get access to your already existing entries and data analytics

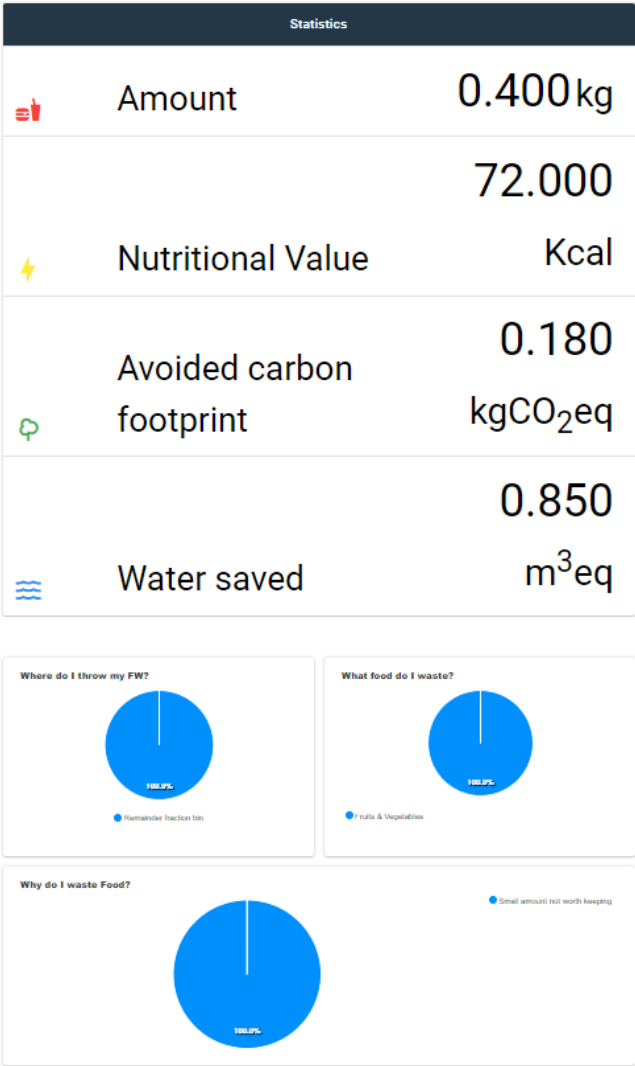


History					
Search					
Quantification	Quantification Date	Type	Weight	Food Category	Disposal
banana	20/6/2022 17:01:39	4 Unit(s) (100 g)	400	Fruits & Vegetables	Remainder fraction bin

For instance:

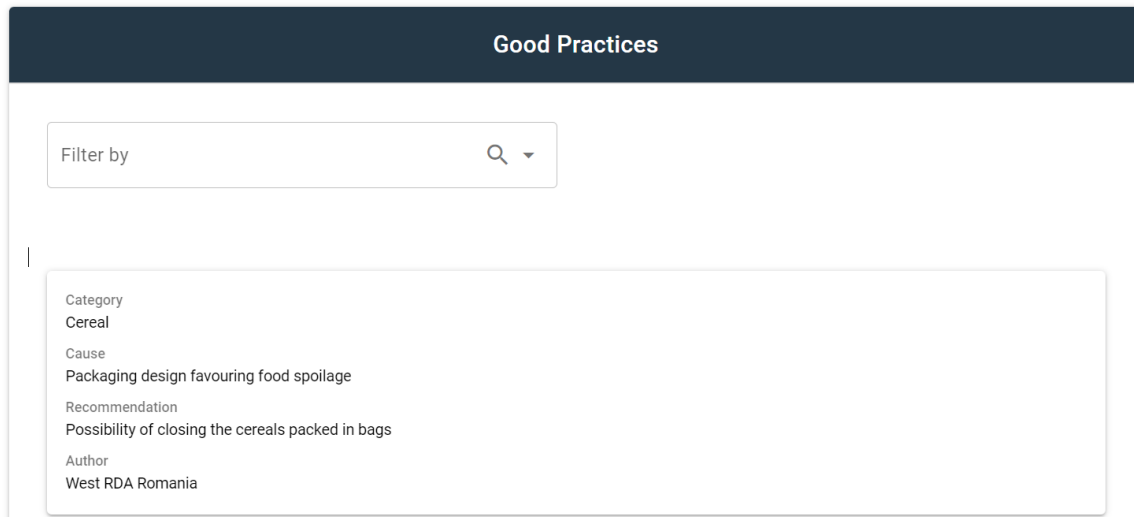


Statistics - amount, nutritional value, avoided carbon footprint, water saved and grafts



Recommendations and good practices -

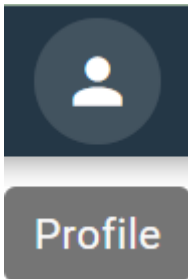




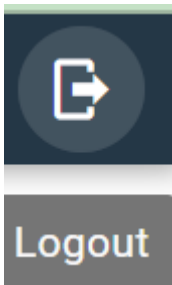
Language - choose one



Profile - if the user wish to fill in a profile



Log out - to leave the app



Annex VI. Urban waste characterization protocol (Spanish version)

La cantidad total de residuo que es recogido en un determinado CRR se denomina **Lote**. Dado que, en general, realizar la caracterización del Lote completo es inviable, se debe reducir la muestra a fin de obtener una cantidad de material menor pero plenamente representativa del Lote que se denomina **Muestra**, sobre la que se efectuará la caracterización.

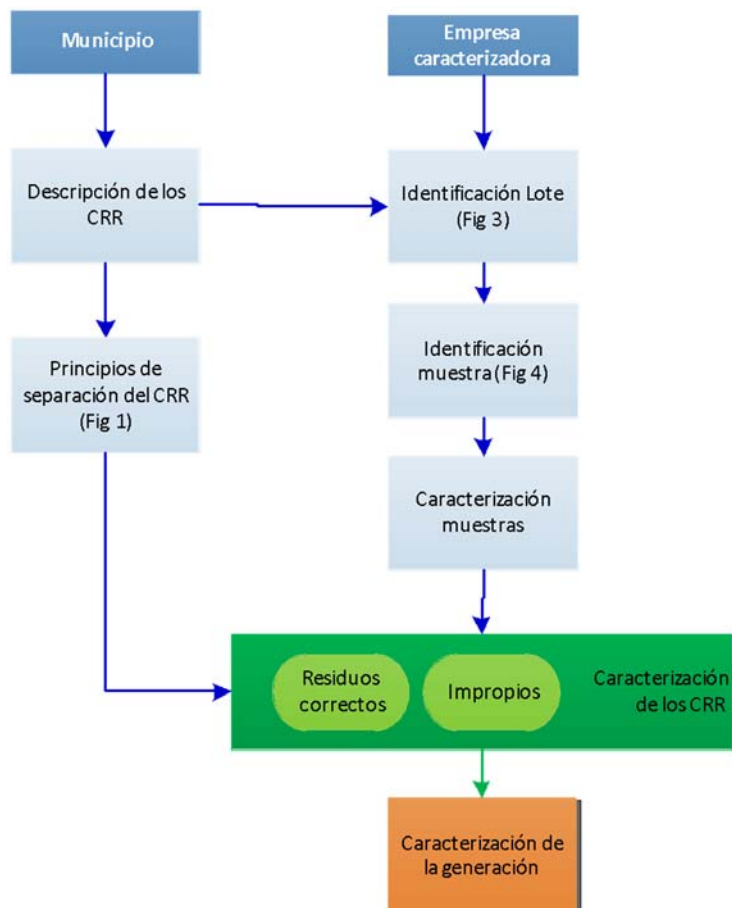


Fig 2 Procedimiento para la caracterización

1.1.2. Identificación y pesado del material

Para proceder a efectuar la caracterización de los residuos resulta imprescindible identificar la procedencia de dicho residuo. Por este motivo, la empresa caracterizadora sólo procederá a efectuar la caracterización del residuo si los titulares y / o gestores de las planta de tratamiento facilitan, la siguiente información (Tabla 1).

Tabla 1 Identificación de los circuitos de recogida

Id CRR			
Fracción		Generador	

Fecha y hora de recepción	
Tipo de vehículo	
Matrícula del vehículo	
Cantidad descargada (adjuntando copia de albarán)	

Para no perder la trazabilidad del origen del Lote, la empresa caracterizadora identificará cada descarga realizada dándole un código numérico a cada lote (**Id Lote**). A partir de la pesada del camión a la entrada de la planta, se conocerá la cantidad total de residuo (cantidad descargada) que se ha recogido en un determinado circuito (el lote). La empresa caracterizadora no debe estar necesariamente presente en las operaciones de recepción, identificación y descarga del residuo. Estas tareas son responsabilidad de los titulares y / o gestores de las instalaciones donde se efectúen las caracterizaciones. La empresa caracterizadora deberá identificar cada lote (Tabla 2).

Tabla 2 Identificación de cada lote

Id Lote		Id CRR	
Cantidad descargada (kg)			

1.1.3. Lugar para la realización de las caracterizaciones

Los titulares y / o gestores de las plantas de tratamiento deberán garantizar que la zona reservada para la realización de la caracterización esté bien acotada, y siempre que sea posible suficientemente iluminada y ventilada, evitando la circulación de maquinaria pesada en las proximidades del lugar reservado para la realización de la caracterización (mientras ésta se efectúe). La empresa caracterizadora carteles para identificar la zona de trabajo de cada Lote individual.

1.1.4. Condiciones de recepción de material

El material a caracterizar será depositado preferentemente en un área pavimentada, limpia y bajo cubierta. La descarga se efectuará directamente sobre el pavimento, sin hacer ninguna cama de poda o de otros materiales absorbentes en la parte inferior del material.

En el caso de tener que efectuar la caracterización de más de un Lote, las descargas se deberán efectuar de forma que queden suficientemente separados unos de otros, y se eviten mezclas de materiales entre lotes. A continuación, se delimitará la zona de trabajo con una cinta de plástico de balizamiento de forma que acote perfectamente la zona ocupada para realizar la toma de muestra y la caracterización.

La caracterización se realizará lo antes posible desde el momento de la llegada del material en la planta de tratamiento, y preferentemente con luz natural de día. El tiempo máximo de almacenamiento de un Lote,

entre la descarga del material y su caracterización no será superior a 24 horas durante el periodo comprendido entre los meses de junio a agosto inclusive, y de 48 horas en el resto de meses del año.

En caso de que la instalación donde se llevará a cabo la caracterización no disponga de pavimentos adecuados, el material a caracterizar será depositado directamente en las lonas colocadas encima de la tierra para evitar que se contamine la muestra.

1.1.5. Consideraciones específicas de los residuos voluminosos

Los residuos municipales voluminosos son los residuos que por su tamaño distorsionan la gestión ordinaria de los residuos municipales. De acuerdo con esta definición, se considerará residuo voluminosos aquellos que dispongan dimensiones superiores a los 50 cm de lado o bien superiores a 50 litros de capacidad. Los residuos voluminosos habrá que separarlos antes de la caracterización de la muestra (en el Lote). La separación se hará manualmente y habrá pesaje de todos estos objetos o residuos. Los pesos se relacionarán en las hojas de campo.

1.1.6. Unidad de muestreo

El rango de caracterización depende del tipo y la densidad de cada fracción. Así para la fracción de envases ligeros se fija en un mínimo de 150kg o lo que fije la normativa de cada sistema integrado de gestión (SIG). Para la fracción resto y la fracción orgánica se fija en 250kg.

Las muestras con cantidad de residuos superior a los 280kg requieren procesos de homogeneización y cuarteo antes de que sean caracterizadas.

1.1.7. Nivel de muestreo

El nivel de muestreo es el vehículo de recogida representativo de cada CRR. Cada unidad de muestreo se obtendrá de un camión representativo, siguiendo el método de pila-cuarteo. Si un determinado CRR únicamente contará con un punto de depósito, la unidad de muestreo sería el punto de depósito.

1.1.8. Proceso de homogeneización y cuarteo

Hay que homogeneizar todo el material de forma efectiva para garantizar una toma de muestra lo más representativa posible. Si la homogeneización se hace con pala o tractor, hay que evitar pasar por encima del material de forma que no se produzca la compactación del mismo y la producción y pérdida de lixiviados. Se parte de la carga total del camión, y se realizará el cuarteo sobre la cantidad total entrada (Lote). Si los residuos han sido depositados encima de lonas, hay que evitar que al efectuar la homogeneización del material se dañe la lona y el residuo acabe contaminándose; por este motivo se tendrá cuidado al dejar la capa más cercana al suelo sin mezclar. Una vez el lote ha sido homogeneizado, y antes de efectuar la caracterización, si se identifican más residuos voluminosos se continuarán separando manualmente y efectuando su pesaje individualizado. Este peso se relacionará en las hojas de campo.

Durante la homogeneización se mezclan los residuos hasta obtener una masa uniforme y homogénea previo a ser cuarteada. El procedimiento de toma de muestra y sistema de cuarteo consiste en efectuar sucesivos cuarteos del lote hasta llegar a seleccionar una fracción representativa de aproximadamente 250 kg de muestra. Se realizará con los siguientes pasos:

- 1 Se distribuye volumétricamente todo el lote en forma aproximadamente circular. Se divide la muestra en cuatro partes homogéneas, con la ayuda de una cinta de plástico de balizamiento (Fig 3).



Fig 3 Torta del lote dividida con cinta de balizamiento

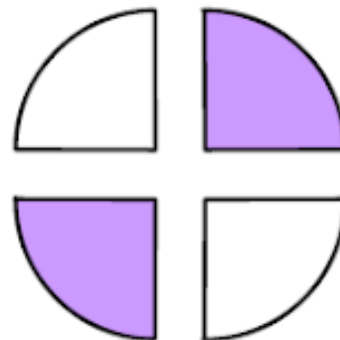


Fig 4 Procedimiento de cuarteo

- 2 Se procede al cuarteo escogiendo dos submuestras diametralmente opuestas y el resto se descarta (Fig 4).
- 3 Nuevamente se homogeneizan las dos submuestras escogidas hasta obtener una muestra uniforme, y se procede nuevamente a su cuarteo de la misma manera que en el punto anterior.
- 4 Este procedimiento se repite sucesivamente hasta obtener una submuestra final adecuada (apartado 4.4.7), que posteriormente será necesario caracterizar.
- 5 La muestra a caracterizar será reservada para su caracterización, y depositada preferentemente sobre un pavimento, garantizando su integridad. Si no se dispone de pavimento, la totalidad de la muestra a caracterizar será depositada sobre una lona colocada entre el suelo y la muestra, a fin de evitar cualquier tipo de afectación.
- 6 La muestra se identificará (*id Muestra*) (Tabla 3)

Tabla 3 Identificación de la muestra

Id Muestra		Id Lote	
Fecha y hora		Peso (kg)	

1.1.9. Caracterización

1.1.9.1. Fracciones a caracterizar

La **caracterización de la generación** es la agregación de las **caracterizaciones de cada circuito de recogida de residuos (CRR)** en el piloto. Es por ello que se deben caracterizar **todos los CRR necesarios para el cálculo de la tasa en el municipio y que tenga en cuenta las categorías relacionadas con el despilfarro de alimentos en la matriz de caracterización**. En el caso de Zamudio se analizarán las fracciones: resto, envases ligeros, papel y cartón, vidrio y fracción orgánica. Asimismo se diferenciarán los circuitos separados de: industrial, HORECA y doméstico.

Las muestras se obtendrán del camión de recogida del CRR. Para aquellas situaciones que únicamente exista un punto de depósito, la caracterización se realizará directamente del contenedor.

Una vez se obtienen los aproximadamente 250 kg de material, según el caso, y ya fuera de las bolsas se procede a la separación del material en diferentes fracciones. La caracterización de los residuos recogidos en cada CRR pretende diferenciar de forma específica la fracción depositada correctamente de la fracción depositada incorrectamente (impropios). Los residuos se agruparán según la matriz de caracterización definida en la Tabla 5. Para diferenciar entre los residuos depositados se debe especificar la naturaleza del sistema de recogida. El municipio deberá facilitar a la empresa caracterizadora información relativa a los principios de separación de los residuos (Fig 1).

1.1.9.2. Frecuencia de caracterización

Se determinan dos niveles:

1. Periodicidad global: esto hace referencia al número de caracterizaciones mínimo del proyecto. Se entiende que el mínimo son aquellas caracterizaciones necesarias para evaluar el impacto de las acciones llevadas a cabo en el proyecto:
 - a. Septiembre 2022 (baseline)
 - b. Abril 2023 (se prevén primeros cambios en sector industria, HORECA y ciudadanía)
 - c. Septiembre 2023 (primeros resultados de la tasa)
 - d. Enero 2024 (fin de proyecto)

De acuerdo a la experiencia previa del municipio no se ha observado una influencia notable debido al **impacto de la estacionalidad** en la generación de residuos. No obstante, se ha añadido una medida intermedia en Septiembre del 2023 para poder eliminar del análisis el posible efecto de la estacionalidad.

2. Periodicidad individual: este nivel hace referencia al número representativo de muestras a analizar para que la caracterización sea representativa. Con el objetivo de evitar el impacto de estacionalidad semanal de la generación de residuos, cada uno de los CRR se debe caracterizar a lo largo de los distintos días de la semana. Para aquellos CRR que la frecuencia los permita se realizarán al menos 3 caracterizaciones para días distintos. Cuando la frecuencia de recogida no lo permita se realizarán 3 caracterizaciones en la frecuencia establecida. Durante la toma de la muestra no se debe alterar el sistema habitual de recogida de los residuos adaptando cada caracterización a la propia situación de recogida de cada CRR.

1.1.9.3. Procedimiento de caracterización

Los pasos a seguir son los siguientes:

1. Depositar los diferentes materiales que se van seleccionando y separando en recipientes (contenedores, capazos, barreños, etc.) bien identificados y previamente tarados. Comprobar frecuentemente las taras de los recipientes (Tabla 4).
2. Una vez finalizada la separación, habrá que determinar el peso de cada fracción siguiendo la matriz de caracterización de la Tabla 5 y efectuar el reportaje fotográfico correspondiente.
3. Una vez efectuado el pesaje de cada una de las fracciones, se deberá entregar el conjunto de impropios obtenidos al sistema de recogida y gestión de rechazo establecido por la planta de

tratamiento, mientras que el material correctamente depositado será reincorporado, siempre que sea posible, en el sistema de tratamiento oportuno. En ningún caso se podrá mezclar los impropios con la fracción compostable.

4. Finalmente, una vez finalizado el trabajo diario, se deberá efectuar la limpieza de la zona de trabajo así como de las herramientas utilizadas.
5. En el transcurso de la caracterización se realizarán fotografías digitales que posteriormente serán introducidas en el informe final, junto con los resultados de las caracterizaciones.

Tabla 4 Ejemplo de etiquetado para recipientes

Id muestra		Id recipiente	
Fecha y hora		Tara recipiente (kg)	
Id fracción		Peso (kg)	
Notas			

En la Fig 5 se muestra cómo reportar toda la información de la caracterización de cada CRR en el archivo excel adjuntado (por el municipio).

	A	B	C	D	E	F	G	H
1	2. Recepción del lote							
2	Id VCC	VCC1		VCC2		VCC3		VCC4
3	Fecha recepción							
4	Hora recepción							
5	Tipo de vehículo							
6	Matrícula del vehículo							
7	Id Lote							
8	Cantidad descargada (kg)							
9	3. Proceso de homogenización y cuarteo del LOTE							
10	Id muestra							
11	Peso muestra (kg)							
12	Fecha							
13	Hora							
14	4. Caracterización de la MUESTRA							
15	Biodegradable Kitchen /canteen waste (food waste)	kg	%					kg
16	Biodegradable Kitchen /canteen waste (no food waste)		#DIV/0!		#DIV/0!		#DIV/0!	
17	Biodegradable garden /park waste		#DIV/0!		#DIV/0!		#DIV/0!	
18	Other biodegradable waste		#DIV/0!		#DIV/0!		#DIV/0!	
19	Paper packaging		#DIV/0!		#DIV/0!		#DIV/0!	
20	Cardboard packaging		#DIV/0!		#DIV/0!		#DIV/0!	
21	Paper-cardboard no packaging		#DIV/0!		#DIV/0!		#DIV/0!	
22	Glass packaging		#DIV/0!		#DIV/0!		#DIV/0!	
23	Glass no packaging		#DIV/0!		#DIV/0!		#DIV/0!	
24	Rigid plastic packaging		#DIV/0!		#DIV/0!		#DIV/0!	
25	Plastic film packaging		#DIV/0!		#DIV/0!		#DIV/0!	
26	Plastic film no packaging and plastic bags		#DIV/0!		#DIV/0!		#DIV/0!	
27	Plastic no packaging		#DIV/0!		#DIV/0!		#DIV/0!	
28	Ferrous Packaging		#DIV/0!		#DIV/0!		#DIV/0!	
29	Non-ferrous Packaging		#DIV/0!		#DIV/0!		#DIV/0!	
30	Ferrous no Packaging		#DIV/0!		#DIV/0!		#DIV/0!	
31	Non-ferrous no Packaging		#DIV/0!		#DIV/0!		#DIV/0!	
32	Composite/Complex Packaging		#DIV/0!		#DIV/0!		#DIV/0!	
33	Other complex packaging		#DIV/0!		#DIV/0!		#DIV/0!	
34	Wood packaging		#DIV/0!		#DIV/0!		#DIV/0!	
35	Other wood		#DIV/0!		#DIV/0!		#DIV/0!	
36	Textiles		#DIV/0!		#DIV/0!		#DIV/0!	
37	Shoes and accessories		#DIV/0!		#DIV/0!		#DIV/0!	
38	Sanitary textile		#DIV/0!		#DIV/0!		#DIV/0!	
39	Nappies		#DIV/0!		#DIV/0!		#DIV/0!	
40	Other miscellaneous		#DIV/0!		#DIV/0!		#DIV/0!	
41	Batteries/Accumulators		#DIV/0!		#DIV/0!		#DIV/0!	
42	Other hazardous waste		#DIV/0!		#DIV/0!		#DIV/0!	
43	Mixed WEE		#DIV/0!		#DIV/0!		#DIV/0!	
44	Bulky waste		#DIV/0!		#DIV/0!		#DIV/0!	
45	Soil and Stones and miscellaneous inerts		#DIV/0!		#DIV/0!		#DIV/0!	
46	20 mm sieved fraction		#DIV/0!		#DIV/0!		#DIV/0!	
47	Other not considered in other categories		#DIV/0!		#DIV/0!		#DIV/0!	
48	Total	0		0		0		0
49	Desvío	0						
50	5. Nivel de impropios en el CRR							
51	Impropios	kg	%	kg	%	kg	%	kg
52			#DIV/0!		#DIV/0!		#DIV/0!	0
53	6. Parametro analíticos							
54	Densidad							
55	Humedad							
56	Materia orgánica total							
57	Poder calorífico							

Procedimiento para identificación y descripción del lote

Procedimiento para identificación de la muestra y el peso de referencia

Lugar para reportar el peso de cada fracción de la muestra correspondiente

Parámetros analíticos de la muestra. ¡Solo para fracción resto!

Instructions | Characterization matrix | WCC description | **WCC characterization** | Re

Fig 5 Procedimiento para reportar la información de la caracterización de cada CRR

1.1.9.4. Consideraciones específicas de los residuos recogidos mezclados (resto)

Para los residuos recogidos de manera mezclada se calcularán a su vez los siguientes parámetros analíticos. Las muestras requeridas para ser analizadas en laboratorio para la determinación de distintos parámetros (humedad, materia orgánica y poder calorífico inferior) deberán de envasarse o embalsarse

convenientemente para su posterior analítica. Por regla general, las muestras de residuo bruto o sus distintas categorías serán introducidas en sacos plásticos de alta densidad, precintados y etiquetados convenientemente. A continuación se procederá a su desvío al laboratorio químico, una vez codificadas las muestras, respetando en todo momento la confidencialidad de su procedencia. Este proceso se llevará a cabo a través de la correspondiente cadena de custodia. En lo que se refiere al tamaño de las muestras se tomarán entre 2 y 3 Kg. de muestra.

1.1.9.4.1. Densidad

La determinación de la densidad, será la relativa a densidad aparente in situ y se obtendrá mediante la realización de pesadas sucesivas del material en un recipiente de capacidad conocida siguiendo el método descrito en ASTM E1109-86.

1.1.9.4.2. Determinación de la humedad

Para determinar la humedad total, se determina la humedad 1 (H1) por calentamiento a temperatura constante de 40° en estufa, hasta alcanzar un peso constante siguiendo el método descrito en ASTM E790-87. Se determina también la humedad 2 (H2) por secado en horno o de mufla a 105°C. Con estos resultados se calcula la humedad:

$$HT = H1 + H2 ((100-H1)/100)$$

1.1.9.4.3. Determinación de la materia orgánica total

Se determina por calcinación a 550°C.

1.1.9.4.4. Determinación del poder calorífico

Mediante ensayos en una bomba calorimétrica, se obtienen los poderes caloríficos superiores (PCS) e inferiores (PCI) según el método descrito en las fichas ASTM E711-87.

El poder calorífico superior seco (PCSs) de la muestra se calcula a partir del PCS obtenido de la bomba calorimétrica corrigiendo el resultado con la humedad presente en la muestra.

El poder calorífico superior bruto es:

$$PCSb = PCSs \times ((100-HT)/100)$$

Por otra parte, la determinación del poder calorífico inferior seco (PCIs) se calcula a partir del PCSs, de acuerdo con la siguiente expresión:

$$PCIs = PCSs - (49,2 \times Hs) \text{ (siendo } Hs, \text{ el valor del hidrógeno seco)}$$

Por otra parte, la determinación del poder calorífico inferior bruto (PC Ib) se calcula a partir del PCIs, corregido con el valor de la humedad, conforme a la expresión:

$$PC Ib = (PCIs \times ((100 - HT)/100)) - (5,49 \times HT)$$

1.1.9.5. Fotografías

Se deberá realizar durante la caracterización fotografías de:

- LOTE
- Identificación del LOTE (cartel con el nombre del circuito)
- Muestra, unos 250 kg, una vez hecha la operación de cuarteo
- Todas y cada una de las fracciones presentes.
- Voluminosos del Lote.
- Otros aspectos.

Las fotografías deben cumplir los siguientes requisitos:

- Calidad entre 0,5 MB y 1,0 MB
- Incorporar la fecha de la toma de muestra y / o de la caracterización
- Deben permitir apreciar con una calidad suficiente de lo que se está fotografiando
- La foto de identificación del circuito debe permitir identificar claramente: el circuito, la planta donde se hace la caracterización, la empresa que caracteriza y el día.

1.1.9.6. Procedimiento en caso de aparición de residuos sanitarios de riesgo

En caso de que durante la caracterización aparezca algún residuo sanitario de riesgo biológico o bien que suponga riesgo de pinchazo o corte (p.ej. jeringas) y pueda contener material biológico que suponga riesgo potencial de contagio de enfermedades graves (VIH, Hepatitis, etc.), se procederá a su separación y se fotografiará, depositándolo en lugar seguro y visible. A continuación, se procederá a continuar caracterización con la máxima precaución hasta que se hayan caracterizado un mínimo de 90kg de la muestra.

Si antes de llegar a los 90 kg se vuelve a encontrar por segunda vez algún residuo del tipo mencionado anteriormente se finalizará la caracterización de la forma indicada en este protocolo, esto es, se para la caracterización, se realiza reportaje fotográfico y se comunica la incidencia en al municipio.

En cualquier caso, cuando se llegue a los 90kg se finalizará la caracterización y se procederá al pesaje de las diversas subfracciones y la toma de fotografías de los montones resultantes. En caso de que aparezca por primera vez algún residuo del tipo referenciado, ya se hubiesen sobrepasado los 90 kg de muestra caracterizada, se finalizará la caracterización de la forma indicada en el protocolo.

1.1.10. Emisión del informe final

Los datos registrados en las hojas de campo y las diferentes fotografías realizadas durante la caracterización, serán posteriormente introducidas por las empresas caracterizadoras en un informe que se trasladará a los municipios y los municipios al coordinador del WP1.

El informe contendrá:

- Caracterización de los distintos CRR señalando el nivel de impropios para cada circuito
- Caracterización de la generación del municipio de acuerdo a matriz de caracterización establecida (Tabla 5)

El resultado de la caracterización de la generación será la suma de los resultados de la caracterización de cada CRR. Se adjunta archivo excel para su cálculo por el municipio.

Tabla 5. Matriz de caracterización²

Categoría primaria		Categoría secundaria	Notas	Ejemplos
Materia orgánica	1	Restos de raíces y tubérculos (cocinados) ²	Restos cocinados de partes comestible de raíces y tubérculos originado en cocinas domesticas o comedores comerciales/industriales	Partes comestibles cocinadas de patatas, rábanos , zanahorias...
	2	Restos de raíces y tubérculos (no cocinados) ²	Restos no cocinados de partes comestible de raíces y tubérculos originado en cocinas domesticas o comedores comerciales/industriales	Partes comestibles no cocinadas de patatas, rábanos , zanahorias...
	3	Restos de raíces y tubérculos (no comestibles) ²	Restos de partes no comestible de raíces y tubérculos originado en cocinas domesticas o comedores comerciales/industriales	Peladuras y otras partes no comestibles de patatas, rábanos , zanahorias...
	4	Productos lácteos y huevos (cocinados) ²	Restos cocinados de partes comestibles de productos lácteos y huevos originado en cocinas domesticas o comedores comerciales/industriales	Partes comestibles cocinadas de productos lácteos y huevos
	5	Productos lácteos y huevos (no cocinados) ²	Restos no cocinados de partes comestibles de productos lácteos y huevos originado en cocinas domesticas o comedores comerciales/industriales	Partes comestibles no cocinadas como queso, yogures, huevos crudos...

² La matriz de caracterización se ha actualizado según las necesidades del proyecto FOODRUS para la cuantificación del despilfarro de alimentos.

6	Productos lácteos y huevos (no comestibles) ²	Restos de partes no comestible de productos lácteos y huecos originado en cocinas domesticas o comedores comerciales/industriales	Cáscaras de huevo, corteza de queso...
7	Cereales (cocinado) ²	Restos cocinados de partes comestibles generados a partir de cereales originado en cocinas domesticas o comedores comerciales/industriales	Pan
8	Cereales (no cocinado) ²	Restos no cocinados de partes comestibles generados a partir de cereales originado en cocinas domesticas o comedores comerciales/industriales	Harina, copos de avena...
9	Cereales (no comestible) ²	Restos de partes no comestible de productos generados a partir de cereales originado en cocinas domesticas o comedores comerciales/industriales	Pan quemado
10	Frutas y vegetales (cocinado) ²	Restos cocinados de partes comestible de frutas y verduras originado en cocinas domesticas o comedores comerciales/industriales	Coliflor cocinada, pures...
11	Frutas y vegetales (no cocinado) ²	Restos no cocinados de partes comestible de frutas y verduras originado en cocinas domesticas o comedores comerciales/industriales	Restos de fruta, lechuga, tomates...
12	Frutas y vegetales (no comestible) ²	Restos de partes no comestible de frutas y verduras originado en cocinas domesticas o comedores comerciales/industriales	Ramas de tomate, huesos fruta...

13	Carne y pescado (cocinado) ²	Restos cocinados de partes comestible de carne y pescado originado en cocinas domesticas o comedores comerciales/industriales	
14	Carne y pescado (no cocinado) ²	Restos no cocinados de partes comestible de carne y pescado originado en cocinas domesticas o comedores comerciales/industriales	Muslo de pollo, filete, lubina, sardina...
15	Carne y pescado (no comestible) ²	Restos de partes no comestible de carne y pescado originado en cocinas domesticas o comedores comerciales/industriales	Huesos de pollo, raspas de pescado...
16	Legumbres (cocinado) ²	Restos cocinados de legumbres originado en cocinas domesticas o comedores comerciales/industriales	Garbanzos cocinados
17	Legumbres (no cocinado) ²	Restos no cocinados de legumbres originado en cocinas domesticas o comedores comerciales/industriales	Garbanzos crudos
18	Restos de jardinería y poda	Todo residuo biodegradable originado en jardines domésticos o municipales, parques o elementos paisajísticos	Flores; Residuo de jardín de frutos y hortalizas; Hierba cortada; Recortes de setos; Hojas; Poda; Ramas; Malas hierbas
19	Otros biodegradables	Todo residuo biodegradable no incluido en las categorías anteriores	Restos de animales, bolsas compostables, serrín, corcho, huesos no de alimentos, excremento. Restos biodegradables de la fracción finos tras tratamiento en estufa

Papel y cartón	20	Papel envase	Papel de envases o embalajes	Bolsas de papel/envoltorios de comida rápida, Bolsas de papel, Cajas de pañuelos de papel, papel de embalaje
	21	Cartón envase	Cartón de envases o embalajes	Paquetes de Cereales, Paquetes de productos de limpieza, Envoltorios de comida rápida, Cajas de huevos, otros envases de comida, Cajas de pañuelos de papel, Cajas de juguetes, Cajas de detergentes, Cartones (de cartón encerado) de líquidos
	22	Papel-cartón no envase	Papel -cartón no utilizado como envase o embalaje	Prensa, libros, folios, papel higiénico, papel tissue, papel de escribir
Vidrio	23	Vidrio envase	Botellas, frascos y botes de vidrio	Botellas y frascos de bebidas (Cerveza, Sidra, Leche, Agua ,Vino) y Botes de comida (Comida infantil (potitos), Café, Mermeladas, Escabeches y encurtidos (aceitunas, pescado...), Salsas) o Frascos de medicamentos
	24	Vidrio no envase	Todo vidrio no de envase	Utensilios de cocina: (Pyrex, Vasos) Vidrio plano, (Encimeras de mesa, Ventana, Espejos, Reforzado, Parabrisas) Vidrio roto mezclado: (Pantallas de televisión/ordenador, separadas sólo)
Plásticos	25	Envases de plásticos rígidos	Todas las botellas y botes incoloros y coloreados y otros envases incoloros y coloreados	Botes y botellas de: Bebidas alcohólicas, Lejías, Detergentes, Productos del hogar/mascotas/jardín, Líquido lavar la ropa, Leche, Aceite, Refrescos, Vinagre, Agua,

			<p>Embalaje de electrodomésticos, Tubos de productos de limpieza, Tubos de cosméticos, Cajas de huevos, Paquetes de comida, Bandejas de alimentos, Tubos de comida (leche condensada), Paquetes de helado, Tarrinas de Margarina, Tapas de plástico, Bandejas de comida preparada, Botes de desodorante Roll on, Bandejas, Vasos de Yoghurt</p> <p>Tapones de plástico de botellas</p> <p>Macetas (cuando se venden con flores)</p>
26	Film plástico de envase	Bolsas de envase/embalaje	"Envoltorios de galletas / Bolsas de sandwich, Paquetes de cereales (bolsa interior), Film adhesivo de envolver, Bolsas de Compost/turba, Paquetes de patatas fritas, Bolsas de comida congelada, Film de plástico de embalaje, Bolsas de plástico de comida /de comida de mascotas/no comida, Bolsas de compra de comercios y supermercados"
27	Film plástico no envase y bolsas de basura	Bolsas de plástico no de envase/embalaje	Celo, Láminas de jardín, Film no de envase/embalaje, Tarpaulins (alquitranado, encerado), bolsas de basura (no compostables)
28	Plástico no envase	Productos de plástico no envase	Soportes de ambientadores, Tarjetas de crédito, Botones, CDs; cassettes Aplicadores de cosméticos/cola/pintura, Cuchillas de afeitar desechables, Linoleum (suelo), Baldosas (vinyl/plástico), Mangueras, Utensilios de jardinería, Plástico duro, Accesorios del

				hogar/coche/jardín Lighters, LPs, Bolígrafos, Macetas, Rieles de cortinas, Marcos de plástico, Gafas de sol de Plástico, Juguetes de Plástico, Reglas, Semilleros, Zapatos (de Plástico), Tapas de inodoro, Tubos/bombas, Video cassettes, Palanganas
Metales	29	Envases férricos	Latas y contenedores Férricos de comida, bebida y no-comida"	Galletas, Bebidas carbonatadas, Pescado, Comida de mascotas, Latas de betún, Aerosoles (desodorante, perfume, laca), Refrescos, Sopas, Caramelos, Comida enlatada, Comida para llevar, otros contenedores
	30	Envases no férricos	Latas y contenedores no-férricos de	Galletas, Bebidas carbonatadas, Pescado, Comida de mascotas, Latas de betún, Aerosoles (desodorante, perfume, laca), Refrescos, Sopas, Caramelos, Comida enlatada, Comida para llevar, otros contenedores
	31	Metales no envases férricos	Todos los objetos férricos excepto envases	Piezas de bicicletas, Materiales de construcción/bricolaje, Piezas de coches, Cubiertos, Llaves, Estanterías metálicas, Clavos, Clips (para papel), Piezas de Fontanería, Ollas y sartenes, Radiadores, Anillas, Imperdibles, Tornillos, Herramientas,
	32	Metales no envases no férricos	Todos los objetos no férricos excepto envases	Piezas de bicicletas, Materiales de construcción/bricolaje, Piezas de coches, Cubiertos, Llaves, Estanterías metálicas, Clavos, Clips (para papel), Piezas de

				Fontanería, Ollas y sartenes, Radiadores, Anillas, Imperdibles, Tornillos, Herramientas,
Envases complejos	33	Envases multicomponentes (composite)	Cualquier envase complejo/multicomponente que no pueda ser fácilmente separado en sus materiales componentes y resulte por tanto difícil de clasificar convencionalmente tipo brick	Cartón y envases de líquidos recubierto de lámina de Aluminio (leche, zumos de frutas (BRIK) Envases y contenedores de film plástico+ cartón ó de film plástico+aluminio
	34	Otros envases multicomponentes	Cualquier envase complejo/multicomponente que no pueda ser fácilmente separado en sus materiales componentes y resulte por tanto difícil de clasificar convencionalmente excepto tipo brick	Capsulas de café
Madera	35	Madera envase	Envases de madera/corcho	Cajas de madera (madera sólida, tablero o mimbre), Envases y embalajes de corcho,
	36	Otras maderas	Madera limpia no combinada con otros materiales	Paletas, Tablero (aglomerado, contrachapado, mdf), Madera sólida (tratada/sin tratar)
Misceláneos	37	Textiles	Prendas de vestir naturales o sintéticas (no includio el calzado) y otros tejidos o mobiliarios	Prendas de vestir: Pantalones-Faldas-Calcetines-Medias-Panties-Ropa-Camisas-Blusas-Jerseys-Chaquetas de lana-Abrigos-Sombreros-Guantes Otros tejidos: Ovillos de lana-Mantas-Cordones trenzados-Alfombra-Trapos-cordones-Cortinas-Mobiliario doméstico blando y tapicería-Tapete, salvamanteles-Funda de almohadas-Almohadas-jirones-Cuerdas-Felpudos, alfombrilla-sábanas-Hilos-Toallas

	38	Zapatos y complementos	Calzado y otros accesorios de vestir no textil	Zapatos, sandalias, cinturones, tirantes, gafas, bolsos
	39	Textil sanitario	Residuos sanitarios domésticos salvo pañales	Compresas y tampones, Vendajes, Algodón, torundas
	40	Pañales y celulosa absorbente	Pañales desechables	Pañales desechables, Celulosa absorbente con restos orgánicos
	41	Otros		cables, cauchos, gomas, poliespan no envase,...)
Residuos peligrosos de hogar	42	Baterías y acumuladores	Todo tipo de baterías domésticas y de coches, recargables y no recargables	Ácidas (plomo), Níquel- cadmio, Otras baterías domésticas y de coches (incluidas baterías recargables)
	43	Otros	Cualquier otro tipo de residuo peligroso del hogar	Asbesto, Aceites de cocinar, Extintores de incendios, Productos químicos de hogar y jardín, Pegamentos y disolventes, Medicamentos, Alcoholes metilados, Grasas y aceites minerales, sintéticos y no comestibles y sus, filtros, Productos del motor, Productos de pintura, Productos Foto-químicos, Refrigerantes, Jeringuillas, Trementina
RAEEs	44	RAEEs mezclados	Grandes electrodomésticos, Pequeños electrodomésticos, Equipos de IT y telecomunicaciones Aparatos de alumbrado Juguetes Instrumentos de control y monitorización	Bombillas: (Normal, Fluorescente, De ahorro de energía)

Voluminosos	45	Voluminosos	Incluye aquellos residuos de dimensiones superiores a los 50 cm de lado o bien superiores a los 25 litros de capacidad, y que no estén en otras categorías	Colchones, sofás,...
Inertes	46	Finos inorgánicos, tierras, cerámica, piedras y pétreos y otros		Cantos rodados, Ladrillos, Grava, Gujarros, Arena, Tierra, Piedras, Cerámicas, Tiestos de arcilla, Vajillas, porcelanas, Azulejos cerámicos/de piedra, Jarrones
Finos	47	Fracción tamizada a 20 mm	Finos tamizada a 20 mm no biodegradable	Cenizas, Arena, Pequeños fragmentos <20mm de todas las categorías
Otros	48	Otros	Otros no clasificables en categorías anteriores	
Humedad	49	Humedad		

Annex VII. Pilots' quantification methodology

COMPANY	NACE CODE	FLW Code	FLW hotspots	Cause(s)	Step to measure	Measurement Unit	Measurement Method	Edible or inedible?	If edible: Also eatable? If not, please indicate why	Cooked?	Destination	Quantity
FLORETTE	A1.1.3 - Growing of vegetables and melons, roots and tubers	FL01	Non-grown seeds	-	Land preparation	%	Comparison of the quantity of sown seeds vs the quantity of germinated seeds.	-	-	No.	-	-
		FL02	Product declared as out of specifications at industrial level	Inaccurate demand forecasting Pests and diseases	Quality Control	Tn	Rejected Tn. Recorded at AGRIS (agronomic ERP)		No because it doesn't meet the quality requirements for its sale. No because it doesn't meet the quality requirements for its sale or industrialization.	No.	Landspreading	
		FL03	Raw material rejections	Out of specifications (defects), microissues...		Tn	Rejected Tn. Recorded at AXAPTA (industrial ERP)	Edible.	No because it doesn't meet the quality requirements for its sale or industrialization.	No.	Animal feeding (except for microissues)	
		FL04	Unharvested product	Inaccurate demand forecasting	Harvesting	Tn	Non harvested Ha (converted to equivalent Tn). Recorded at AGRIS (agronomic ERP)	Edible.	Yes.	No.	Landspreading	
		FL05	Out of shelf-life raw materials	Inaccurate demand forecasting	Storage	Tn	Out of shelf-life Tn or Kg. Recorded at AXAPTA (industrial ERP)	Edible.	No because it doesn't meet the quality requirements for its sale or industrialization.	No.	Animal feeding	
	C10.3.9 - Other processing and preserving of fruit and vegetables	FL06	Raw material rejections	Out of specifications (defects), microissues...	Product reception	Tn	Rejected Tn. Recorded at AXAPTA (industrial ERP)	Edible.	No because it doesn't meet the quality requirements for its sale or industrialization.	No.	Animal feeding (except for microissues)	
		FL07	Out of shelf-life raw materials coming from Vegetales de Navarra	Inaccurate demand forecasting	Quality Control	Tn	Out of shelf-life Tn or Kg. Recorded at AXAPTA (industrial ERP)	Edible.	No because it doesn't meet the quality requirements for its sale or industrialization.	No.	Composting	
		FL08	Food losses at production steps due to production line performance	Inaccurate demand forecasting Damages during harvesting	Product reception	%	Challenge (difference between real and theoretical consumes). Registered at Challenge	Edible.	No because it doesn't meet the quality requirements for its processing or for its sale as a raw material. Yes.	No.	Animal feeding for outdoors products, landspreading for greenhouse products.	
		FL09	Out of shelf-life/rejected ingredients	Cold chain interruptions Out of shelf life due to wrong storage	Quality Control	Tn	Out of self-life Tn or Kg. Recorded at AXAPTA (industrial ERP)	Edible.	No because of food safety risks.	No.	Landfill	
		FL10	Losses due to production line performance in the assembling salads in bowl	Damages during chopping	Assembling of salads in a bag	%	Challenge (difference between real and theoretical consumes). Registered at Challenge	Edible.	Yes (but only for animal feeding, it's not a commercial product). Yes.	No.	Animal feeding (In Miagro).	
		FW11	Short life product not able to be sold at Miagro's distribution centre (consumer orders lower than production)	Inaccurate demand forecasting	Storage	Kg and units	Out of self-life Kg and units recorded at AXAPTA (industrial ERP)	Edible.	Yes.	No.	Landfill (In Arguedas).	
		FW12	FW (finished product rejected by the client retailer). Product return.	Cold chain interruptions	Transport to the client facilities	Kg and units	Product return Kg and units. Recorded at AXAPTA (industrial ERP)	Edible.	No because of food safety risks.	No.	Donation or vending for staff. Landfill	
		FW13	Discarded product in logistic platform	Food quality and aspect requirements in standards and policies Inaccurate demand forecasting	Storage in logistic platform	Kg and units		Edible.	No.	No.	Destroyed or waste container (it depends on the flaw).	
		FW14	Expired product or low visual freshness in the retail point	Keeping on-shelf availability of products (brand image) Close to expiration date	Storage in the retail point (shelves)	Kg and units	There is a measurement of sales by reference and by store in our systems, as well as data on disposal, donations, breakages, etc.	Edible.	No because of food safety risks.	No.	Waste container.	
								Edible.	Yes.	No.	Donation	
EROSKI	G47.1.1 - retail sale in non-specialised stores with food, beverages or tobacco predominating	FW13	Discarded product in logistic platform	Food quality and aspect requirements in standards and policies Inaccurate demand forecasting	Storage in logistic platform	Kg and units		Edible.	No.	No.	Destroyed or waste container (it depends on the flaw).	
		FW14	Expired product or low visual freshness in the retail point	Keeping on-shelf availability of products (brand image) Close to expiration date	Storage in the retail point (shelves)	Kg and units	There is a measurement of sales by reference and by store in our systems, as well as data on disposal, donations, breakages, etc.	Edible.	No because of food safety risks.	No.	Waste container.	
								Edible.	Yes.	No.	Donation	

COMPANY	NACE CODE	FLW Code	FLW hotspots	Cause(s)	Step to measure	Measurement Unit	Measurement Method	Edible or inedible?	If edible: Also eatable? If not, please indicate why	Cooked?	Destination	Quantity
SENPEK	C10.7.1 - Manufacture of bread; manufacture of fresh pastry goods and cakes	FL01	Surplus dough	Demand forecasting + inefficiency in the processing	Ingredients mixing	Kg	Mass balance (ingredient input & product output).	Inedible.		No.	It is baked and then sent to animal feed (It is the case of 1 industrial bakery)	
TESCO AND KAUFLAND	G47.1.9 - Other retail sale in non-specialised stores	FW02	Surplus bread	Demand forecasting + legal restrictions	Storage in the shelves	Pieces	Counting the pieces of bread purchased and sold.	Edible.	Yes (if no more than 24h have passed).	No.	Redistribution for human consumption, animal feed, incineration	
TBS	I55.1.0 - Hotels and similar accommodation	FW03	Surplus bread	They serve more bread than needed (sometimes without asking) + They don't use up all the bread because of an inadequate demand forecasting They don't use up all the bread that was not served.	Consumption (HORECA)	Kg	(Only bread is not being measured right now) --> Methodology defined for CS1.	Edible. Edible.	No. Because it has been already served. Yes.		Biogas/landfill/composting (management is private)	
SUA and all the pilot	-	FW04	Surplus bread	They don't store it properly. They buy more than needed because it is cheap.	Storage (households)	Kg	Amount of bread bought and amount of bread wasted.	Edible.	Yes if bread is stale. No if bread is moldy.		Communal biowaste --> Biogas or composting	
		FW05	Stale bread	Lack of knowledge on how to use up the stale bread.	Consumption (households)	Kg		Edible.	Yes.			

COMPANY	NACE CODE	FLW Code	FLW hotspots	Cause(s)	Step to measure	Measurement Unit	Measurement Method	Edible or inedible?	If edible: Also eatable? If not, please indicate why	Cooked?	Destination	Quantity
HORKRAM		FL01	Inedible parts	(mainly inedible parts of the fish: spines...)	Cutting	Kilograms of fresh food	Net weight waste -> Measured with scales	Inedible.	Uneatable.	No.		
		FL02	Discarded products	Contractual constraints for surplus food. They need to have some kind of products (mandatory)	Storage in wholesale	Kilograms of fresh food	Net and gross weight (it is specified in the product) waste in the monitoring system of Horkram.			No.		
		FL03			Distribution	Kilograms of fresh food	Net and gross weight (it is specified in the product) of surplus food.			No.		
JESPERS	156.2.1 - Event catering activities 156.2.9 - Other food service activities	FW04	Inefficiency at preparation and cooking		Preparation and cooking (kitchen)	Kilograms of fresh food	Measured with scales			Yes.		
		FW05	Surplus food offered	Inefficient cooking	Buffet (cantina)	Kilograms of fresh food	Measured with scales			Yes.		
		FW06	Surplus food served	Consumers take more than necessary	Consumption (plate waste)	Kilograms of fresh food	Measured with scales			Yes.		