



Towards a new zero food waste mindset based on holistic assessment

D1.2 Requirements & science-based decision-making standards

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1. Introduction and scope

ToNoWaste is a project funded by the European Union under the programme Horizon Europe in the topic HORIZON-CL6-2021-FARM2FORK-01-13.

The project started 01/09/2022 with a project duration of 48 months.

The mission of ToNoWaste is to encourage actors in European food systems, using evidence-based tools and lessons learned, to make better decisions towards more sustainable food production and consumption patterns.

ToNoWaste main objective is to provide farmers, supply chain companies, as well as consumers and policymakers with more objective, integrated, and standardized information about the impacts and global co-benefits of their daily actions in terms of food waste. ToNoWaste will inspire them to co-create a portfolio of positively assessed pathways to shift Europe towards a healthier, more resilient, inclusive, and sustainable food production and consumption.

1.1 Specific objectives of the project

(O1) To design an open innovation ecosystem that engages European researchers, municipalities, farmers, supply chains and citizens to share open access scientific knowledge about FWPR (Food Waste Prevention and Reduction) and its assessment. (WP1)

ToNoWaste seeks to create synergies with other ongoing actions related to FWPR at EU level keeping in touch with four H2020 sister projects to reuse data and collaborate in the actions assessment for avoiding duplication.

(O2) To unveil what better decision means in the fresh food value chain (FFVC), supporting the FWPR actions with the best impacts for the food system sustainability. (WP1)

ToNoWaste has selected FFVC because Milan urban food policy pact prioritized to make fresh food accessible for all due to its potential to solve dietary-related illnesses (e.g., diabetes, heart disease and cancer). Therefore, O2 will investigate how to make FWPR compatible with FFVC sustainable development with a cost-benefit approach (RO1).

(O3) To co-create a new science-based framework (SBF) for evidence-based decision making in food systems. (WP2)

O3 will look for synergies with H2020 sister projects, city councils and JRC to define logical steps for environmental/social/economic holistic impact FWPR assessment (RO2).

(O4) To transform the SBF into Quantitative Decision-Making Methods (QDMM) that supports researchers and professionals in decisions related to FWPR in the FFVC. (WP2)

O4 requires the SBF decomposition into specific workflows for the fresh products under study, considering its origin and business processes involved to establish the limits of acceptance/significance for each decision maker (RO3).

(O5) To engage more and more FSC actors in the mindset and behavioural shift offering open access to: i) consumer perception of the FWPR problem in fresh food value chain (FFVC) and potential solutions; ii) learning contents, technical guidelines to implement the best practices available - including date marking and smart food packaging, as well as iii) apps

that automate the participation and monitoring process for facilitating decision making for supply chain actors (WP4 and WP5).

The behavioural change will be prompt by results of social research (RO4) focused on understanding the consumers' and producers' perception of the problem and the solutions proposed by decision-makers. ToNoWaste will facilitate the co-creation of FWPR guidelines to identify hotspots of problems, plan actions, assess corrective solutions and document improvements. During multi-actor workshops and other networking events, we will validate the tools (PR, DEM) by discussing the practical learnings (KH1) and quantitative data from actions assessment (KH2).

(O6) To take advantage of synergies among R&I projects and local/national FWPR actions to co-create specific accounting tools and an integrated platform for assessing the root causes behind FW along the value chain as well as fostering the most beneficial FWPR actions. (WP2 and WP3)

O6 will require the creation of accounting tools for professionals and its integration into an open platform for non-expert users (DEM) to facilitate the decision-making process to all the actors involved in the value chain. DEM will maximize the impact at EU level using open-source technologies as FIWARE. The previous/current FWPR actions in sister H2020 projects will be compared to detect the best practices that maximise the overall positive impacts.

(O7) To foster the organisational change with new coaching services and best practices in FSC. (WP6)

O7 is based on the creation of learning contents, training actions and a business coaching service oriented to support entrepreneurs. ToNoWaste will take advantage from current innovation HUBs related to urban FFVC where food companies (mainly SMEs) can co-create more sustainable business models.

(O8) To co-create new EU policies considering the diversity on regulatory ecology about FWPR. (WP6)

O8 will consider the new accounting and reporting methodology developed for ensuring a deeper integration of sustainability into the corporate governance and regulation of public supporting schemes for innovative businesses (KH4). The project will investigate how to transform the best FWPR actions in terms of KPIs into new standards and labels for fostering the organisational change. The project will use the Covenant of Majors and Milan Urban Food POLICY Pact for the open discussion of the white paper where other agencies like DG AGRI and JRC will be invited.

1.2 Scope of the deliverable

This deliverable is a report on agreed requirements and science-based standards to make better decisions regarding food losses and waste prevention and reduction (FLWPR) action. This 'agreement' is the result of the co-creation work carried out in several spaces for reflection and debate among the ToNoWaste partners and stakeholders (technical workshops in Valencia, Vienna and Graz, Delphi process, STEEPLED analysis, coordination meetings intra WP1 and inter WPs leaders, communication and dissemination activities with partners and stakeholders, etc.).



It should be noted that the philosophy and development adopted behind each technical workshop in each city pilot consisted of coordinating contents and objectives (considering the aim and relevance of WP1 inside ToNoWaste project), but adapting methodologies and timing to the different idiosyncrasies, as well as stakeholder profiles and their role within ToNoWaste of each city pilot.

Consequently, an open innovation ecosystem has been designed and implemented to enable engagement among European researchers, municipalities, FFVC and citizens to create open access scientific knowledge about FWPR (O1).

Knowledge obtained from this open and participatory innovation ecosystem, has also allowed us to reach the first Milestone set for the ToNoWaste project: the 1st version of the ToNoWaste Framework.

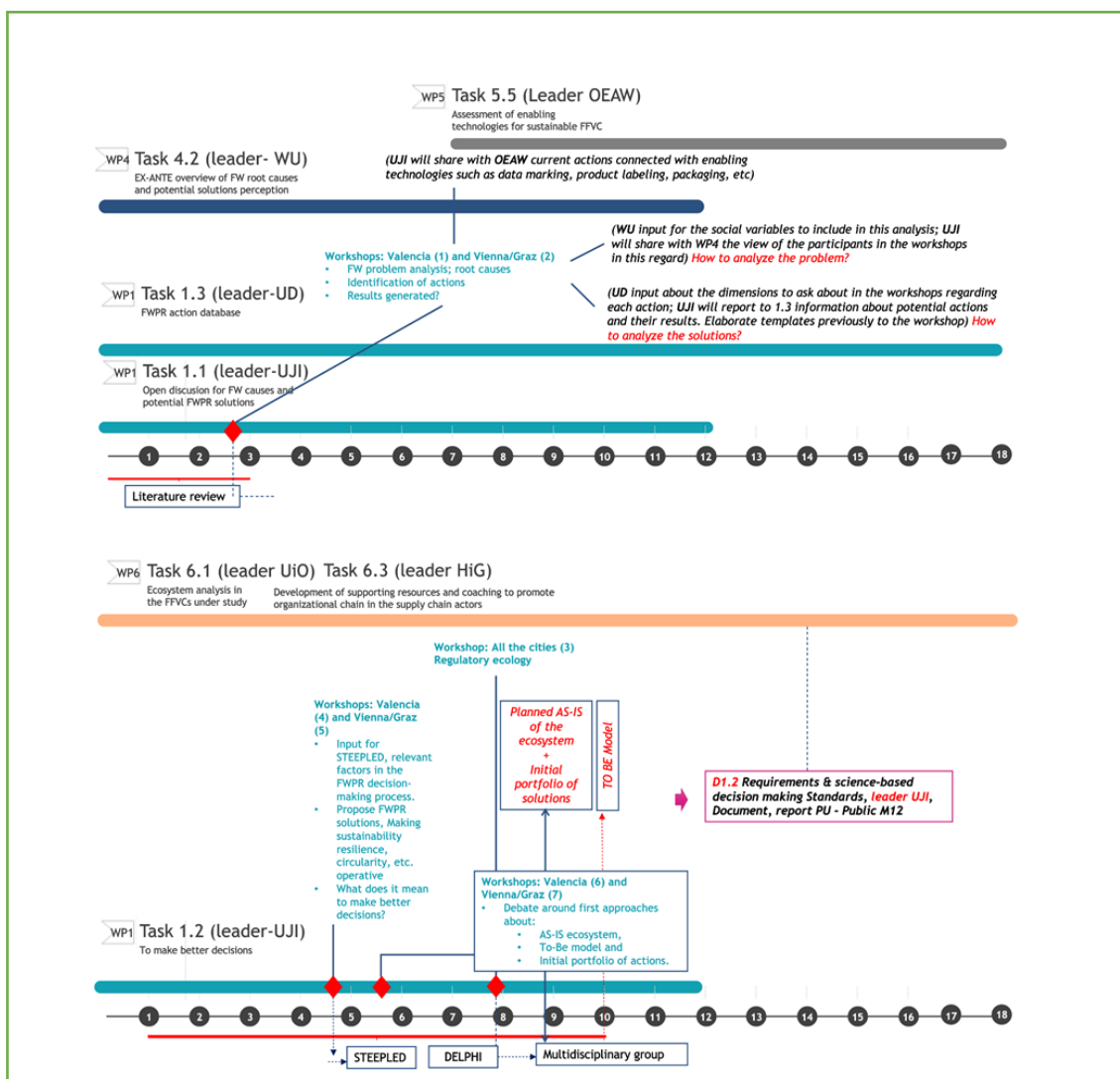


Figure 1. Definition of requirements & science-based decision-making standards (Deliverable D1.2) and WP1 workflows from month 1 to month 12 of ToNoWaste project.

Figure 1 places deliverable D1.2 within the context of other ToNoWaste WPs activities and outputs during the twelve months dedicated to the elaboration of this deliverable. It also

shows the main research, participatory and co-creative activities carried out to achieve the objectives of WP1 and to elaborate this deliverable D1.2.

2. Open discussion for FW causes and potential FWPR solutions

This section of deliverable D1.2 focuses on the realization of an in-depth analysis of different actors' perceptions of the FFVC and of the main reasons behind food losses and/or waste, as well as on the typology of actions that could be developed for their prevention and/or reduction.

2.1 Theoretical background

The following section begins with an analysis of food waste in EU countries from a general perspective to serve as an introductory framework and context.

The available data used has been obtained from the official statistical information source Eurostat, available under the following headings and categories:

1. **Food waste and food waste prevention by NACE Rev. 2 activity - tons of fresh mass** (ENV-WASFW_custom585400) within waste categories: *"Food waste - bio, household and similar waste"*:
 - a. Variables used:
 - i. Tonnes of food waste¹
 1. Total food waste by country and EU (27)
 2. Total by *"Statistical classification of economic activities in the European Community (NACE Rev. 2)"* by country and EU (27).
 - b. Unit of measure:
 - i. Kilograms per capita
 - ii. Ton
 - c. Time: 2020
2. **Population and employment** [NAMA_10_PE\$DEFAULTVIEW]
 - a. Variable used:
 - i. Population (thousands of inhabitants).
 - b. Time: 2022
3. **Gross value added of the agricultural industry - basic and producer prices** [TAG00056]
 - a. Variable used:
 - i. Production value at basic Price (million euro)
 - b. Time: 2022
4. **GDP and main components** (output, expenditure and income) [NAMA_10_GDP\$DEFAULTVIEW]

¹ No data available for Romania

- a. Variable used:
 - i. Gross domestic product (GDP) at market prices (million euro)
- b. Time: 2022

From the above data, the following series of indicators have been developed to be represented in the graphs and maps that appear in Figures 2, 3 and 4:

- i. Total kilogram (kg) per capita of food waste by country.
- ii. Percentage distribution of food waste by country in relation to the EU (27).
- iii. Life cycle phase where most food waste is generated.
- iv. Total kg food waste per capita by life cycle stage and country.
- v. Percentage distribution of kg food waste per capita by life cycle stage and country.
- vi. Comparative GDP per capita (euro) versus Agriculture GDP per capita (euro/inhabitant).

For the elaboration of the **cartography**, the software Quantum GIS in its version v3.22 and v3.28 has been used. This program is a geographic information system (GIS) in which the national "Administrative boundaries" layer (NUTS²0), obtained from the official cartographic source of the European Commission – Eurostat/[GISCO](#), has been incorporated.

The reference coordinate system used for the elaboration of the cartography is the ETRS89-extended/LAEA Europe – EPSG: 3035.³⁴⁵

² NUTS: Nomenclature of territorial units for statistics.

³ ETRS89: European Terrestrial Reference System 1989.

⁴ LAEA: Lambert's Azimuthal Equal-Area.

⁵ EPSG: European Terrestrial Reference System



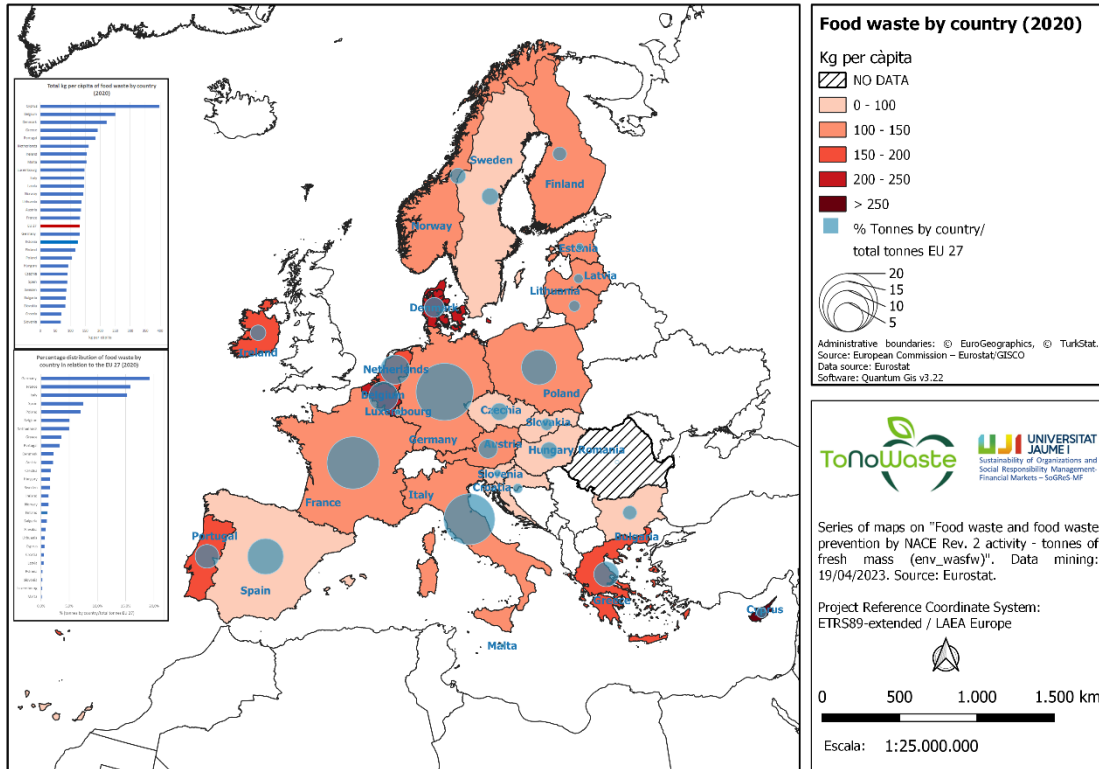


Figure 2: Food waste by country 2020

Figure 2 represents the indicators "Kilogram per capita by country" and "Percentage of tons by country/total of tons by Europe 27". Taking as a reference an average of 131 kilograms of food waste per inhabitant generated in the whole of the EU 27, the European countries that generate the most amount of waste under this indicator are Cyprus (397), Belgium (250) and Denmark (221). Those that generate less than 100 kilograms of food waste per inhabitant (8 out of 27) are located mainly in southeastern Europe, such as in Slovenia (68), Croatia (71) and Slovakia (83), among others, except for Spain (90) and Sweden (87). Regarding the 27 European countries, Germany, France and Italy each generate between 15% and 20% of European food waste (EU 27). By contrast, 22 of the 27 countries generate less than 5% each, with Malta, Luxembourg, Slovenia, Estonia, Latvia, Croatia, Cyprus, Lithuania and Slovakia generating less than 1%.

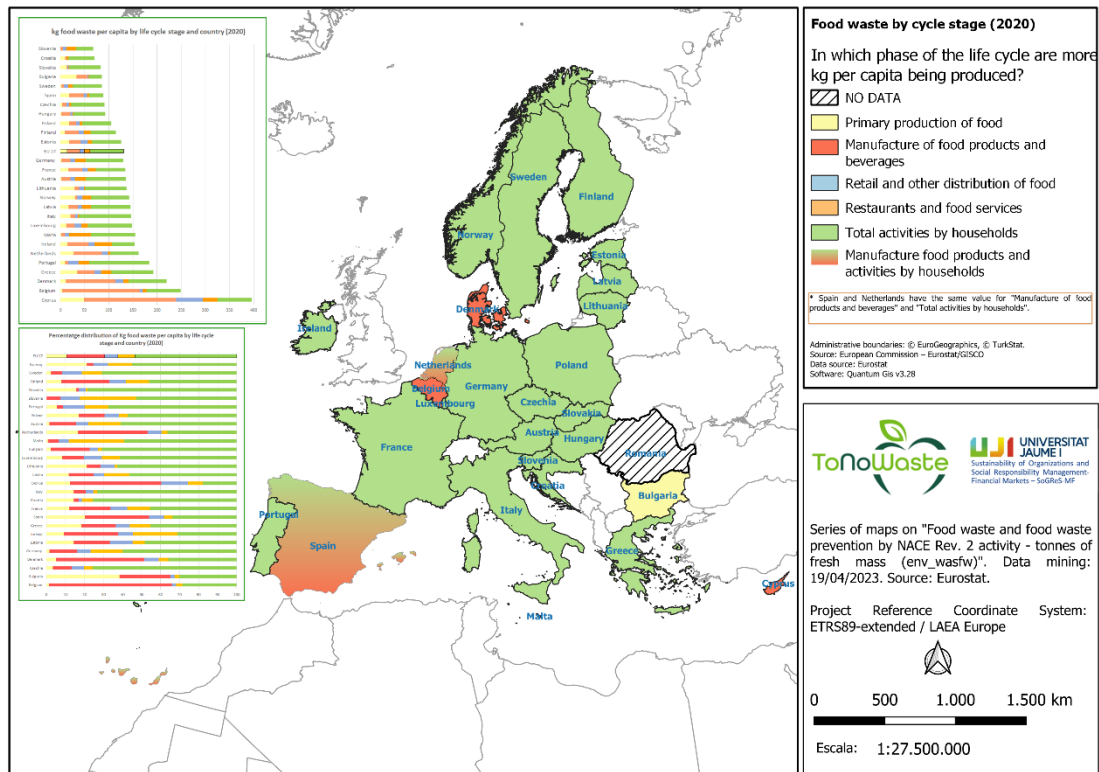


Figure 3: Food waste by cycle stage 2020

In Figure 3, the indicators "*Kilogram per capita by country*" and "*Percentage distribution of kg food waste per capita by life cycle stage and country*" are represented. **81%** of European countries generate **more food waste per inhabitant in households**, with Portugal standing out with 124kg and Italy with 107kg of food waste per inhabitant in households. Cyprus (190kg), Belgium (161kg) and Denmark (102kg) are the European countries that generate the highest food waste per capita in the **food and beverage manufacturing** phase of the cycle. Bulgaria is the only country out of the 27 that concentrates the highest food waste per inhabitant in the **primary production** phase.

In the **EU 27** as a whole, **53.4% of the kilograms of food waste produced per inhabitant** is generated in **households**, occupying the second place, with approximately 20% of economic activities included within the "*Manufacture of food products and beverages*".

Those countries whose food waste generated in households per inhabitant accounts for **more than 75% of the total national food waste** are Czech Republic, Croatia and Slovakia. In the case of the "*Manufacture of food products and beverages*" sector, Belgium stands out, with approximately 65% of the national total and in second place comes Cyprus with 47% followed by Denmark with 46%. In the "*Primary production of food*" sector, as mentioned above, Bulgaria stands out, representing 38% of the total food waste per inhabitant at the national level. In this economic activity, between 20% and 22% are produced by Lithuania, Norway, and Spain.

In the "*Retail and other distribution of food*" sector, Cyprus is the country of the EU 27 that concentrates 14% of the total food waste per inhabitant generated nationwide.

On the other hand, in the activities of "Restaurants and food services", Slovenia and Malta stand out, with 29.4% and 29% respectively and Ireland, with 23.4%.

Taking into account the results obtained in Figure 2 and Figure 3, the countries that generate greater food waste in absolute values (tons) are Germany, France, and Italy, and do not coincide with those that produce more food waste per inhabitant. In the latter case, Cyprus, Belgium, and Denmark in turn, also differ from the rest of the European countries, since they concentrate their production in the "Manufacture of food products and beverages" sector instead of in households and percentages are between 40% and 65%.

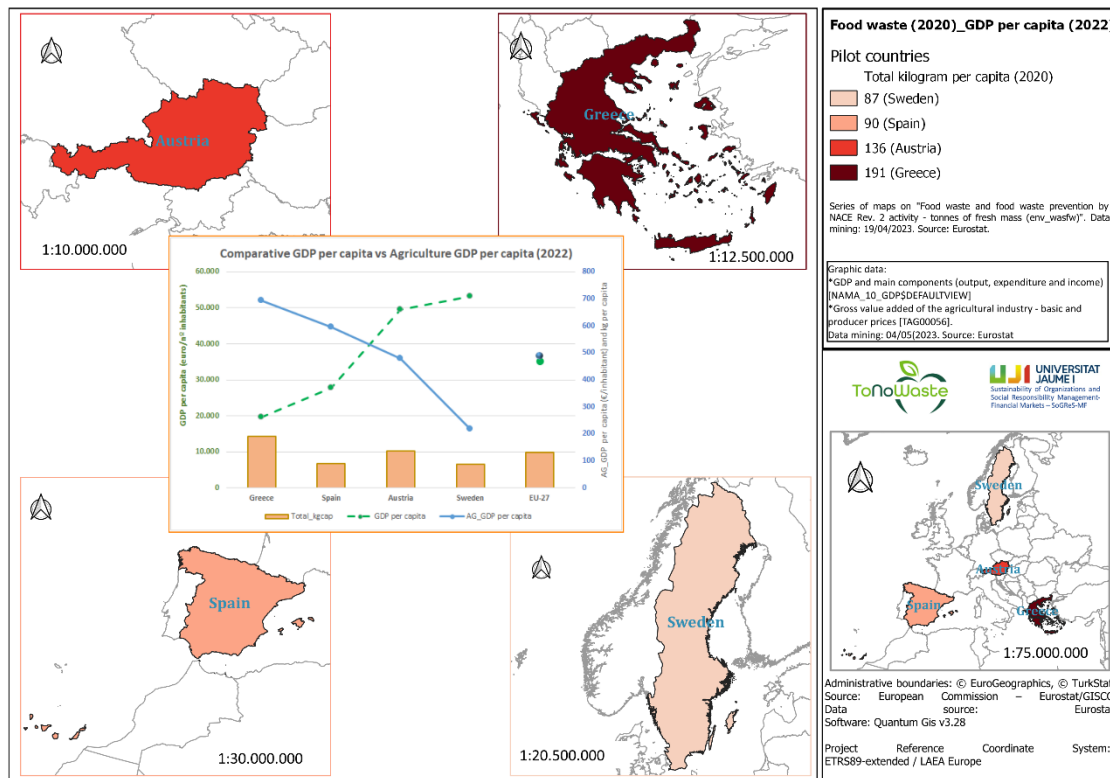


Figure 4: Food waste 2020 and GDP per capita (2022)

In Figure 4, the variables of "kilogram per capita", "GDP per capita" and "Agriculture GDP per capita" are represented for the four pilot countries that are part of the ToNoWaste project and the whole of the EU 27. Both in the map and in the graph, we observe that Greece is the country with the highest food waste (191 kg per capita) of the four ToNoWaste countries and Sweden has the least food waste (87 kg per capita), taking as a reference the value of the EU 27, which is 131 kg per capita. Comparing this value with the data corresponding to its GDP per capita and Agriculture GDP, we see that Greece has the lowest GDP per capita (19,666 € per inhabitant) and Sweden has the highest (53,164 € per inhabitant) out of the four pilot countries. Just the opposite occurs with the Agriculture GDP in these two countries, which is 684.5 € per inhabitant in Greece and 217 € per inhabitant in Sweden.

In the case of the Mediterranean countries (Greece and Spain), we observe that in comparison to Austria and Sweden, the weight of the economic activities of the primary

sector in the GDP per capita of their economy stands out, with values higher than the European average (487 € per inhabitant). The differences between GDP per capita and Agriculture GDP per capita are greater in Austria and Sweden, between 48,500 and 53,000 euros, respectively, while in Greece and Spain the range of differences is smaller, oscillating between approximately 18,500 and 27,500 euros, respectively.

As the Farm to Fork Strategy remarks, *"Tackling food loss and waste is key to achieving sustainability"*. Nevertheless, behind this statement several questions arise.

On the one hand, looking for potential solutions to the FLW problem requires a previous identification and analysis of the causes behind this problem, considering several perspectives such as actors involved, social basis, economic origins, environmental reasons, governance context, value chain description, among others. Moreover, since these parameters can be context-dependent, it is necessary to carry out this previous study considering the different ToNoWaste pilots and follower cities.

In this regard, some of the causes mentioned by the European Commission⁶ can be highlighted:

- Insufficient and/or poor planning of purchases and meals by consumers.
- Buying environment (e.g., promotions that encourage consumers to buy more than initially planned).
- Misunderstandings about the meaning of "Best Before" and "Expiration Date" labels.
- Packaging is too large.
- Aesthetic considerations.
- High quality standards.
- Errors in production, products and/or labelling that do not meet specifications.
- Improper storage/transport at all stages of the food chain, including in households.
- Lack of knowledge and/or misinformation about the environmental, social and financial impacts of food waste.
- Low perceived value of food.
- "Busy" lifestyle and conflict of priorities.
- Others.

On the other hand, just to characterize the current situation of the geographical influence area directly connected to the ToNoWaste project regarding FLW, we also need to identify FLWPR solutions and their maturity level in terms of sustainability and scope along the whole food value chain, from primary producers to end of life management.

Concerning solutions, the Joint Research Center (2019) identifies five categories: redistribution of food for human consumption; food valorisation; consumer behavioral change; improvement of the supply chain efficiency, and; food waste prevention governance.

⁶ https://food.ec.europa.eu/safety/food-waste_en

2.2 General outline

2.2.1 Aim and scope

The objective of this subsection is to reflect upon the results obtained from the technical participatory processes carried out with the ToNoWaste partners and stakeholders regarding two main initial questions:

- 1) What are the main causes of the problem of FFLW throughout the supply chain?
- 2) What are the main characteristics of the current actions for the prevention/reduction of food losses and waste associated with fresh food in the city pilots?

2.2.2 Process design

The literature review performed by project researchers regarding food losses and waste and its roots and assessment provided the theoretical basis necessary to decide on the focus of the study and the most relevant economic, social and environmental determinants for current research.

With this information as a main input, two technical workshops were organized, one in Valencia, Spain and another in Vienna/Graz, Austria.

With the objective of maximizing knowledge extraction from each technical workshop, and simultaneously optimizing the ToNoWaste project's stakeholder engagement connected to both city pilots, several questions were considered:

- To integrate in the discussion research results from the Joint Research Center, DG Sante and previous European research projects.
- To include participants from all the stages of the food value chain.
- To encourage participative processes by means of group dynamics, technological tools, integration, etc.
- To design hybrid sessions to facilitate the attendance of relevant stakeholders and experts.

These technical workshops resulted in the development of open discussions around food losses and waste causes and potential solutions in both city pilots, Valencia and Vienna/Graz.

2.3 Open discussion process for FW causes and potential FWPR solutions in the Valencia pilot

2.3.1 Planification

The first WP1 technical workshop in the city pilot of Valencia, took place on 16th of November 2022. It was coordinated by the University Jaume I (UJI) team, with the support of Las Naves, the coordinator of the pilot in Valencia. The workshop was structured around the following content:

- Open discussion on the problem of fresh food losses and waste and analysis of the causes along the entire supply chain.
- Identification of current actions to prevent/reduce food losses and waste associated with fresh food, deployed in the pilot cities, which could be selected for evaluation within the ToNoWaste project.
- Introductory debate on the current processes of evaluation of results of actions to prevent/reduce food losses and waste associated with fresh food.

All the partners belonging to the Valencian pilot (Las Naves, Cuinatur, Mercavalencia, Cooperativas Agro-Alimentarias) participated in the selection process of the most appropriate participants of this open discussion considering the ToNoWaste objectives.



Figure 5: Poster of the Technical Workshop - 16th November 2022, Valencia.

2.3.2 Implementation

More than thirty attendants belonging to different members of the supply chain participated in the workshop. Specifically, the following actors were represented:

Public administrations, large distributors, producers, small distributors, research institutes, specialized consultants, school canteens, researchers from the Joint Research Center, coordinators of related projects, actors with initiatives in development from other Spanish regions and academia.

2.3.3 Results

In the first phase of the workshop, a brainstorming session was conducted where the different participants talked about the problem of losses and waste of fresh food and the causes throughout the supply chain. The main contributions are listed below.

- Disconnected actors along the chain. There is a need to establish greater interconnection between different actors in the chain, from agricultural producers to consumers.

- Three different parts of the chain (production, marketing and consumption) that do not know the others' problems and needs. If the different actors in the chain come closer together, better decisions could be made.
- Change in the destination of production from a first class to other uses is not contemplated from the beginning. (Loss of commercial value. One of the actors has a loss vision associated with an economic perspective).
- Rejection by the food chain of fresh production. Aesthetic quality requirements in supermarkets.
- Different consumption and purchasing habits (cultural and social theme): you cook less, you buy worse, everything faster, culture of immediacy, etc.
- More demanding consumers.
- Problem of consumer education (products are considered second quality when they are not).
- Losses and waste of fresh food were not considered a problem until 2012.
- Food waste is often falsely linked to the most disadvantaged people.
- Lack of sufficient public policies.
- Standardization of gauges. It is necessary to avoid productions that are not transferred to the market.
- Need to measure fresh food waste and its impact. From the consumption side, measurements are beginning to be made, but it requires greater awareness among final consumers (starting with schools) about the need to know the impact of their actions. Education of families.
- Indeterminacy of the definition of waste. Propose that the standard be revised (what has been produced to be consumed and has not been consumed).
- Need to review the regulations of the expiration date. Review of dates. Better inform and train consumers so that they are clear about what is the "best before date" and what is the "expiration date", etc. (dietary culture).
- Food manufacturing has become industrialized and systematized production is poorly differentiated. Need to diversify products.
- Packaging in supermarkets that generate food waste.
- How to sanction food waste produced by each individual.
- Waste associated with a planning problem. Solution e.g. kitchen of use, return to previous solutions.
- Need to make greater use of technological applications to measure waste.
- Lack of information to take effective solutions. You need to go to the root cause of the problem to come up with effective solutions. Example: consumers throw away a

lot of products because they expire, but why does a product expire at a consumer's home? Why has a product been purchased that is going to expire soon?

- Waste may be located in one stage of the product cycle, but the origin of waste may be found in another stage; e.g.: expiration date. The flow of information between the various actors in the chain may not work well.
- Delegated Decision (EU) to quantify food waste that includes total edible and non-edible waste (could be differentiated, although not mandatory under the directive). Need to discuss the aspects that the Delegated Decision (EU) has determined to include in the quantification of food waste (e.g. packaging waste, etc.).
- Lack of the ability to better manage waste.

After a deep analysis of all these proposals, they were associated with the definition of potential causes mentioned in section 2.1. The next step comprised of voting on the aspects considered most relevant, using the *Mentimeter* application for mobile devices. The results of the vote indicated that the most significant causes were (in this order):

1. Insufficient and/or poor planning of purchases and meals by the consumers.
2. Lack of knowledge and/or misinformation about the environmental, social and financial impacts of food waste.
3. Perceived low value of food.

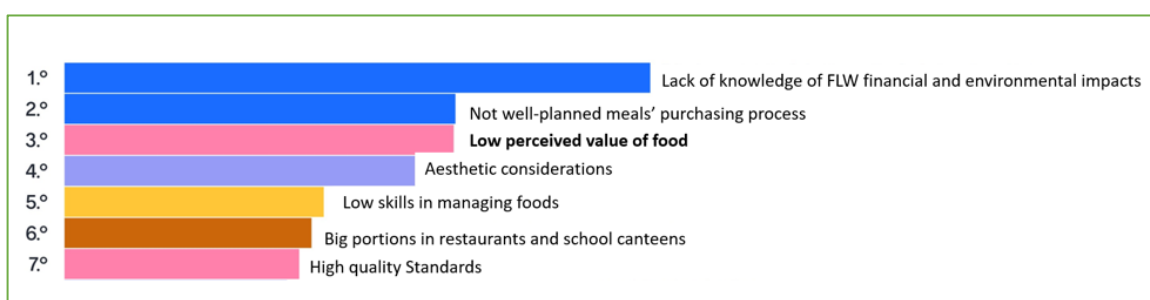


Figure 6: From your experience, which factors contribute most to food waste?

Regarding the first approach of the ToNoWaste project to the existence of FLW actions driven by different food system actors, a short questionnaire was elaborated to obtain basic information about the nature of these actions, associated with fresh food, deployed in the pilot cities, which could be selected for evaluation within the ToNoWaste project (Figure 7).

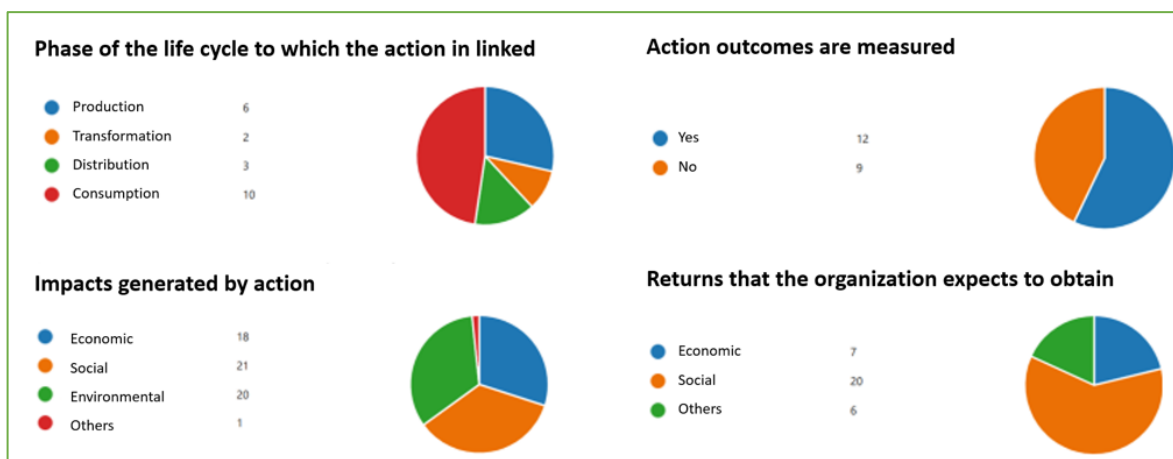


Figure 7: First approach of the identification of food losses and waste prevention/reduction actions in the Valencian pilot

Attendants mentioned some of the food losses and waste prevention/reduction actions currently implemented by them, linked to training programs, supplier management, technological solutions and awareness campaigns, among others.

2.4 Open discussion process for FW causes and potential FWPR solutions in Vienna/Graz pilot

2.4.1 Planification

The first workshop carried out in the pilot of Austria (Vienna/Graz) took place online on 5th December 2022, from 9:30 am to 12:30, and participants included policy and decision-making process, city administration, research and education sectors.

After a short welcome from the OEAW, an introduction round and the presentation of the ToNoWaste project, the session was carried out as follows:

- Group works: Moderation (OEAW, Caritas) and co-moderators (using templates as reference: OEAW, Strateco).
- Round 1: it was organized based on intra-group discussions, followed by a short presentation per group and a discussion in a plenary. Partners from Bio Ernte Austria, Zero Waste Austria, Akaryon, Perspective Handel and Strateco supported the discussion as informants. The discussion sessions were structured around two main questions:

A) Part I: What problems are visible along the value chain? A template along the flow line of the value chain (production, transport, marketing, purchase, enjoyment, waste, no-waste ...) was presented and elaborated according to what is said.

B) Part II: Framework conditions based on social, technological, economic, ecological, political, legal, ethic and demographic (STEEPLED) aspects to distinguish

factual aspects that are concretely related to the value chain and structural-political framework conditions.

After that, the dynamic of the session was designed in such a way that an intermediate presentation of results was shared by the groups with the other participants, followed by a discussion of group results in the plenary.

- Round 2: group discussion, presentation per group and discussion, around two issues:
 - A) "After thinking about the problems, what solutions (solution strategies) come to your mind?"
 - B) Concrete measures: "What actions can be effective here (in relation to specific problems or clusters of problems in each case)?" and "How do we recognize that these are really effective (indicators, criteria, ...)?" ; relevant actors are also noted.
- Presentation of a summary of the discussion developed in the plenary.

2.4.2 Implementation

Fifteen people participated in the first Austrian technical workshop, belonging to organizations such as chambers of agriculture, city councils, environmental agencies, academia and technical schools, research centres, city kitchens, city food councils, and ecology institutes. Both cities, Vienna and Graz, were duly represented by these institutions.

2.4.3 Results

Several problems were identified by the attendants. The next sections reproduce (almost literally) answers given in the different sessions, connected to food production, trade and consumption.

Production

- Overproduction.
- Planning: dependence on orders and legal framework conditions.
- Secure purchase cannot be guaranteed due to legal framework conditions.
- Evaluation criteria for tenders should consider local/ national and EU levels.
- Production goes over entire vegetation period. Farmers will strive for operational optimization and grow crops that generate income.
- No federal coordination – for example, which amount of tomatoes is needed. Also related to changing consumption preferences. Fresh Food is in demand before the products are ripe and if they are ripe, sales are not big enough.
- Inflexibility of production must be considered.
- Uncertainty about demand for the coming year.
- Other ways of using the products must be enabled and allowed to be implemented, e.g.: processing cannot be implemented by everyone / hardly any producing company, would need for this.



- Devaluation of food - agricultural business wants to generate income, it is not only about the products being consumed, but the business should also be able to earn something with it.

Trade

- It is necessary to differentiate between a retailer who is self-employed and a group-controlled retail company.
- Big difference between rural and urban areas. Passing the overproduction on in the city is less difficult.
- It is difficult for retailers to survive due to changes in consumer behavior and economic crisis, more bulk purchases/promotions/cheap private labels.
- Income issue - applies to farms, but also to retail.
- Food retail: small retailers have become very familiar with food waste; in comparison, supermarkets organized by corporation care less.
- Stakeholder list: differentiate wholesale and food retail.
- "Nobody believes in labels anymore" - audit system does not have to end in a label - can run on supply chain level.

Consumption:

- District work - consumption side: oversupply tempts people to buy too much.
- Behaviors are strongly characterized by uncertainty, even when food is tasted - people are afraid of food poisoning.
- Planning security along the entire value chain. How to optimize planning as much as possible?

2.5 Main FW causes and potential FWPR solutions identified by

ToNoWaste stakeholders

2.5.1 Main reflections and conclusions about FW causes

The results obtained from both technical workshops reinforce the initial statement regarding the complexity of the FLWPR problem and potential solutions. Previous relevant causes mentioned in the theoretical analysis at the beginning of the project were also identified as relevant by the ToNoWaste stakeholders. In addition, other key issues can be highlighted and considered for the FLW research along the entire food value chain.

On the one hand, room for improvement is identified regarding planification in primary production in order to optimize production processes and avoid overproduction. This reflection on the lack of planning can also be applied to the case of purchase and meals definition by consumers. However, while both aspects are evident for FLWPR, ToNoWaste stakeholders pointed out other interesting considerations that are not always at the forefront of FLWPR solutions.



In many cases, the identification of food production versus consumption as potential roots of FLW problem is unclear or interdependent, which makes it difficult to put the focus on a single solution or on a specific food system actor. In this sense, overproduction, understood as the excess of supply, is identified as part of a larger problem, that is the low perceived value of food by consumers.

On the other hand, the availability and/or quality of information is another key problem identified that can be applied to the study of the causes of FLW at the different stages of the food value chain. In this regard, and especially connected to the ToNoWaste project, the lack of knowledge and/or misinformation about the environmental, social and financial impacts of food losses and waste by producers, manufacturers and consumers must be highlighted.

Linked to this problem, price arises as an insufficient mechanism for the transmission of information. It has usually been the reference for quality considerations, and quality is frequently linked to aesthetic aspects. However, it says little about sustainability impacts along the entire food supply chain, including the impacts of potential losses generated until the food product is available for consumption. Nevertheless, ToNoWaste stakeholders advise caution with the supply of labels; the excessive presence of labels can easily overwhelm consumers and therefore represent a risk.

Finally, the gap between rural, regional producers and urban, city consumers should be highlighted. The connection to regional producers in the countryside is strong and local products are consumed more than in the city. Nevertheless, other ToNoWaste stakeholders believe that this does not guarantee sustainable food consumption/production and less FLW.

2.5.2 First approach to potential FWPR solutions

The main solutions proposed by ToNoWaste stakeholders in the technical workshops can be initially summarized and clustered into: i) system solutions; ii) production; iii) trade; and iv) consumption.

The following contents include some of the solutions initially proposed by the participants of the project. The objective is not to identify current specific solutions but to delve into the needs of food system and food system actors for preventing and reducing food waste, by discussing potential solutions. We note that there are proposals that have not been submitted to a consensus process among the different stakeholders. Moreover, it should be highlighted that they are general solutions that should be concretized and tested to analyze the costs and benefits of their implementation.

1. **System solutions**

These kinds of solutions go beyond the action of one isolated food system actor, requiring the intervention at meso and/or macro level.

Value chain

- Reduce alienation between production and food consumption, understand linkage between trade-consumption-production.

- The need to promote consensus building and coordination between value chain stages.
- Innovative cooperation between public institutions, companies and consumers.
- Product type-specific analysis is needed.

Global dimension

- Explore the roots of food waste in global commodity flows.
- Improve time management of global value chains.
- Provide tools for the sustainability assessment of global food value chains.
- Improve data infrastructure for balancing the resilience of food systems with the FLWPR objective.

Regulation

- Review regulations that lead to more waste, improving the consistency of regulatory frameworks.
- Adapt losses and waste laws to improve the decision-making process of food system actors.

Regional solutions

- Create regional platforms with countries and cities as food networks that ensure the security of supply and quality.
- Evaluate whether direct marketing/alternative trade channels lead to less food waste.

Employment quality, including training

- Support farmer profession to improve its attractiveness and intergenerational relay.
- Improve education offers and multi-actor projects, including large educational projects for improving management skills.

Awareness raising

- Holistic awareness raising.
- App (information in text, pictures and data, motivation, visualization of existing projects and potentials).
- Nationwide campaigns for sustainability-friendly and low-waste production and consumption patterns.
- Target group-oriented information.

2. Production

- Promote knowledge and knowledge transfer about sustainability-friendly and low-waste farming.
- From a harvest perspective, consider the whole chain and coordinate transport flows.
- Innovation in production, such as in the field of agricultural machinery.

3. Trade and Consumption



- Transparency and information traceability along the food value chain.
- Awareness raising and incentives for waste prevention.
- Appreciation and awareness to prevent over-purchasing.
- Promote sustainability-friendly consumption.
- Prevent the misinterpretation of the "best before" date.
- Social media: raise awareness and distribution.
- Time management for consumption of all food that is purchased.

Additionally, to obtain more information about potential FLWPR actions, the ToNoWaste project includes the development of a Delphi process among experts from different EU countries. Based on the results of the two first technical workshops of WP1, a list of potential questions for the Delphi⁷ process was defined linked to the categories reflected in Table 1.

| Category | Description |
|-----------------------|--|
| Importance of regions | <ol style="list-style-type: none"> 1. Creation of regional platforms as food networks along the entire value chain 2. Regional products on sales slips 3. Support of regional producers with the calculation of ecological footprints and waste backpacks |
| Regulations | <ol style="list-style-type: none"> 1. Transparent presentation of current information about the manufacturing conditions of products and their waste backpacks (e.g.: in the Food Information Regulation) 2. Review of standards and regulations towards their potential for waste prevention (EU hygiene regulation, waste management rules, opening hours, product classification, best before date, etc.) 3. Financial incentives for waste reduction at each stage of the value chain 4. Review and certification of innovative digital applications with regard to their problem-solving potential, consumer protection and user friendliness, as well as possible deficits, problem shifting and rebound effects |
| Production | <ol style="list-style-type: none"> 1. Innovations in agricultural devices and their use in agriculture 2. Contract security for small and medium-sized producers when trading to avoid overproduction 3. Re-evaluation of leftover utilization in production and its potentials |

⁷ Results in section 4.5

| | |
|--|--|
| | |
| Logistics along the entire value chain | 1. Optimization and reduction of transport flows, storage and cooling (e.g.: scope for regional low-waste and climate-conscious production on demand, etc.). |
| Distribution and trade | <ol style="list-style-type: none"> 1. Expansion of direct marketing (solidarity farming, FoodCoops, ...) 2. Avoid actions that create price pressure for producers and lead to overproduction 3. Avoid actions that lead to excessive purchasing 4. Management and monitoring of various marketing channels for waste reduction potential 5. Storage and packaging from the point of view of shelf-life management for a longer time window for consumption |
| Consumption | <ol style="list-style-type: none"> 1. Reflection on consumption, food and meal culture in order to support low-waste and climate-conscious action 2. Initiatives for food procurement and consumption at the neighborhood level (logistics, cooking, information exchange, ...) |
| Gastronomy | <ol style="list-style-type: none"> 1. Optimization of planning and emergency solution for food surplus through monitoring, measurements, linking of information, participation and training of employees and transparent communication of optimization plans 2. Tender criteria for community kitchens and food deliveries regarding low-waste operation, climate-conscious production and responsible action |
| Education | <ol style="list-style-type: none"> 1. Educational projects (school projects, training for stakeholders on low-waste practices) 2. Education about best-before dates for stakeholders and consumers |

Table 1: Development of questions for the Delphi process

3. What does it mean to make better decisions regarding FWPR actions? Multidisciplinary research

The third section of the deliverable D1.2 regards the development of multidisciplinary research about a key question for the ToNoWaste project: *What does it mean to make good decisions in a FLWPR context?* Different actors from the FFVC can have differentiated or even contradictory answers to this question. Nevertheless, the challenge within these open, multi-actor and participatory processes is to arrive to a consensus that can be accepted by every actor, regardless of their role and the regional context.

3.1 Theoretical background

From a ToNoWaste perspective, the best decision in the FFVC will be one that supports FLWPR's actions and improves the sustainability of the food system. In addition, solutions on FLWPR should be based on resilience, healthy diets, circularity, resource efficiency and inclusion of vulnerable groups (alignment with the SDGs). However, in this context, one key question arises: What does it mean to make good decisions to prevent/reduce food waste?

In relation to the meaning and variables that operationalize sustainability within the food system, the definition provided by SAPEA (2020) can be taken as a reference (Evidence Review Report No. 7):

*'A sustainable food system for the EU is one that: provides and promotes safe, nutritious and healthy food with low environmental impact for all current and future EU citizens in a way that also protects and restores the natural environment and its ecosystem services, is robust and resilient, economically dynamic, fair and equitable, and socially acceptable and inclusive. It does so without compromising the availability of nutritious and healthy food for people living outside the EU or harming their natural environment.'*¹

Moreover, the Inception Impact Assessment⁸ paper of the proposal of a new initiative under development in the EU on a sustainable EU food system, led by DG SANTE Farm to Fork/ DG AGRI/DG ENV/DG MARE that could be published in 2023, highlights several sub-objectives to be considered in this regard. Among others, it includes the optimisation of the production, distribution and consumption of food, with the aim of increasing resource efficiency and reducing food loss and waste.

At the same time, this sub-objective coexists with others such as *'to ensure that a favourable food environment makes it easier to choose healthy and sustainable diets providing benefits for consumers' health and contributing to the reduction of the environmental footprint of the food system as well as attracting investments into sustainable production methods'*; or *'to ensure transparency for sustainability purposes'*. Consequently, FLWPR actions shall belong to a food system that makes economic, social and environmental sustainability compatible. That will be the framework for the operationalisation of the 'best decision' criteria regarding FLWPR actions within the ToNoWaste project.

Also, decision-making processes can be influenced by different environmental conditions, and decisions around FLWPR actions are not alien to it. Approaches like the STEEPLED (Social, Technological, Economic, Environmental, Political/legal, Ethical, Demographic) analysis may be useful (European Parliament, 2017) to identify the most relevant contextual factors that

⁸ Ref. Ares(2021)5902055 - 28/09/202

should be considered in a decision-making process. Focusing on the food losses and waste matter, the STEEPLED analysis allows to present the following reflexions:

Social (societal) – The basic assumption is that new technologies will save resources, for example, because the use of information technologies lead to less food waste. However, this can have very different kinds of impacts.

- (i) New short-term problems: e.g.: transport more products and cause more transport emissions;
- (ii) The gained efficiency and reduced environmental impacts of the food production and consumption; or
- (iii) The technical, social or organisational innovations themselves might lead to long-term environmental or economic problems according to current uncertainties.

Several societal factors can affect the decision-making process regarding FLWPR and the identification and assessment of its potential impacts. These include issues such as religion, ethnicity, employment status, economic means, well-being, health, (dis)abilities, habits, awareness-education, etc.

Technological – Innovations to prevent and reduce food waste continue to develop, especially in terms of quality of production, packaging, logistic, food processing and preparation. Actors along the value chain should be well prepared and updated to adapt to new changes.

The aspects that are usually considered when analysing technological solutions are their purpose, application, accessibility, effectiveness, added value, dual use, required research and innovation, challenges or the existence of alternatives, among others.

Economic – The data generated by decision-making tools will be used for commercial purposes, opening up the way for new forms of “commercial sales”. The decision-making tools will also enable the production of new forms of “customized sales” since customized offers might reduce food waste. As such, decision-making tools could disrupt the existing economic model by decentralising the production of food.

In any case, there are different economic factors to be considered due to their potential influence in the decision-making process of FLWPR: economic value and commercialization, job creation and loss, infrastructure & resources needs, equality of access, skills dependency, resource dependency, infrastructure dependency, affordability, etc.

Environmental – A big promise of several technologies is that we could become more sustainable in taking care of the environment. However, other environmental issues, such as the use of natural resources, resource efficiency, energy efficiency, water efficiency, recyclability, production/process safety, product safety, among others, should be considered.

Political/legal – Legislation on the prevention and reduction of food waste is scarce and needs to catch up with the fast-evolving technological possibilities. In the food value chain, we must pay attention to the information provided and individual rights of consumers

regarding privacy and data protection. Instead of monitoring systems for everyone, identifying best possible incentives and awareness building measures is needed.

Consequently, geopolitical aspects, individual rights, democratic aspects, liability, laws and regulation, market structure, guidelines for foresight-based policy analysis and privacy issues, are potentially relevant factors in FLWPR-related decision making-process.

Ethical - Given the EU Green Deal, social justice is a pressing issue. Particularly, ICT technologies are constantly recording users' personal data, such as eating habits, weight and health issues, financial transactions, personal relationships, etc. The application of data bases will require a huge amount of data collection and assimilation. This includes both the privacy of the public and of individual users for whom data may automatically be uploaded into 'the cloud' in a non-transparent way.

The 'Big Data' poses serious ethical implications, as it is being used without users' consent or control, and remains stored on the cloud, somewhere where the user cannot delete it. Users normally do not have control over their personal data. Should governments be responsible for enhancing the public's literacy about their privacy concerns and possible consequences? Is it the users' responsibility to inform themselves properly and, based upon that, to take decisions on using or not certain devices and services?

Questions like this should be included when thinking about the different ethical implications linked to the FLWPR problem, such as respect for persons and the environment, the availability of justice (fair availability), collective wellbeing, individual freedom (autonomy), and taboos/social norms concerning FLWPR.

Demographic - The development of decision tools offers a huge potential to select the type of information on food and make decisions to reduce food waste. At the same time, this development could be influenced by demographic factors and decision-maker profiles such as age, gender, household composition, education level, occupation or geographical residence.

3.2 General outline

3.2.1 Aim and scope

This subsection focuses on the explanation of the results obtained from two key knowledge extraction procedures within WP1 of the ToNoWaste project: specific technical workshops and STEELED analysis. Both procedures are characterized by being open, technical and participatory multi-stakeholder processes within multidisciplinary research around the topic of making "good decisions" to prevent and reduce losses and waste of fresh food throughout the supply chain.

That means keeping in mind two main questions:

What does it mean to make good decisions?

What factors of the general environment affects this process?

Moreover, a deep analysis of these issues also involves reflecting on current practices of evaluation of actions for the decision-making of prevention/reduction of food losses and waste. The relationship between "better decisions" (or "good decisions"), contextual factors associated to the decision-making process, and evaluation criteria is clear. These evaluation

criteria should support the operationalization of "good decisions". Due to the relevance of this topic for the ToNoWaste project, it will be discussed in a specific section, section 4.

It should also be noted that a variety of economic, political, social, environmental, etc. factors can influence decision-making processes, determine the connotations linked to what is understood as a "good decision" and, consequently, its materialization in evaluation criteria of the different decision alternatives.

3.2.2 Process design

A previous analysis regarding the state of the art of the meaning of better decisions in terms of FLWPR, both in scientific and grey literature of European institutions, pointed out the multidimensionality of the problem and the lack of a clear and unequivocal answer.

Under this premise and considering the inextricable relationship between FLWPR decisions and sustainability within the ToNoWaste project, two technical workshops were organized, one in Valencia and another one in Vienna/Graz.

The primary objective of each technical workshop was to explore stakeholders' experiences and opinions with the problem under study. In addition, organizers are aware about the relevance of these technical workshops for reinforcing synergies and the ToNoWaste stakeholder engagement with the project, connected to both city pilots.

With that aim, several aspects were intentionally integrated in the workshop design process:

- To keep in mind the concept of a sustainable food system.
- To include a multidisciplinary composition of researchers among the participants, in addition to actors from all the stages of the food value chain (primary producers, distributors, public administrations, consumers, technological providers, etc.).
- To encourage participative processes by means of open debates, group dynamics, the integration of technological tools, etc.
- To design hybrid sessions to facilitate the attendance of relevant stakeholders and experts.

As a result, these technical workshops allowed for the development of open discussions around food losses and waste causes and potential solutions in both city pilots, Valencia and Vienna/Graz.

3.3 Better decisions about FWPR actions: Valencia pilot

3.3.1 Planification

The second technical workshop belonging to the WP1 research deployment in the city pilot of Valencia, took place on 17th of January 2023. It was coordinated by the University Jaume I (UJI) team, with the support of Las Naves, coordinator of the pilot in Valencia. It was structured in the following way:

- Participatory discussion among attendees: What does it mean to make good decisions to prevent/reduce food waste?
- Open discussion among attendees on the social, technological, political, legal, economic, environmental and demographic factors that influence decision-making processes to prevent/reduce food losses and waste associated with fresh food.

- Introductory discussion regarding the most relevant social, economic and environmental criteria for evaluating the results of actions to prevent/reduce food losses and waste associated with fresh food.



Figure 8: Poster of the Technical Workshop, 17th January 2023, Valencia

All the partners belonging to the Valencian pilot actively participated in the process of inviting experts and stakeholders that could participate in this technical workshop within the scope of the ToNoWaste objectives.

3.3.2 Implementation

Almost thirty participants (in person and online attendants) attended the workshop, and the profile of the participants covered different food system actors: public administrations, academia, technology providers, primary producers, distributors, school canteens, consumers, trainers and researchers.

The session was also supported by technological tools that allowed the organizers to obtain participants' perceptions and knowledge in a more efficient and clearer way.

3.3.3 Results

Participatory discussion among attendees: What does it mean to make good decisions to prevent/reduce food waste?

From a ToNoWaste perspective, the best decision in the FFVC is the one that supports FLWPR actions that generate the best impacts for the sustainability of the food system.

FLWPR decisions should also consider basic aspects of resilience, healthy diets, circularity, resource efficiency and the inclusion of vulnerable groups (alignment with the SDGs).

The first question is about the introduction of decision-making criteria to make the best possible decisions.

The answer to this question will be tackled in the next section. Nevertheless, a brainstorming process was generated in which all participants presented their ideas as a first approach to addressing this challenge. The main contributions grouped by different themes are set out below.

Identification of concepts:

- Lack of scientific criteria to convey the sustainability or unsustainability of food waste.
- Importance of defining what is sustainable in the agri-food sector with a scientific basis.
- It is essential to recover the concept of "feeding" to understand the concept of reduction. All agents in the chain must be involved, but at the centre, in addition to sustainability, must be the person.
- Keep in mind the concept of "durability", although sometimes it is not aligned with the concept of "reduction".
- Consider the concept of "expiration".
- Concept of "stable and unstable defect". It is very difficult for a consumer to differentiate between these two concepts.

Metrics:

- It is necessary to have impact metrics in the industry to detect where food waste comes up. Impact metrics should be used to make decisions based on concrete objectives that cover both prevention and reduction. In addition, we must consider actions that reduce environmental or social footprints, but what aspects to contemplate?
- To talk about good decisions, these must be consensual for which coordination at all stages of the product life cycle is essential. The different members of the chain will have to make different concessions to achieve an overall objective.

Governance:

- Consider the importance of governance models for the whole food system and the supply chain.

Regulations/Legislation:

- It is necessary to consider existing initiatives and prior know-how to define new strategies or initiatives.
- It is necessary to consider different measures and regulations so that supermarkets cannot sell unsustainable products.
- Within the legislative framework, it is important to pay attention to food systems.



- Food procurement criteria for public organizations should be considered. In this sense, we must work on measures related to the field of "public food procurement" since this constitutes 14% of GDP in Europe. In Spain, we are not yet working as in a big part of Europe, but this is a strategic tool to provide the minimum criteria on issues such as, making menus seeking the minimum requirements in terms of quantities and nutrients, for the generation of climate policies, integration of all actors, etc.
- The relevant role of the administration is fundamental in the definition of minimums, for example, to ensure that vulnerable families are assured a daily healthy menu.
- There is a dichotomy between environmental regulations and food safety regulations. But what regulations and/or guidelines should be prioritized? Traditionally, health is prioritized, but we must try to make the rest of regulations coherent by putting health first.
- Differentiate between local and foreign consumption for the definition of regulations. It is necessary to define regulations that adapt to everyone's needs.
- The needs of the different actors in the supply chain must be transferred to public administrations and the impact of certain organizations.
- At the legislative level, there is still much to be discussed in relation to other issues such as energy, mobility, etc. that also affect us today.
<https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220925-2>

Communication/Information/Training:

- It is key to inform and communicate well the different actions to stakeholders.
- We need criteria that allows us to inform about the measures that the different actors generate to reduce food waste.
- Report on the economic value of impacts.
- Information/training. It is necessary to define what is relevant information to be able to train, but first we must know the consequences and impacts that we are not measuring of the different actions. For example, food is thrown away because the final consumer considers that "there is no value" in the product, in this context it is necessary to know the consequences and impacts that we are not measuring yet.
- Children in schools need to know what they are eating. Teach children the origin of what they eat, where food comes from and the situation of the rural world and to know the impact of waste that is generated beyond what they eat.
- Nutritionists play a key role in the training process.
- Define incentives for that information to be generated.

Networking/ Coordination:

- Networking is necessary for concepts to be understood in all areas.
- The coordination of actors in the process of taking actions plays an important role in public administration. Public administrations must have coordination, cohesion and coherence in the definition of their policies.
- Coordination between actors, but also between regulations along the chain for different actors.
- There is also a need to address the problem individually in each sector.

Final consumer/citizen:



- Translation into the language of the citizen is paramount. Consumers must be involved in decision-making. This means a circular policy where the citizen is involved from the beginning in the decision-making process.
- On the other hand, it is essential that the consumer is aware of the product's characteristics (origin of the product, main farming techniques, etc.).
- In many cases, it is unfair that the responsibility falls on the consumer side, because he/she does not always have the capacity to make certain consumption decisions.
- The final consumer stage produces the highest percentage of food waste, so actions with final consumers are key.

Farmers/producers:

- It is important to define the actions that a farmer must undertake to reduce food waste. For this, there is a need for the farmer to know what it is a sustainable crop, to better define what actions to take to reduce food waste. This is difficult since many of the resources that allow them to make a product more marketable, according to industry and consumer standards, are not at their disposal (e.g. due to financial restrictions).
- Who is responsible for selecting what to produce? The following questions must be answered: is a producer free to choose what to produce? Who chooses what to produce? These decisions depend on the business model, but is there freedom to choose the business model? According to the current regulations, when ecological production shares space with traditional production, is necessary to isolate the ecological production to maintain its characteristics, although this can generate more plastic. Can the producer influence those decisions? Who makes the decision to sell in bulk or in packages? Who makes the decision of the packages to be packaged in plastic?
- It is considered relevant to prioritize local products.

Open discussion among attendees on the social, technological, political, legal, economic, environmental and demographic factors that influence decision-making processes to prevent/reduce food losses and waste associated with fresh food (STEEPLED)

The objective of this phase was to determine which factors influence the decision-making process on FLWPR actions, considering the geographical scope of Valencia and the experience of the participants and their organizations.

STEEPLED analysis is used as a frame of reference. Specifically, participants filled out a questionnaire in which they could identify for each group of aspects raised by the STEEPLED analysis (social, technological, economic, environmental, political and legal, ethical and demographic) the factors that influence decision-making processes to prevent / reduce food losses and waste associated with fresh food.

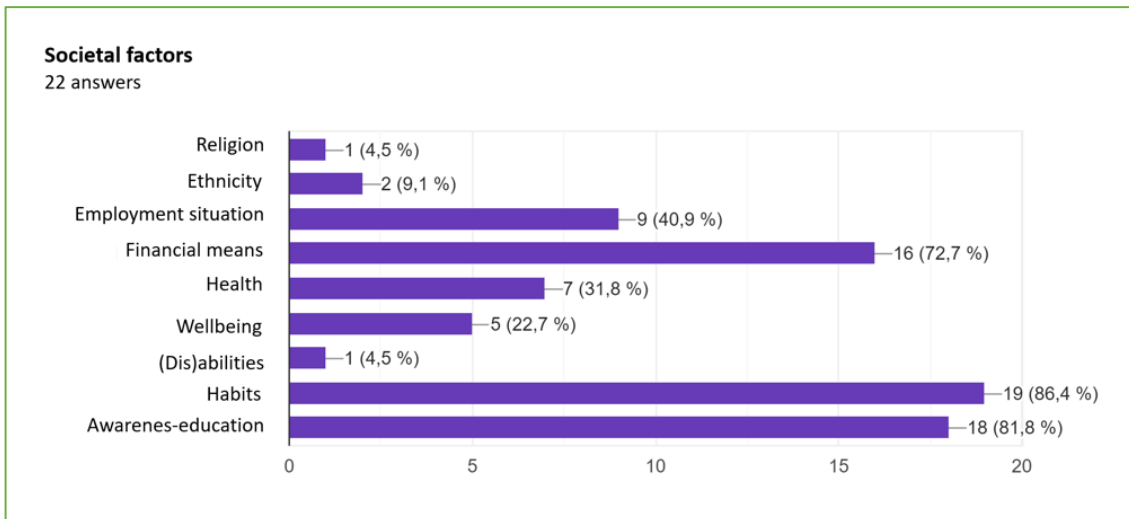


Figure 9: STEEPLED Analysis: Societal factors. Valencia pilot

Regarding social factors, workshop participants identified habits, awareness, education and financial means as the most important factors that can influence the decision-making process related to the FLWPR.

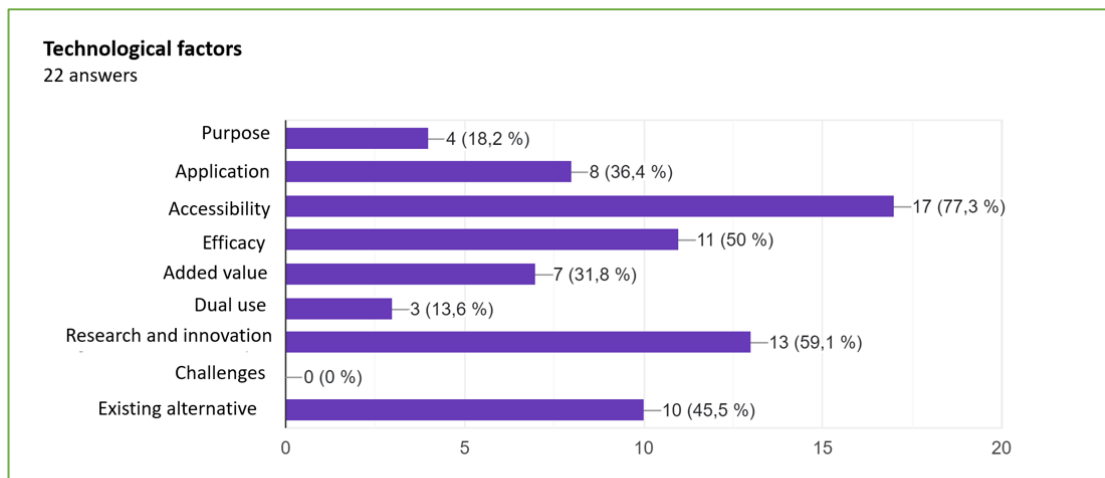


Figure 10: STEEPLED Analysis: Technological factors. Valencia pilot

Technological accessibility, the level of research and innovation and the effectiveness of technological solutions, are perceived as the most important technological factors to make decisions linked to FLWPR.

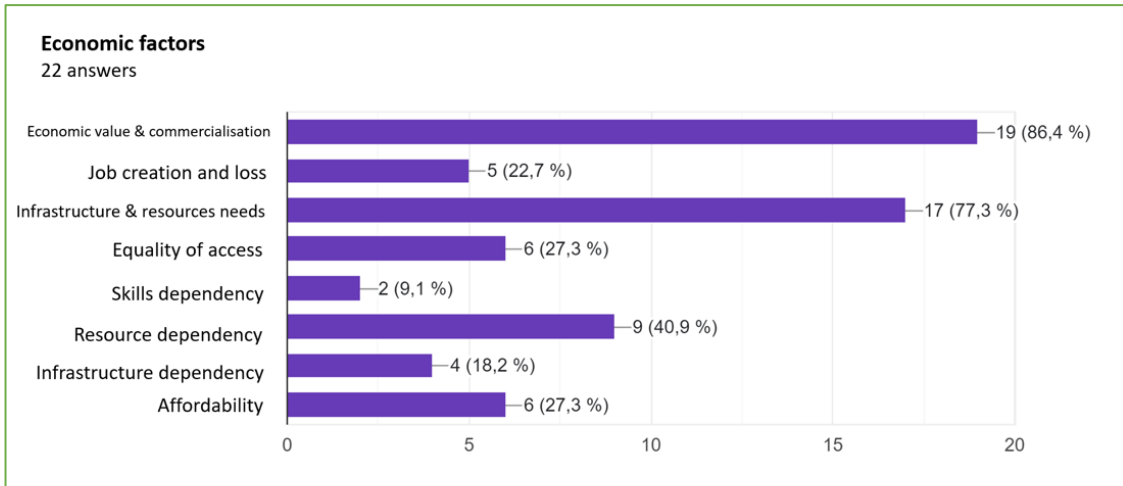


Figure 11: STEEPLED Analysis: Economic factors. Valencia pilot

In terms of the economic factors most likely to affect FWPR decision-makers, attendees highlighted two factors above all others: the economic value and the commercialisation of potential solutions and the need for infrastructure and resources.

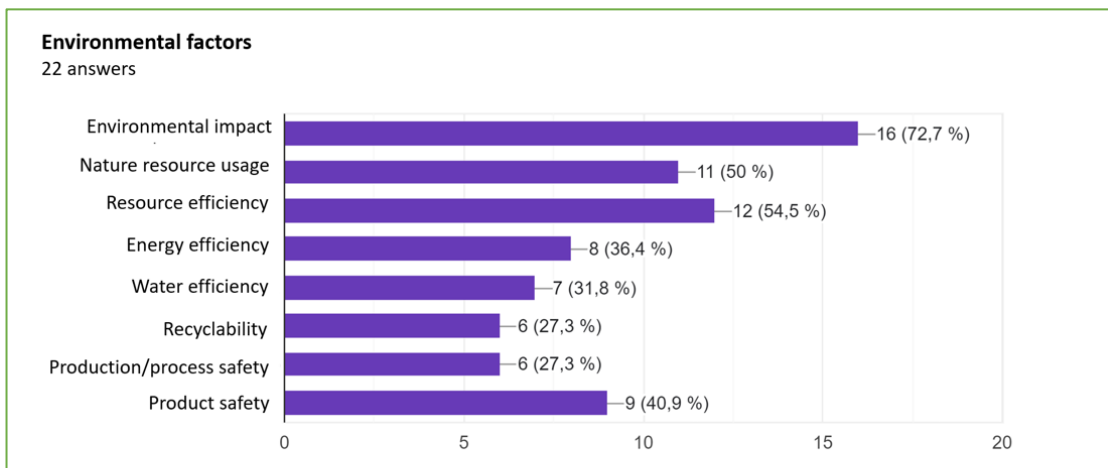


Figure 12: STEEPLED Analysis: Environmental factors. Valencia pilot

Concerning environmental impacts, from a general perspective the use of natural resources and resource efficiency were identified as the most influential factors.

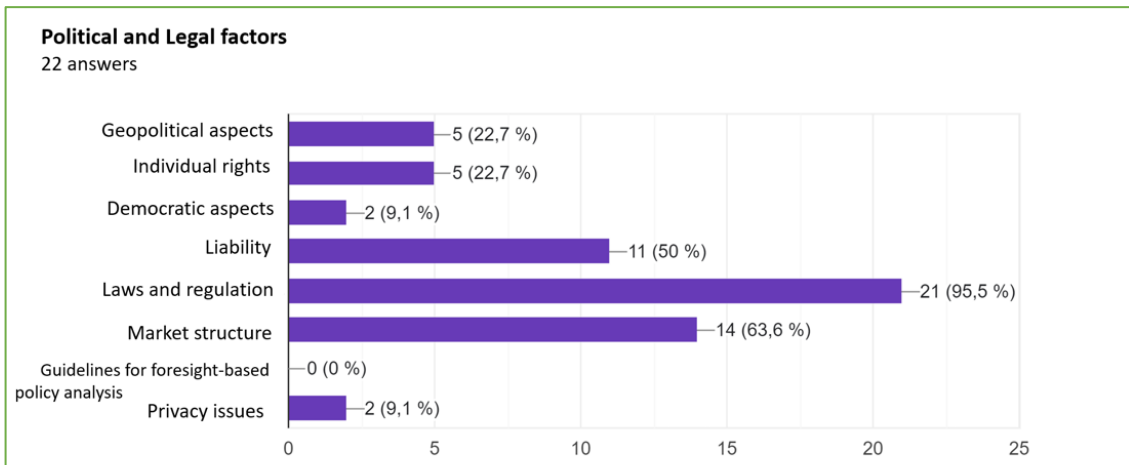


Figure 13: STEEPLED Analysis: Political and Legal factors. Valencia pilot

Laws and regulations were identified as the most important political and legal factors by almost 100 percent of the participants in the technical workshop.

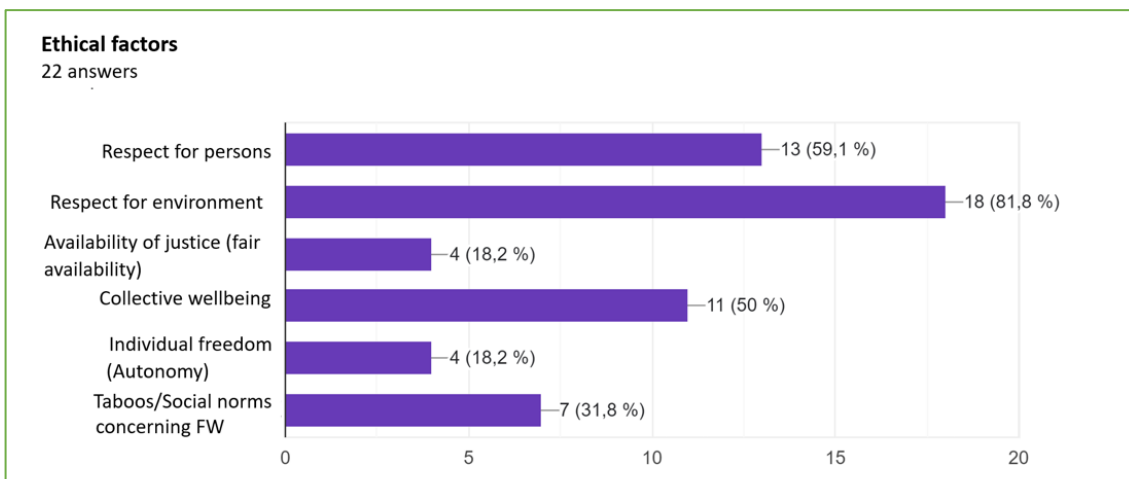


Figure 14: STEEPLED Analysis: Ethical factors. Valencia pilot

In line with previous responses, respect for the environment and for people are considered the main ethical factors in an FLWPR decision-making process. Collective well-being comes in third, as a close second.

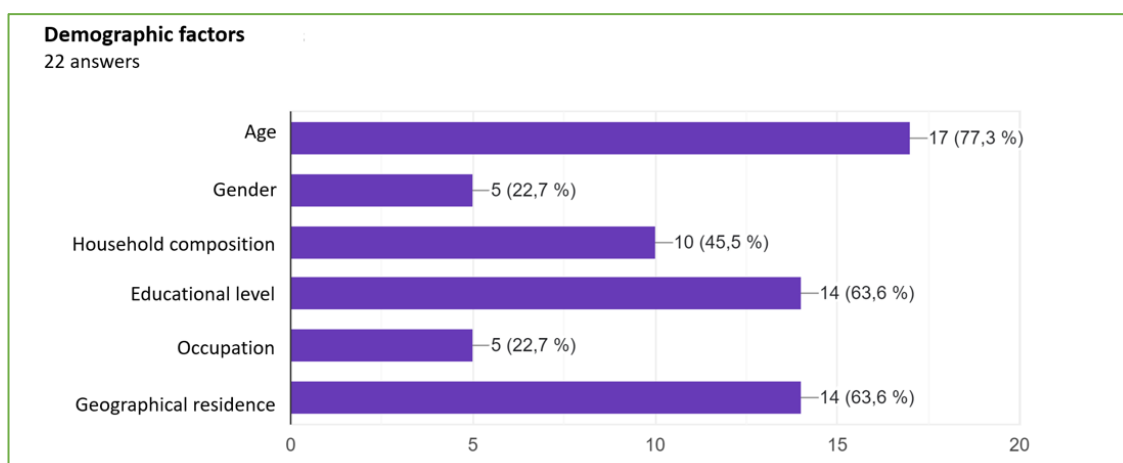


Figure 15: STEEPLED Analysis. Demographic factors. Valencia pilot

Last but not least, in terms of the most influential demographic factors in the FLWPR decision-making process, age, educational level and geographical residence are the most prominent factors.

3.4 Better decisions about FWPR actions: Vienna/Graz pilot

3.4.1 Planification

The Vienna/Graz workshop took place in Vienna at the Ankerbrot-Fabrik 1110 (one of the Caritas community kitchens) on 26 January 2023.

The discussion took place in the following four groups:

- Community catering & gastronomy
- Community events (educational projects such as the Graz Environmental Circus, ...)
- Food distribution, supermarkets & social responsibility
- Production, farmers' markets and direct marketing (e.g. foodcoops)

The presentation round by participants was long enough to provide a good overview for all participants. The short project presentation outlined different possible concepts of good decision for FWPR.

- Group work - Round 1: Good decisions from farm to fork included:
 - Overview of successes and challenges
 - Discussion on key decision-making factors and initial list of initiatives and solutions

Lunch was prepared at the Caritas kitchen with vegetable leftovers from a supplier. The time was used to mix the participants of different groups.

- Group work - Round 2: Analysing and anticipating the impact of an initiative (See STEEPLED factors)
- Group work - Round 3: Which success factors are necessary for a pilot project from different perspectives?



The workshop finished with the presentation of group results and with a short summary of the main conclusions.

3.4.2 Implementation

Out of 30 invitations, 20 participants together with 12 staff members from six Austrian ToNoWaste partners took part in the workshop.

The participants' profiles included non-governmental organisations, educational companies, organic farmers, food processing companies, logistics companies, community kitchens and gastronomy as well as social markets and supermarkets.

3.4.3 Results

Results in Round 1 analysed the meaning of making good decisions around FLWPR actions, and as a first step, studied the success factors of different good practices (Table 2).

| Food system actor | Success description |
|---------------------------------------|--|
| Food Distribution Group, Supermarkets | Facilitate access to customers Create shopping experience like in other supermarkets Orientation towards customers' needs Cooperation with organic gardens Making good use of donated food Waste project - valid data should help achieve goals (measurement of various types of waste, linking to menus and measurement of customer frequency) Climate plate project (regional, organic, often vegetarian) Voluntary commitment to collect valid food waste data Supply chain - accurate ordering system enables quantity control that also takes into account weather data and public holidays with regard to shopping behavior Fruit + vegetables: hardly any stock left, mainly re-sizing in the warehouse, earlier delivery time 6 - 7 days, now delivery time within 48 hours from the field to the market, only actual demand is imported Cooperation with social organizations Information to users, if possible, about the materials used to make shopping bags Individual campaigns by wholesalers Information sheets for customers (on shelf life, recycling, etc.) Inform users with knowledge |

| Food system actor | Success description |
|---|--|
| | <p>Cooperation with partners forced</p> <p>Implementation of savings projects, self-filling stations, utilization of food leftovers, no production of pastries until the end, no stock due to ordering system</p> |
| <p>Group Communal Catering & Gastronomy</p> | <p>Planning/supply: Reduction in bread & pastry types</p> <p>Better planning in the kitchen</p> <p>Reduce meat consumption</p> <p>Promote vegetable dishes</p> <p>Quantity planning through statistics & experience, distribution in time (surplus)</p> <p>Food shops/Restaurants: not everything has to be available by kitchen closing time, direct marketing of local, seasonal, fair, organically produced foods, offer the possibility to take away food</p> <p>Survey of needs or questioning: survey customers' needs, food waste monitoring (survey & observation), evaluation of portion sizes</p> <p>Education: education, sensitization of staff & customers, training for guests and volunteers</p> <p>Digitalization/technology/logistics: digitalization (affects all areas), ordering logistics (e.g. choice of menu system)</p> <p>Other: composting of food that can no longer be used, testing the expiry date</p> |
| <p>Group Production</p> | <p>Introduction to direct marketing</p> <p>Establishment of a market gardening and supplying vegetables directly to customers --> Quality criteria for vegetables can be defined by the farmers themselves; no specifications from resellers = considerable increase in usability; few rejects, quantities can be calculated well through solidarity farming, as production is calculated in advance --> hardly any overproduction.</p> <p>Organic conversion + circular economy = more resilient during crises --> production of food requires little importation</p> <p>Feedback (automation) in the case of a large kitchen enables better planning with e.g. weight scales or feedback buttons. Through digitalization, quantities can be better calculated and raw materials can be purchased in a more targeted way.</p> <p>Teamwork and system thinking</p> <p>Start of cooperation with research centers, NGOs, civil society</p> |

| Food system actor | Success description |
|--|---|
| | <p>No requirements from traders or resellers --> goods do not come back because standard does not fit --> farmers are more flexible in marketing;</p> <p>Winter vegetable cultivation established</p> <p>Bringing surpluses to refugees or to large events</p> <p>Makeup supermarkets and foodcoops</p> <p>Customers are keen to buy directly from their local areas. Often do not attach great importance to permanent availability and standardized qualities --> products are bought as available --> fewer rejects.</p> |
| Group Education and Awareness building | <p>Training for gastronomy: calculate quantities more precisely (waste prevention, waste avoidance)</p> <p>Gastronomy: the vegan diet enables the saving of resources like animal husbandry and meat processing</p> <p>Involve farmers, support local organic farmers</p> <p>Cooperation with social markets</p> <p>Workshops at schools</p> <p>Education on quantities at buffets</p> <p>Zero waste conference</p> <p>Community food procurement and consumption</p> <p>Composting instead of landfill (Onion story)</p> <p>20 years of pesticide reduction program (sustainability through soil health)</p> <p>Combining projects (efficiency & impact)</p> <p>Launching an open discussion on good food vision</p> |

Table 2: Factors of success of different good practices

These factors of success are complemented by the reflection on their associated challenges identified by every food system actor participant in the second technical workshop in Vienna/Graz (Table 3), for making good decisions.

| Food system actor | Challenges description |
|---------------------------------------|---|
| Food Distribution Group, Supermarkets | <p>Communication between food retailers and social markets (how do goods get to the social markets?) (Social markets)</p> <p>It depends on branch management/market management whether goods reach the social market (Social markets)</p> |

| Food system actor | Challenges description |
|--------------------------------------|---|
| | <p>Since 2022 there are 50% more customers and at the same time less goods (Social markets)</p> <p>More consumers, less goods = planning difficulties</p> <p>Problem of centralized tendering (regional partners cannot be preferred)</p> <p>Education, poor food handling</p> <p>Legal requirements regarding disposal</p> <p>Staff - handling of procedures not efficient</p> <p>Lack of knowledge + lack of time (lifestyle) = problem for food waste</p> <p>Promotions like 4+4 encourage rash purchases and more waste</p> <p>Trade thrives on increasing sales</p> <p>Training of employees on the topic of sustainability</p> <p>Revision of best-before dates</p> <p>Waste hierarchy - what has priority & needs public support</p> <p>Need to strengthen cooperation</p> <p>High technical hurdle due to app</p> |
| Group Communal Catering & Gastronomy | <p>Lack of knowledge about waste quantities and insight</p> <p>Legal framework in relation to waste</p> <p>Food procurement law: grey area</p> <p>Budget and subsidies</p> <p>Inclusion problem: unaffordable education</p> <p>No overarching coordination (between organizations)</p> <p>Human resources, staff turnover, staff shortage</p> <p>No planning security</p> <p>Lack of standards</p> <p>Availability (supply)</p> <p>Obligatory delivery when remaining time is reached (input & output)</p> <p>Changing values among consumers and in politics</p> <p>Lack of acceptance among consumers</p> <p>Lack of technology in the overall process</p> <p>Lack of Data/facts</p> <p>Lack of incentives to donate food (tax benefits)</p> |

| Food system actor | Challenges description |
|------------------------------------|---|
| Group Production | <p>Awareness raising in agricultural schools (waste prevention, sustainability, organic farming, etc.) Often food waste is not an issue in agriculture - it is simply accepted.</p> <p>Involve associations more --> Offers for awareness raising on food waste</p> <p>Education for children, youth and adults</p> <p>Raising consumer awareness</p> <p>Agreement within the sector due to competition</p> <p>Lack of staff</p> <p>Due to low staffing levels, the food value chain should be digitalized from start to finish and processes optimized - Data currently only known from smaller projects; too little meaningfulness; more data on food waste but also availability and demand would result in better quantity calculation.</p> <p>Quantity requirements and security of supply (because of capacities, processing and securities: currently a lot of purchasing is done via wholesalers and not directly --> many narrow standards have to be met again --> a lot of waste).</p> <p>Automation of food performance specifications (for large kitchens).</p> <p>Lack of new technologies to deal with food waste; example: currently, damaged food is often removed from the food chain (small visual defects, small rot on apple, wireworm puncture on potato, etc.). With better technologies, it could still be possible to recycle such products (for example, automated removal of damaged spots on the product).</p> <p>Rejects in the trade, up to 50% of the harvest goes by the wayside - 1/3 is already sorted out in the field, another 20-25% during sorting for the trade). Standards for the LEH (food retail trade)</p> <p>Requirements for the degree of food processing: in canteen kitchens often only pre-sorted and prepared food is used (example: potato standard size washed); leads to 1. more rejects again, 2. reduced shelf life of the product</p> <p>General conditions are lacking (social, environmental, ...)</p> <p>There is too much cooking in large kitchens, leading to surplus and waste.</p> <p>Accessibility of FoodCoops, direct marketing etc.</p> |
| Group Education-Awareness building | Change of opinion among consumers needed, because: What are good fresh vegetables? |

| Food system actor | Challenges description |
|-------------------|--|
| | <p>Changes needed in organizations</p> <p>There is no coordination platform for surpluses</p> <p>Clear communication of the ecological footprint of the respective food is missing</p> <p>Site-specific over- (and under-) production in the field</p> <p>Legal basis for food waste and compulsory is missing, there is a very large grey area</p> <p>Low appreciation of food and unconscious consumption</p> <p>General education on food production and cooking could be better</p> <p>Lack of awareness: food in the supermarket vs. food in the field</p> <p>Demand for diverse, full buffets</p> <p>Food production lacks transparency</p> <p>Too few volunteers, few staff</p> <p>Financial sustainability of sustainable initiatives</p> <p>Logistics challenging</p> <p>Grey areas of laws, opaque information channels</p> <p>Rethinking school and kindergarten catering</p> <p>Community kitchens rarely work with food waste so far</p> <p>Neoliberal growth logic</p> <p>Malformed food has not been used in public kitchens so far</p> <p>Investing time is only possible with social security for volunteers</p> <p>Most people do not know how to process food anymore (If it is in the law, you do not need to think about it?)</p> <p>Trainings include: understanding and complying with laws. But not: knowledge to further develop the waste concept of the business, is sector specific</p> <p>Coordination point for surpluses, where waste can be reported, is missing. Expected rejects of e.g.: tomatoes occur - share knowledge: where is what available?</p> <p>Possibilities of a networking platform must also be open to small businesses</p> <p>Self-harvesting is a possibility, but becomes a challenge when waste is left in the field.</p> |

Table 3: Factors of success of different good practices



In this context, several key decision-making factors for developing the best practice have been identified. Among others, technological issues (cooperation with IT and communication for valid data, accurate ordering system); social and labour aspects (involvement of people, availability of staff resources, opinion forming; leadership, bring about small changes in behavior, not radical changes); marketing strategies (orientation towards the needs of customers-social markets); diversity management (discussion between generations, openness to hear other opinions and to exchange views); strategic management (small intermediate goals, awareness raising in LW schools is needed, networking, everyone in the organisation involved in the process, create time for strategic development); expertise needed in innovation (passing on knowledge; external partner (experts) necessary); economic benefits ("Quick wins" in the foreseeable future to increase motivation); political and legal issues (innovative regional policy and Green Deal); and environmental (ecoefficiency), can be highlighted.

These factors point out directly to the results of the STEELED analysis.

Relevant STEELED factors:

- Society (affordability, healthy nutrients/nutritional practices, habits, community actions, inclusion)
- Technology (accessibility, multiple use of technology, infrastructure dependency)
- Economy (job creation, value creation, resource dependency, natural resource management)
- Environment (energy efficiency, efficiency of water and other resources, biodiversity)
- Politics (participation (involvement) at local level, transparency, democracy, respecting consequences (respecting needs, taking responsibility), responsibility (market regulation)
- Law (contracts, consumer protection (protection of privacy/data protection), liability)
- Ethics (fairness from the field to the plate, protection of living organisms, climate protection, cost-benefit ratio, risk awareness)
- Demography (equality, gender diversity, age diversity, education)

| Example of FWPR Solution | STEEPLED Factors |
|--|--|
| "Own" food bank with educational mission | <p><i>Society:</i></p> <ul style="list-style-type: none"> – Inclusion/community action <p><i>Technology:</i></p> <ul style="list-style-type: none"> – Infrastructure dependencies; urban-rural divide – Digitisation/logistics – Technological accessibility <p><i>Environment:</i></p> <ul style="list-style-type: none"> – Efficiency of water and other resources <p><i>Economy & environment (climate protection):</i></p> <ul style="list-style-type: none"> – Resource conservation – Management of natural resources <p><i>Policy:</i></p> <ul style="list-style-type: none"> – Market regulation, waste prevention through timely sharing. <p><i>Law:</i></p> <ul style="list-style-type: none"> – Liability (clear liability limits) |

| Example of FWPR Solution | STEEPLED Factors |
|---|---|
| | <ul style="list-style-type: none"> - Clear legal basis for handover to organisations - Consider consequences of? commitment & responsibility <p><i>Ethics:</i></p> <ul style="list-style-type: none"> - Access for all to affordable food - Climate protection (also in politics & environment) <p><i>Demography:</i></p> <ul style="list-style-type: none"> - Education for consumers & producers - Age diversity and differences |
| <p>Central reporting system for food surpluses in primary production and processing</p> | <p><i>Society:</i></p> <ul style="list-style-type: none"> - Inclusion: involve disadvantaged groups - Communication: definition of food waste - Change consumer expectations: not everything has to be on the shelf all the time. <p><i>Technology:</i></p> <ul style="list-style-type: none"> - National Platform - Expand the well-known platform Willhaben for food - Trucks drive empty for logistics and how could they be used for the project? <p><i>Environment:</i></p> <ul style="list-style-type: none"> - New products, less waste - Europe - water waste due to overproduction: every person in the world could take a full bath every second day <p><i>Economy:</i></p> <ul style="list-style-type: none"> - Producer tries to pass on everything to the trade, trade sometimes returns products, which could then be used again - 2nd marketing channel: further processors or major customers such as hospitals and schools - Wholesale trade is sometimes damaged - Creation of new jobs, new distribution channels <p><i>Politics:</i></p> <ul style="list-style-type: none"> - Participation of various groups involved in the conception of the platform <p><i>Law:</i></p> <ul style="list-style-type: none"> - Market regulation: e.g.: 10% must be recycled socially - Data protection: it is possible to draw conclusions about the producer's processes from the offers posted, and authorities can draw conclusions from the quantities produced. - Regulating the obligation to register by law (Player AMA etc.) - Contracts: as a farmer you produce at 130% in order to plan for weather-related fluctuations and pests, etc. and still achieve 100% quantity. - Fluctuations in trade order quantities <p><i>Ethics:</i></p> |

| Example of FWPR Solution | STEEPLED Factors |
|--------------------------|---|
| | <ul style="list-style-type: none"> – Logistics: because of climate protection, there must be a minimum purchase quantity so that journeys can be made (do not create incentives to drive all the way to southern Burgenland for 10 kg of tomatoes). – Important: instead of labelling certain products as waste (conveys wrong understanding and wrong handling), they should be called surplus production. |

Table 4: STEEPLED Factors on two examples

3.5 To make better decisions regarding FWPR actions: ToNoWaste conclusions

3.5.1 Main reflections

The decision-making process for the prevention and/or reduction of FLW by the different actors of the food system is a combination of subjective and contextual factors. Subjective elements are inherent to these actors' own expectations, personal principles and/or experiences of the decision-maker. Questions such as awareness regarding the scope of the problem of FLW, personal position regarding global social and environmental challenges or political ideology, influence the way in which food system actors address FLW solutions, and even the mere decision of adopting or not a solution for preventing or reducing FLW.

Nevertheless, the impacts of such decisions go beyond the personal sphere, so that decision-making processes about FLWPR solutions is not a matter of private preferences but a question of individual responsibility with collective consequences. Therefore, since every member of the food system can have different roles inside the system (primary producer, manufacturer, distributor, consumer, etc.), it is relevant to be aware of the multiple faces of the FLW challenge and the impacts that every decision from every position along the system can have, both individually and collectively.

This is also connected to the identification of contextual factors that influence the decision-making process regarding FLWPR solutions. It is possible to differentiate between the immediate context and the general context. The immediate or specific context regards the position of the actor along the food value chain, and the decisions this actor must make from his/her role as regulator, business manager, employee, etc. Within the general context, it is possible to identify economic, social, technological, environmental, political, legal, ethical and demographic factors potentially relevant to make decisions about FLW.

However, one key question arises and is related to the meaning of making "good" decisions. What does it mean to make good decisions regarding FLWPR solutions? The preceding section analysed the relevance of considering the sustainability context for answering this question, both in terms of the analysis of the problem and in terms of the definition of the solution. Sustainability understood under economic, social and environmental parameters, integrates food system challenges such as resilience or a healthy diet. Consequently, it is necessary to translate these dimensions into more operative terms for every decision-maker, and to give him/her the appropriate tools to make better decisions about FLWPR or,



at least, the best decision considering the existing constraints and the current set of information.

The next section reflects the research carried out in this regard, delving into the operationalization of sustainability linked to the assessment of FLWPR solutions.

4. Open discussion for potential FWPR solutions

assessment within the ToNoWaste objectives

Advances in research on the issue of food losses and waste, potential solutions and social, economic, environmental, political, legal, technological, ethical and demographic factors that can influence in decision-making process, allow the ToNoWaste project to delve into the assessment of potential FLWPR solutions in terms of sustainability, by means of open discussion dynamics. This section focuses on this topic.

4.1 Theoretical background

In the regulatory and strategic EU context (European Green Deal priorities, Farm to Fork Strategy, Bioeconomy strategy, Food 2030 priorities and the European Pillar of Social Rights; Circular Economy Action Plan), a better decision is what contributes to prevent and reduce food losses and waste making a more sustainable food system.

As has been exposed in previous sections, the challenge is to prevent and reduce food waste by integrating the prevention/reduction actions into a more sustainable food system, making different organisations and actions more resilient, safe, inclusive, healthy, circular, and resource- efficient, while contributing to achieving the SDGs within the planetary boundaries. Consequently, the decision criteria shall consider the impacts of the FLWPR action at three levels:

- Impacts on the beneficiary/implementer of the action, members of the food system directly linked to the action.
- Impacts on the food system considering the entire supply chain.
- Impacts on society at large, beyond the food system.

The decision-making process requires to identify an assessment framework that specifies the criteria and delimitates the scope of the parameters under which the alternatives are going to be evaluated.

In this sense, there are two basic and essential concepts to be parameterized. On the one hand, it is necessary to have a clear definition of FW that allows us to improve the process of data collection and the standardization of the calculation methods (Lemaire and Limbourg, 2019). In this regard, in a European context, the FUSIONS-project provided a definitional framework (Östergren et al., 2014) and the European Commission has established common metrics for being measured (European Union, 2019) and reported (European Commission, 2020).

On the other hand, it is crucial to determine the multidimensional frame of the impacts that a FLWPR action could have over a food system in terms of sustainability, including social,

environmental, economic, resilience, healthy, circular, resource efficiency, and inclusivity parameters, considering the different market actors' needs and expectations (Escrig et al., 2017) and the challenges the food system is currently facing.

4.2 General outline

4.2.1 Aim and scope

This subsection concerns the disaggregation of the economic, social and environmental dimensions related to sustainability in specific impact categories that can help the decision-maker to make better decisions regarding FLWPR. In this sense, several aspects shall be considered:

- As described in previous sections, the ToNoWaste partners and stakeholders, by means of participatory, open, diverse, inclusive and active discussion processes, have reflected on current limitations and concerns to be considered for taking good decisions on FLWPR.
- Decision-makers can have a variety of profiles, i.e.: public administrations, companies, NGOs or consumers, with different expectations and needs.
- The assessment of economic, social and environmental impacts of any unit of analysis is complex by nature. Consequently, the identification of the potential impacts of decisions on FLWPR should be based on available tools and research, especially in those highlighted as relevant inside the EU context (where possible). In this sense, the European Environmental Footprint of products⁹, the UNEP SETAC¹⁰, the Social Hotspots Database and the Joint Research Centre research, were specifically considered.
- *Learning by doing* is an especially powerful tool for the process of knowledge extraction in a cocreation dynamic. Therefore, different ToNoWaste partners and stakeholders are invited to share their knowledge and experience regarding specific FLWPR actions and their assessment, as is being currently carried out.

4.2.2 Process design

The reflection on the most suitable criteria for the impact assessment of decisions on FLWPR has followed a progressive approach along the different technical workshops from the beginning of the WP1 development.

Stage 1: Organizers (ToNoWaste researchers and pilot coordinators), asked the different stakeholders (and potential decision-makers) about current assessment practices, applied to FLWPR actions, including economic, social and environmental dimensions.

Stage 2: Organizers (ToNoWaste researchers and pilot coordinators), presented the variety of economic, social and environmental criteria that can be included under the umbrella of

⁹ European Commission (2013) “2013/179/EU: Commission Recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations”, Text with EEA relevance Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013H0179>

¹⁰ UNEP-SETAC (2009), ‘Guidelines for Social Life Cycle Assessment of Products’. Available online: http://www.unep.fr/shared/publications/pdf/DTIx1164xPA-guidelines_sLCA.pdf

impact assessment to the different stakeholders (and potential decision-makers), considering current knowledge and advanced assessment tools.

Stage 3: The different stakeholders (and potential decision-makers) analyse and discuss the criteria and identify those that they consider as the most relevant.

Stage 4: The different stakeholders (and potential decision-makers), expose advanced FWPR practices based on their experiences, including a detailed explanation of the decision-making process associated and the assessment criteria applied.

Meetings with the partners, in person and hybrid technical workshops, and questionnaires launched to experts through a Delphi process, form the triad of knowledge sources for identifying potential assessment criteria of FWPR solutions within the ToNoWaste objectives.

4.3 Open discussion process for potential FWPR solutions assessment approach in Valencia pilot

4.3.1 Planification

As mentioned above, the discussion around criteria for the impact assessment of FLWPR solutions has followed a progressive approach. It has been a cross-cutting topic along all the open technical workshops carried out in the pilot of Valencia:

- Introductory discussion about what are the most important dimensions for evaluating the results of actions to prevent/reduce food losses and waste associated with fresh food, introducing the possibility to select economic, social and environmental dimensions. (**Stage 1**, workshop 16th November)
- First approach to the most relevant social, economic and environmental categories inside each dimension, for evaluating the impacts of actions to prevent/reduce food losses and waste associated with fresh food. (**Stage 2, Stage 3**, workshop 17th January); and
- Deepen the analysis of actions under development in the influence area of the Valencia pilot and their evaluation. (**Section 4**, workshop 28th February).

Hence, the third technical workshop belonging to the WP1 research deployment in the pilot of Valencia, took place the 28th of February 2023. As in previous occasions, it was coordinated by the University Jaume I (UJI) team, with the support of Las Naves, coordinator of the pilot in Valencia. It was designed with the aim of delving into the FLWPR actions developed in the Valencia pilot and their current evaluation process. A Plan-Do-Check-Act management structure was proposed as an explanation outline for the development of the session:

Plan: Information on the process followed in the exposed FLWPR action to decide its implementation, planning process.

Do: Implementation of the FLWPR action, i.e.: to show the result of the process specifying the type of action in question according to the stage of the life cycle.

Check: Process of control and evaluation of results (success/failure in terms of FLWPR, impacts)

Act: Challenges identified from experience to improve the impact of the action.

4.3.2 Implementation

As far as the Valencia pilot is concerned, along the different technical workshops and meetings with partners, a variety of actors pertaining to the food system, especially to the food system of Valencia, analysed deeply and actively which kinds of impacts should be selected to measure and assess the sustainability impacts of FLWPR actions.



Figure 16: Poster Technical Workshop 28th February 2023, Valencia

Therefore, members of public and private organizations, multidisciplinary and multistakeholder in nature and belonging to diverse age generations, with a balanced gender presence, have participated in the cocreation process of the assessment framework of FLWPR actions.

4.3.3 Results

Results in this subsection represent the first outputs directly connected to the codesign of the assessment framework. As has been detailed in previous sections, these results were obtained after a deep shared analysis of the FLW problem and after reflexive and open discussions around the meaning of good decisions regarding sustainable FLWPR.

For order purposes, results are going to be presented considering the stages defined in subsection 4.2.2.

Stage 1: Current assessment practices, applied to FLWPR actions, including economic, social and environmental dimensions.

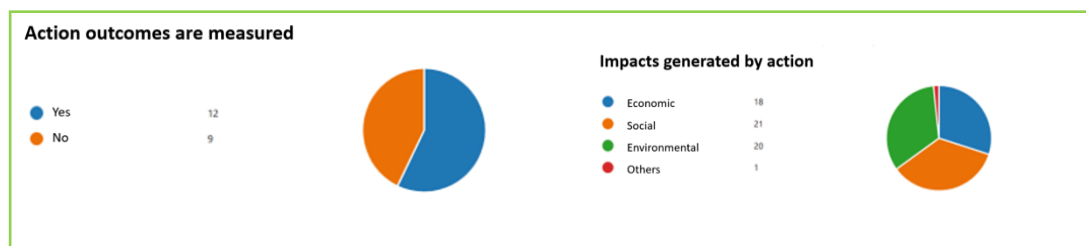


Figure 17: Valencia pilot area of action to prevent/reduce food losses and waste. Are the social, economic, and environmental impacts of their FLWPR actions being measured?

In this regard, most actors of the food system belonging to the Valencia area of action, stated they are measuring the outcomes of their FLWPR actions, admitting the diversity of economic, social and environmental impacts generated by these actions.

Stage 2: Variety of economic, social and environmental criteria that can be included under the umbrella of impact assessment, considering current knowledge and advanced assessment tools.

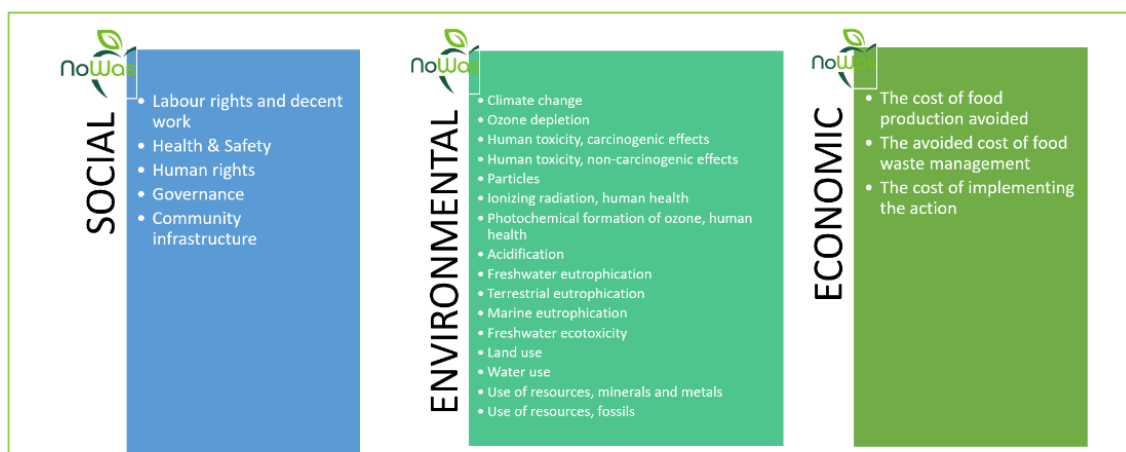


Figure 18: Potential social, environmental and economic impacts of FLWPR actions

The proposal of the potential impacts of decisions on FLWPR is based on available tools and research highlighted as relevant inside the EU context (where possible). In this sense, the European Environmental Footprint of products (for environmental impacts), the UNEP SETAC and the Social Hotspots Database (for social impacts) and the Joint Research Centre (for economic impacts), were specifically considered.

Stage 3: The different stakeholders (and potential decision-makers) analyse and discuss about the criteria and identify those that they consider the most relevant.

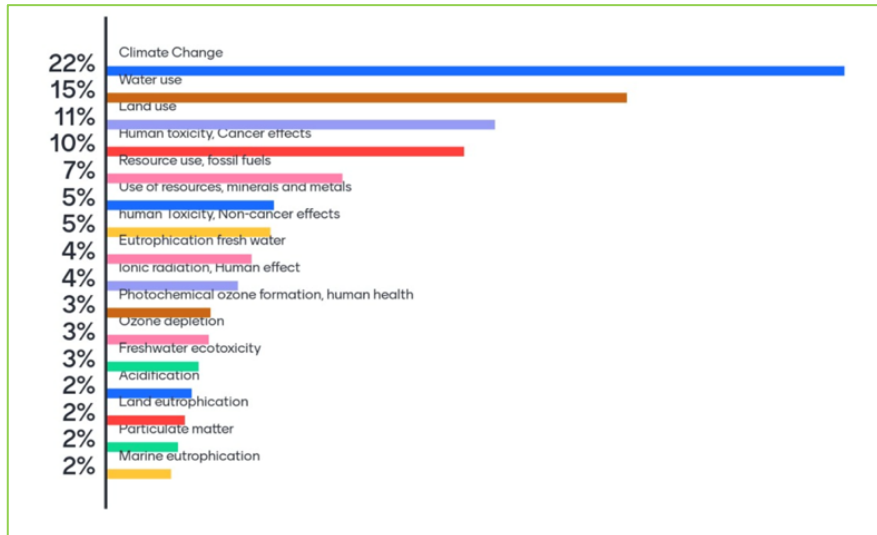


Figure 19: What environmental impacts do you consider relevant to make good decisions regarding decisions on FLWPR?

In environmental terms, all the impact categories integrated in the analysis were considered at least by one actor, with climate change and water and land use being the most highlighted impact categories.

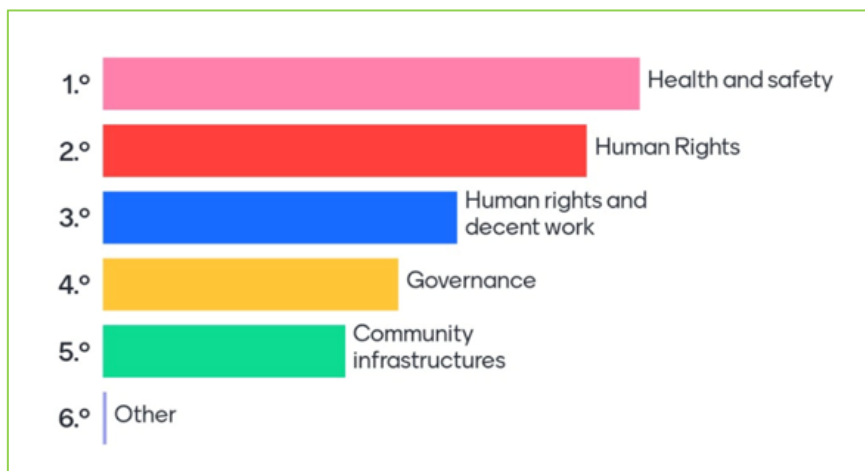


Figure 20: What social impacts do you consider the most relevant to make good decisions regarding FLWPR decisions?

Regarding social impact categories, consistently with the kind of product involved in this research, health and safety is outstanding as the most important. Human rights and decent work are placed in second and third position respectively.



Figure 21: What economic impacts do you consider the most relevant to make good decisions regarding FLWPR decisions?

Concerning economic impacts, focusing on costs linked to the action, there are no relevant differences among the impact categories considered within economic dimension.

Stage 4: The different stakeholders (and potential decision-makers), expose advanced FWPR practices based on their experience, including a detailed explanation of the decision-making process associated and the assessment criteria applied.

Interesting FLWPR actions were deepened and explained, and linked to training, supply chain management, supply chain governance, consumers awareness, technological solutions, technical tools for impact assessment, among others.

4.4 Open discussion process for potential FWPR solutions assessment approach in Vienna/Graz pilot

4.4.1 Planification

The third workshop (online on 23rd February) started with a round of introduction and project presentation.

- Round 1 of discussion: was about pilot actions and introduction: What must a pilot project (FLW solution) do?
- Round 2 of discussion: started with a survey on some examples for potential pilot actions and a presentation and discussion of results: Why did certain options count on a higher agreement rate? Problem/objective, or options that had low agreement rates (Pilot project as a means of transformation from current state to target state)
- Round 3 of discussion: included a survey on evaluation criteria (EU survey tool) for the evaluation of pilot actions and a presentation of criteria selection followed by a discussion of results.

4.4.2 Implementation

Participants of this workshop included academia, public agencies, the coordination offices of three ministries for sustainable food production, community catering, and research institutions.

4.4.3 Results

Round 1 and 2:

Participants in these rounds provided arguments that could be useful in terms of the definition of better FLWPR actions.

- In this regard, a system approach and contract security should be chosen. Participants' view is that it has been known for a long time that there is a lot of potential in changing the rules for procurement/tender, not only in terms of reduction, but also in terms of transformation. Tender criteria for gastronomy - not only the criteria, but also the daily rates/financial means must be adapted.
- Different opinions consider that rural supply networks are more resilient because of a higher number of producing farms. However, flexibility is also important - it is difficult to be flexible in menu planning. System problem, also in the example of schools - e.g.: Sweden, facilities are only planned with kitchen and staff for self-cooking.
- According to discussion results, distribution is not a systemic solution and should be considered as an emergency solution.
- Regarding building supply networks, participants considered that there are already numerous initiatives, but no comprehensive offer.
- Regarding Foodsharing, participants wondered about the possibility of networking with social institutions; nevertheless, there is a shortage of food.
- In terms of the leftovers App for products in farms, participants considered that there are such Apps, but they may not be well-known.
- "From the tuber to the leaf" is a solution identified by participants, but they considered that this solution may contain ingredients that are not healthy or have a higher content of harmful substances.
- Reduce FW in hospitals: participants identified several problem areas, there could be possibilities for simplification/improvement without jeopardizing hygienic safety.
- Participants discussed the relationship between food waste knowledge and behavior. Questions about where the obstacles are, how knowledge can be incorporated into actions, consider psychological effects, etc., can be relevant.
- The discussion rounds results pointed out that the mapping of the legal situation is relevant. It is important to think about the legal situation and bring that into the discussion. Legal framework conditions could also be obstacles.
- Participants highlighted the relevance of tailoring public sector food procurement: starting with production, it has a great potential in every stage. However, they consider that it is a very utopian idea with a huge challenge for its implementation.

Round 3:



In this round, assessment criteria were discussed regarding the environmental, social and economic aspects.

Environmental criteria: Land use and climate change were selected by a majority of participants, following by water use and use of fossil fuels. Other environmental impacts mentioned were the use of resources, human toxicity and eutrophication.

Social criteria: All five categories have been considered as relevant. The most selected criteria were:

1. CATEGORY: Labor rights and decent work conditions

Discrimination and equal opportunity: all persons, institutions, and entities, public and private, including the State itself, are accountable to just and equitable laws and are entitled, without discrimination, to equal protection under the law.

2. CATEGORY: Health and safety

Work-related exposure to toxics and hazards: hazardous and toxic substances are defined as chemicals that can cause harm to living organisms.

3. CATEGORY: Human rights

Gender equity: it implies a society in which women and men enjoy equal opportunities, rights, and obligations in all spheres of life.

4. CATEGORY: Governance

Corruption: it can occur in both the public and private sectors. It includes bribery, extortion, nepotism, bias, patronage and embezzlement.

Legal system/actors along the value chain: fair competition, promotion of social responsibility, supplier relations, respect for intellectual property rights.

5. CATEGORY: Community

Access to improved drinking water sources: an improved drinking water source is one which, by the nature of its construction, adequately protects the supply from external contamination, particularly fecal matter.

Children out of school: ensuring that all children go to school and that their education is of good quality is the key to preventing child labor.

Smallholders' vs commercial farms table: in areas with a high population density and favorable farming conditions smallholders will normally cultivate less than one hectare of

land, but in dry desert locations with low population and unfavorable conditions they may cultivate up to 10 hectares of land and manage 10 hectares of livestock.

Economic decision criteria:

The avoided cost of food production, value creation and reduction of resource dependency.

4.5 Open discussion process for potential FWPR solutions

assessment: Delphi process

4.5.1 Planification

The online survey was conceived as a participative method to ensure a gender balance and the inclusion of a broad spectrum of activity fields. Consequently, a set of questions were developed and agreed during November and December of 2022. Questions were tested in an internal process and during the third technical workshop in February 2023.

Partners (HAL, HAE and UJI) translated the English version of questions to provide a multilanguage questionnaire in German, English, Spanish, Greek and Swedish.

4.5.2 Implementation

The EU online survey was applied and conducted anonymously with the option: anonymous for a high level of quality of privacy. In a second stage, partners invited their stakeholders' networks to join this qualitative survey. The link and invitation were also available on the Tonowaste.eu site, as well as on the web site of OEAW/ITA (<https://www.oeaw.ac.at/en/ita/projects/tonowaste>).

The next paragraph reproduces the invitation text. Questions can be found in the website <https://ec.europa.eu/eusurvey/runner/ToNoWasteDelphiSurvey2023>

Information: Joint collection of solutions and measures to prevent and reduce food waste

This survey was created in the course of the EU project ToNoWaste, which aims to identify pilot projects within the ToNoWaste project. It is completely voluntary and anonymous.

To include the perspective of a broad spectrum of experts on future solutions, this Delphi survey will be filled by experts in the field of Food Systems in Austria, Spain, Sweden and Greece.

The results from this survey will allow us to identify good practices and relevant impact categories from different perspectives in an early phase of the ToNoWaste project (March to April 2023). The results will be analyzed and used for a second round of survey.

We are very grateful if you consider taking some of your time (around 30 minutes) to help us in the project.

<https://ec.europa.eu/eusurvey/runner/ToNoWasteDelphiSurvey2023>



A draft can be saved at any time to continue answering later. This survey will be online from the 8th of March until the 21st of April 2023.

There are three main sections to the survey:

- *Your opinion on some examples of potential pilot-projects along the whole value chain based on our three project-workshops that took place between December 2022 and February 2023*
- *Your suggestions for a pilot-project that either exists already or that should be implemented.*
- *Evaluation of three sets of science-based indicators to assess the environmental, social and economic impact of various initiatives or pilot project (yours or any other) for food waste reduction and prevention.*

You have the possibility to choose English and German languages. The Spanish, Swedish and Greek language will be available soon.

For more information, see the website of the project: <https://tonowaste.eu/project/>

4.5.3 Results

This section presents the results derived from the Delphi questionnaire, considering that 77 finished responses were obtained.

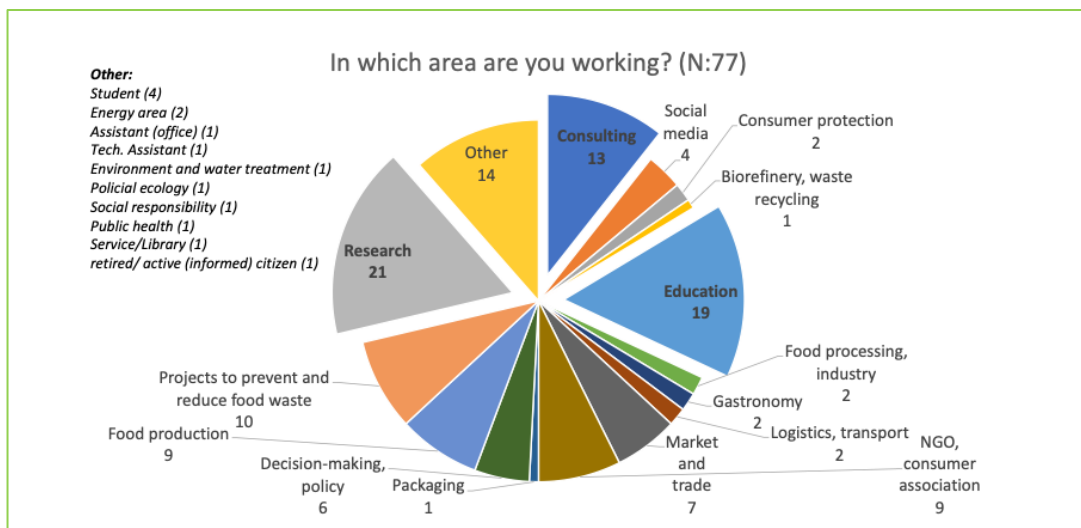


Figure 22: Profile of participants (activity)

Concerning the profiles of the survey participants, most of them pertained to education, research and consulting sectors. Regarding nationality, Austrian and Spanish were the most numerous. The experience of the respondents in their field of expertise should also be pointed out with most of them having more than six years of experience. By gender, female is the most represented.

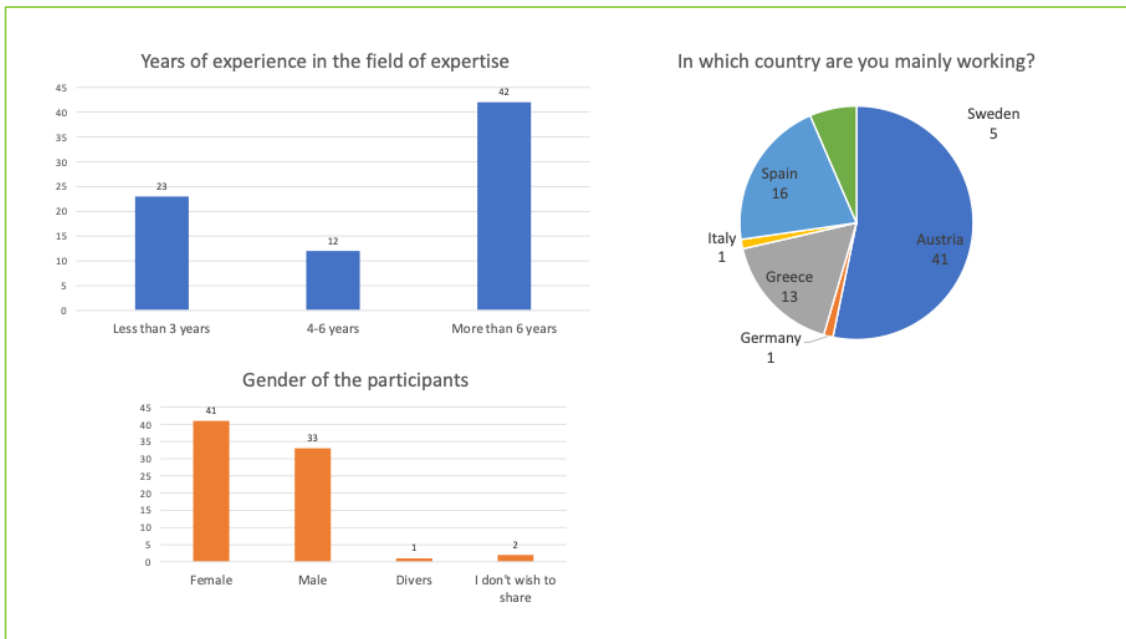


Figure 23: Profile of participants (experience, gender and country)

Survey participants selected some pilot actions as relevant for the coming five years. The list of the most suggested examples categories is reflected in Figure 24 and it should be highlighted that “Make food re-distribution from retail into social organization more efficient” was identified as the most feasible solution in the next five years.

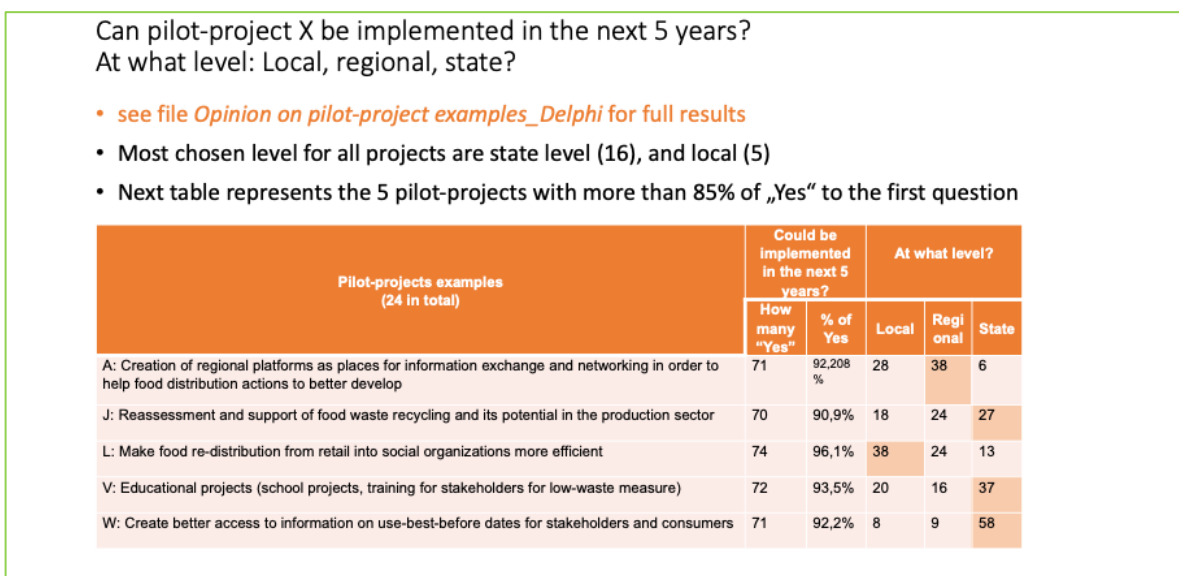


Figure 24: Opinion of examples of FLW solutions

The Delphi survey included FLWPR solutions pertaining to eight areas. In this regard, education, consumption and regulation solutions have been classified as the most significant for solving the problem.

- **Education (6,07)**
- **Consumption (5,12)**
- **Regulation (5,03)**
- Food production (4,59)
- Sales and trade (4,4)
- Logistics along the food chain (4,12)
- Gastronomy (3,11)
- Relevance of the regions (3,11)

Figure 25: Problem-solving of the areas of implementation for FLWPR solutions examples

Results of the assessment criteria from the Delphi survey pointed to “Climate change”, “Water use” and “Land use” as the most relevant environmental criteria; “Management of natural resources” and “Avoided cost for food waste management” as the most relevant economic criteria; and “Poverty” (linked to labour rights and decent work conditions), “Gender equity” and “Human health” (linked to human rights), “Work-related toxic and hazards” (linked to health and safety), “Legal system/actors along the supply chain” (linked to governance), “Access to improved drinking water source” (linked to community) as other relevant criteria.

The list of suggested pilot actions will be provided in D 1.3.

4.6 Potential FWPR solutions assessment identified by ToNoWaste main stakeholders

4.6.1 Main reflections about the assessment of FWPR solutions

The discussion with the ToNoWaste stakeholders evidenced the diversity of solutions that can be implemented for solving the problem of FLW. This diversity enriches the potential development of innovative solutions by the different actors. At the same time, this variety and the chain of potential economic, social and environmental impacts, makes it difficult to decide which is the best solution among them without the application of advanced assessment frameworks.

This assessment framework should provide a sound basis for the identification of the economic, social and environmental impacts of FLWPR actions along the entire food value chain. The ToNowaste Deliverable D1.1 evidenced the most advanced accounting tools and methodologies for addressing this challenge. In this regard, methodologies based on the social life cycle assessment (S-LCA), environmental life cycle assessment (LCA) and life cycle costing (LCC) are the most useful tools for the assessment of FLWPR solutions under sustainability parameters. In addition, proposals from the Joint Research Centre can be also specifically adapted to the topic studied in this project.

Moreover, despite the difficulty to solve complex problems with simple solutions, the principle of proportionality should also be considered. Consequently, applied assessment tools should be flexible enough to be adapted to different actions (from isolated

interventions to multistakeholder actions) and users (from single consumers to big organizations).

5. First version of the ToNoWaste Science-Based Assessment Framework

This section presents a first draft of the science-based assessment framework proposed by the ToNoWaste project for the assessment of FLWPR solutions in terms of sustainability (Figure 26). It is based on the SMART Corporate Sustainability Assessment Framework (Muñoz et al., 2018) approach, developed by the H2020 SMART project, but includes technical developments for being applied to a different problem, with different actors and sustainability accounting methods, and to a different context and assessment units, as a consequence of the research tasks carried out in this WP1, explained in the previous sections of this deliverable.

Several aspects could be highlighted from previous reflections on the FLW problem and potential solutions (Section 2):

Firstly, FLW is a systemic problem, which applies to different food system actors (from primary producers to supply chain members, policymakers and consumers), but with consequences that go beyond the boundaries of the system. Consequently, solutions should consider their impacts along the entire food value chain and within and beyond the food system.

Secondly, this multi-actor problem requires the analysis of solutions from a multi-actor perspective to take into account different needs and expectations, and the needs of next generations. This implies the potential presence of multiple criteria in a decision-making process around the solutions to this typology of problems.

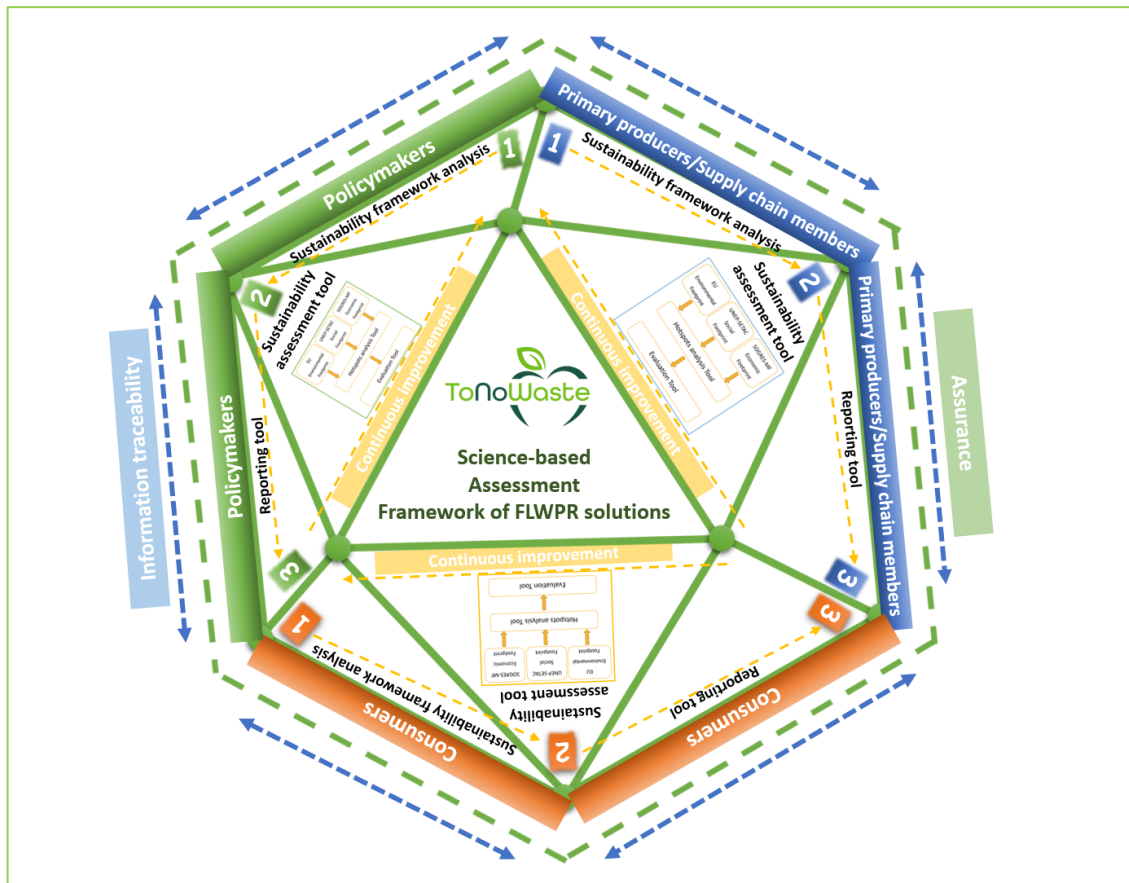


Figure 26: First draft of the ToNoWaste science-based assessment framework of FLWPR solutions

Moreover, the FLW problem is associated to business, political, legal, ethical, environmental, social and basic human needs aspects. The decision-making process around a FLW problem is multi-dimensional.

Finally, solutions to the FLW problem requires the availability of reliable information about the economic, social and environmental impacts of FLW for two main reasons: i) for having a whole picture of both the problem and the solution; and ii) for encouraging the “good” decision making for the solution to the FLW problem.

Conclusions in Section 3 analyse whether it is possible to “objectively” determine that a decision regarding FLWPR is “good”, considering current available tools. An affirmative answer to this question would imply that there exist FLWPR solutions that could be positively assessed by the different decision-makers as “good” in absolute terms, that is, regardless of their specific context and personal expectations and needs. Within the ToNoWaste project, the degree to which a decision can be considered “good” is conditioned by its impacts in sustainability terms.

Unfortunately, until now, practitioners, policymakers, consumers, companies and researchers have pointed out that such an assessment may be utopic. The current state of the art does not allow us to state whether a FLWPR solution is “good” or not in these absolute terms. Therefore, the next level of the assessment should consist of determining the degree to which a decision can be regarded as “good” regarding FLWPR in relative terms, speaking

about “the best” decision or “better” decisions, considering contextual constraints (context-dependent assessment).

In this regard, the design of an assessment framework for FLWPR solutions within the ToNoWaste project should include the following considerations:

- It should be science-based, so it must be based on the best available technologies of sustainability impacts accounting and assessment of actions.
- It should consider the relevant STEEPLED factors of the FLW decision making context.
- It should provide reliable information based on transparency and traceability of the assessment process.
- It should provide significant information about the economic, social and environmental hotspots of the potential solution for being useful for the different FLW decision makers.
- It should include an intertemporal perspective, which implies giving due consideration to the impacts of FLWPR solutions in the short, medium, long and longer terms.
- It should allow for the comparison between different FLWPR actions.
- It should allow for both internal and external verification.
- It should include a continuous improvement approach.

Section 4 delves into the development of these aspects for advancing in the concretization of a ToNoWaste science-based assessment framework (SBF). Based on the perspective of the assessment criteria analysed in this section and considering the discussions and opinions of stakeholders and experts from the technical workshops and the Delphi process, the following final remarks about the ToNoWaste Science-Based Assessment Framework are highlighted:

- It should capture the relevant system information to provide a comprehensive sustainability assessment from a life cycle perspective.
- It should adopt a flexible approach compatible with different types of FLWPR actions, which can be grouped according to the JRC classification: redistribution, food valorization, consumers behaviour change, supply chain efficiency and food waste prevention governance.
- The stakeholders and experts supported the integration of the most advanced assessment tools and methods (like the European Environmental Footprint of products, UNEP SETAC, the Social Hotspots Database and the Joint Research Centre research) in the framework.
- It should address the economic, social, and environmental impacts generated by the FLWPR actions. In this context, the stakeholders and experts agreed upon the most relevant environmental impacts to make a good decision regarding FLWPR actions, which are climate change, water use and land use. In terms of the social impact categories, there was a consensus regarding the most significant impacts linked to Health and Safety, Human Rights, Governance and Community categories. Nonetheless, participants provided a higher level of variability in terms of importance to the Labour Rights and Decent Work conditions category and to the economic impacts of FLWPR actions. This means that the Science-based Assessment Framework should integrate the different points of views of the stakeholders (multi-



actor approach) and consider the idiosyncrasy of each region (context dependent approach).

In this context, the general outline of the **ToNoWaste science-based assessment framework of FLWPR solutions**, has the following key elements:

- It is defined for being useful and usable specially to three profiles of decision makers: primary producers and other supply chain members, policymakers and consumers.
- It is structured in three steps:
 - **Step 1:** sustainability framework analysis of the general (STEEPLED factors) and specific context (sustainability principles/strategy, stakeholders, expectations and needs, role within a sustainable food system, etc.) of every decision maker.
 - **Step 2:** sustainability assessment tool, which includes the integration of the best sustainability accounting and assessment methodologies under a life cycle thinking. At the moment of closing this deliverable, these methodologies relate to the European Environmental Footprint, the UNEP-SETAC social life cycle assessment methodologies, Life Cycle Costing and Joint Research Center proposal. These assessment tool will allow for the identification of sustainability hotspots of the FLWPR solution.
 - **Step 3:** reporting tool, which regards the availability of relevant information for the decision-making process of every decision maker considered in the framework, in such a way that allow him/her to make better decisions.
- Moreover, it includes three key processes:
 - Traceability: in a systemic environment such as sustainable food system is, traceability of information among the different actors is crucial for identifying key stakeholders, their expectations and needs, the analysis of the problem, the identification of solutions, and the impacts of this solutions in sustainability terms.
 - Assurance: all the information obtained from/generated in the assessment framework should be reliable.
 - Continuous improvement: the sustainability assessment framework should provide the possibility of making the best decisions under the best available technology and data; that implies a continuous improvement of the whole assessment system.

Future ToNoWaste deliverables will present advanced versions of this sustainability assessment tool of FLWPR solutions, integrating improvements derived from ToNoWaste research and results.

6. References

Escrig-Olmedo, E., Muñoz-Torres, M. J., Fernández-Izquierdo, M. Á., & Rivera-Lirio, J. M. (2017b). Measuring corporate environmental performance: A methodology for sustainable development. *Business Strategy and the Environment*, 26(2), 142-162.

- European Commission (2019). Evaluation of marketing standards. Directorate-General for Agriculture and Rural Development. Available at <http://publications.europa.eu>
- European Commission (2020). Guidance on reporting of data on food waste and food waste prevention according to Commission Implementing Decision (EU) 2019/2000. Version of June 2020. Eurostat
- European Commission (2013) "2013/179/EU: Commission Recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations", Text with EEA relevance Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013H0179>
- European Parliament (2017). Multiple framework service contract in five (5) lots for the provision of external expertise in the field of Technology Options Assessment and Scientific Foresight (STOA). EPRS/STOA/17/004. Directorate-General for Parliamentary Research Services (EPRS).
- Joint Research Centre (JCR) (European Commission) (2019). Assessment of food waste prevention actions. Development of an evaluation framework to assess performance of food waste prevention actions. Available at: <https://op.europa.eu/en/publication-detail/-/publication/8f771f0c-1d4c-11ea-95ab-01aa75ed71a1/language-en>
- Lemaire, A., & Limbourg, S. (2019). How can food loss and waste management achieve sustainable development goals? *Journal of cleaner production*, 234, 1221-1234.
- Muñoz-Torres, M. J., Fernández-Izquierdo, M. Á., Rivera-Lirio, J. M., Ferrero-Ferrero, I., Escrig-Olmedo, E., Gisbert-Navarro, J. V., & Marullo, M. C. (2018). An assessment tool to integrate sustainability principles into the global supply chain. *Sustainability*, 10(2), 535.
- Östergren, K., J. Gustavsson, H. Bos-Brouwers, T. Timmermans, O.J. Hanssen, H. Møller, G. Anderson, C. O'Connor, H. Soethoudt, T. Quested, S. Easteal, A. Politano, C. Bellettato, M. Canali, L. Falasconi, S. Gaiani, M. Vittuari, F. Schneider, G. Moates, K. Waldron, B. Redlinghöfer (2014). FUSIONS Definitional Framework for Food Waste – Full Report. FUSIONS Report. Swedish Institute of Food and Biotechnology, Goteborg, Sweden.
- SAPEA Science for Policy Advice by Europeans Academies (2020). A sustainable food system for the European Union Berlin: SAPEA. <https://doi.org/10.26356/sustainablefood>
- UNEP-SETAC (2009). 'Guidelines for Social Life Cycle Assessment of Products'. Available online: http://www.unep.fr/shared/publications/pdf/DTIx1164xPA-guidelines_sLCA.pdf.
- UNEP-SETAC (2013), 'The Methodological Sheets for Sub-categories in Social Life Cycle Assessment (S-LCA)'. Available online: www.lifecycleinitiative.org