CHORIZO PROJECT

Deliverable 1.4

SECTOR-SPECIFIC GUIDANCE

CHORIZO PROJECT

D1.4

Sector-specific guidance

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Glossary of terms and acronyms

Acronym/Term	Description
0FLW	Zero Food Loss & Waste
B2B	Business to Business
B2C	Business to Costumer
CA	Consortium Agreement
D	Deliverable
FL	Food Loss
FLW	Food Loss and Food Waste
FW	Food Waste
GA	Grant Agreement
GHG	GreenHouse Gas
HORECA	Hotels, Restaurants and Cafes
KPI	Key Performance Indicator
LCA	Life-Cycle Assessment
MOA	Motivation, Opportunity, Ability
NGO	Non-Government Organisation
QR	Quality Review
R&D	Research and Development
ROI	Return On Investment
SDG	Sustainability Goals
SME	Small and Medium-sized Enterprise
SN	Social Norms
T	Task
WP	Work Package

Executive summary

The CHORIZO project aims to improve understanding about how social norms (rules and expectations that are socially enforced) influence behaviour related to food waste generation. This deliverable utilises actions (interventions) identified and analysed in T1.2 and T1.3 of the project's first WP to develop **sector-specific guidance** on actions that address food loss and food waste (FLW). The focus is on key success factors, impacts of the actions, challenges and implementation barriers, and ultimately identifying what is needed to facilitate interventions with a high-potential to address food waste.

This report is divided into the following main chapters:

Introductory chapter and chapter 2: An overview of the CHORIZO project and this deliverable, followed by an explanation about the **methodology** used to formulate guidance specific to certain sectors throughout the food chain; outlining data sources, analyses, as well as an overview of the MOA Framework.

Chapter 3: The third chapter is dedicated to discussing the interventions identified and analysed along the supply chain, and in particular the social, economic and environmental **impacts**, **challenges**, **success factors**, and **key lessons learned**. Included as well is analysis using the **Motivation** (including **social norms**), **Opportunity**, and **Ability** Framework (MOA), and what the application of that framework has meant in terms of highlighting the drivers of behaviour towards food waste. The chapter distinguishes 6 sectors and 3 additional contexts wherein food waste occurs, providing a comprehensive framework for targeting impactful interventions. The sectors covered are: primary production (section 3.1), processing and manufacturing (including valorisation) industry (section 3.2), retail sector (section 3.3), transport and redistribution (section 3.4), and food services industry (section 3.5). The additional contexts included are interventions that take place at the municipal level (section 3.9), at the households (section 3.6), those that cover the entirety of the supply chain (section 3.7), and finally actions which are geared primarily to raise awareness about the FLW issue (section 3.8).

Chapter 4: A summary of the findings is presented in the fourth chapter. The aim of this chapter is to tie together the information presented in chapter 3, and to provide a subsequent synopsis of what factors need to be addressed in order to **facilitate high-potential actions**.

The information provided in this deliverable is meant to complement European Union (EU) research and project initiatives in this field. It can be built upon as more knowledge about interventions is accumulated over time, and can serve to supply information which can be actively utilised during the planning and implementation of new **interventions to address food waste**.

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1 INTRODUCTION

1.1 CHORIZO project

The CHORIZO Project ("**C**hanging practices and **H**abits through **O**pen, **R**esponsible, and social **I**nnovation towards **Z**er**O** food waste") is a Horizon Europe, European Union (EU)-funded project, which aims to improve the understanding about how social norms (rules and expectations that are socially enforced) influence behaviour related to food waste generation. The subsequent goal is two-fold: firstly, that the acquired knowledge be utilised to increase the effectiveness of decision-making and engagement of food chain actors in changing social norms towards zero food waste, and secondly that the research results from this project are embedded into innovation products that can foster change when it comes to food waste-related social norms.

In order to understand which FLW actions have been and are taking place, and their current impacts, the CHORIZO project started with a comprehensive evidence-based analysis of past and current FLW prevention actions (interventions) across the EU member states. To supplement and enrich this evidence, CHORIZO utilises 6 real-life case studies to provide first-hand, primary data on how social norms affect behaviour in relation to FLW at different stages along the supply chain. All of this information in turn will be included in the modelling and predictive analytics portion of the project, with the aim of uncovering key correlations between social norms and behaviour towards food loss and waste, and thus providing insights into how people behave when it comes to food waste - and importantly, why (i.e. what is guiding their behaviour). New, more engaging, and effective communication and education packages will be produced, along with efforts to upscale, as well as capacity-building activities to not only foster change in social norms and behaviours, but to help all actors along the food supply chain to continue their efforts towards zero FLW.

This deliverable focuses on the **lessons learnt from past and current FLW prevention actions (interventions)** across the EU member states. Key success factors and barriers are discussed and main **guidance per sector** are formulated to support different types of actors from the food system (see Table 1) to design and decide on their efforts towards zero FLW.

1.2 Deliverable overview and report structure

This deliverable is an outcome of T1.4 within the CHORIZO project. The objective of T1.4 is to share insights gathered from past and ongoing initiatives dedicated to minimizing or preventing food loss and waste (FLW). These insights are organised based on different sectors and contexts throughout the food value chain to offer tailored advice to various stakeholders in the food chain. These stakeholders include individuals and organisations involved in key sectors of the food chain, **providing** them with **evidence-based inspiration for addressing food waste** in their respective fields. Table 1 outlines the sectors and contexts and their associated actor profiles, facilitating a quick reference to the chapters most relevant to their interests.

This deliverable continues the work performed in T1.2 and T1.3; in fact, the purpose of this deliverable is to advance and enhance the analyses initiated in T1.2 and T1.3, specifically by providing sector-specific guidance derived from the identified actions. **Six sectors and three additional contexts** wherein food waste occurs are distinguished, providing a comprehensive framework for targeted interventions. The sectors include **primary production, processing and manufacturing (including valorisation), transport and redistribution, retail,** and **food services**; and the additional contexts encompass **municipal-level interventions**, actions targeting **households**, initiatives covering the **entire supply chain**, and those primarily focused on **raising awareness** about food loss and waste. This categorisation of sectors and contexts results from a combination of a bottom-up emergence from the types of actions collected in T1.2 combined with a top-down determination of categories most conducive to fostering solutions throughout the entire food system.

Sector/industry/ approach	Chapter	General target audience for this chapter	Examples of actors
Primary production	3.1	Entities and individuals (a) interested in minimizing on-farm waste, improving harvest efficiency, and optimizing production processes (b) interested in valorisation of food losses streams, (c) keen to safeguard food security, and/or (c) interested in supporting agricultural development, sustainable and responsible food production practices.	• farmers and food producers • farmer associations • cooperatives • agribusiness Executives • auctions • academic and research institutions specializing in agriculture and food science • NGOs
Food processing and manufacturing	3.2	Individuals, entrepreneurs, entities and companies interested in responsible business practices, optimizing production processes to minimise waste, improve efficiency, and enhance overall environmental sustainability.	• food processing executives and managers • food safety and quality managers • supply chain and logistics managers • quality assurance and food safety professionals • sustainability officers • regulatory bodies and policymakers focused on the food industry • academic and research institutions specializing in food science and technology • NGOs • trade and services associations
Retail	3.3	Entities, entrepreneurs and individuals involved in selling food products or overseeing	• wholesalers, retailers • supply chain managers • retail managers and executives • sustainability officers

Sector/industry/ approach	Chapter	General target audience for this chapter	Examples of actors
		retail operations who want to improve logistics efficiency, reduce waste, and improve environmental sustainability. Organisations aiming to assess the environmental and social performance of retail companies.	• trade and services associations • NGOs • investors in the retail industry, especially those concerned with sustainable and responsible business practices • government agencies and policymakers
Transport and redistribution	3.4	Organisations focused on redistributing surplus food. Entities involved in the transportation of food products who are interested in optimizing logistics, reducing transit times, and implementing efficient practices to minimise food waste during transportation.	• logistics and transport companies • food redistribution organisations • supply chain and logistics managers • NGOs dedicated to reducing food waste and alleviating hunger • trade and services associations • government agencies and policymakers
Food services and hospitality industry	3.5	Entities and individuals interested in promoting or adopting practices that optimise resource efficiency, ingredient usage, reduce overproduction, and creatively repurpose food to minimise waste in e.g. company kitchens, restaurants.	• restaurant owners and managers • catering companies • hotel managers • event planners • chefs and kitchen staff • sustainability officers • government agencies and policymakers • research institutions • consumers who like to dine out or utilise hospitality services may be interested in supporting establishments that prioritise sustainability and food waste reduction
Households	3.6	Individuals and groups advocating for sustainable practices within communities. Entities aiming at implementing programs and initiatives to reduce food waste at the household level. Consumers and household food managers interested in supporting environmentally conscious and socially	• entities interested in promoting responsible consumer behaviour and offering guidance on food storage and utilisation, such as: • local government and municipalities • consumer organisations • knowledge hubs, educational institutions, and schools • NGOs dedicated to environmental sustainability, food security and quality, and community development

Sector/industry/ approach	Chapter	General target audience for this chapter	Examples of actors
		responsible businesses; who want to make informed choices.	• community leaders, ambassadors, and groups advocating for sustainable practices within communities • government agencies and policymakers
Whole supply chain	3.7	Those interested in strategies to optimise inventory and minimise food waste throughout the supply chain.	• trade and services associations • regulatory bodies and policymakers focused on addressing food waste at a systemic level • food manufacturers and processors • businesses involved in production, processing, selling, (re)distribution and/or valorisation of food products • restaurants, hotels, and catering services, wholesale kitchens • research institutions focused on food science, sustainability, and environmental studies
General awareness raising	3.8	Companies interested in improving corporate social responsibility and sustainability. Entities focused on sustainability, food security, and environmental issues; aimed at educating residents about food waste reduction. Consumers interested in making informed choices and reducing their own contribution to food waste.	• foundations and philanthropic organisations • food businesses and corporations • media and communication professionals (journalism, and public relations) • educational institutions • government agencies and authorities responsible for public health, environmental policies, and sustainability initiatives • NGOs
Municipalities	3.9	Entities and entrepreneurs aiming to adopt effective strategies to reduce food waste and improve overall waste management.	• municipalities and local authorities • environmental and sustainability departments • government agencies and policymakers at higher levels (regional or national authorities) • waste management professionals responsible for managing waste collection, disposal, and recycling programs • teams engaged in community outreach and public engagement within municipalities • environmental and community-focused NGOs

Sector/industry/ approach	Chapter	General target audience for this chapter	Examples of actors
			• residents of municipalities interested in reducing their own contribution to food waste

Table 1 Overview of food value chain sectors and contexts; their related actors (not exhaustive) who are keen to address FLW and get inspiration from previous and on-going actions; and respective deliverable chapters.

2 METHODOLOGY

2.1 Data and analyses

The initiatives analysed in this document originate from a preceding CHORIZO activity, namely T1.2, where initiatives/actions/activities/intervention (these synonyms are used interchangeably throughout the document) from across Europe were collected through desktop research and compiled into a comprehensive longlist. This longlist of 395 identified actions can be consulted in the project's Deliverables Repository (D1.2 materials) (available for download here: Deliverables Repository | Chorizo Project).

CHORIZO project's T1.2 (evidence-based analysis) and T1.3 (the CHORIZO FLW Index) already initiated the process of extracting valuable evidence from the longlist of actions to explore best practices in combating food waste. The preliminary analyses under these 2 preceding tasks involved the following steps. First, for each action it was evaluated how the action aligned with the **Food Waste Hierarchy** (EC, 2020) prioritisation logic. As illustrated in Figure 1, this logic emphasises a proactive approach to food waste solutions, giving foremost preference to preventing waste generation whenever feasible. Subsequently, in instances where food waste is inevitable or challenging to avoid, various valorisation pathways are arranged in an order of preference that represents food value and resource efficiency. Second, an assessment was conducted to determine whether these actions took into account factors such as **Motivation, social norms, Opportunity, and Ability**. This step relates to the CHORIZO conceptual framework which is summarised in the section 2.1.1 below. Third, for 46 out of 395 actions, **semi-structured interviews** were performed in the context of T1.2 to better understand these actions, how they were initiated and developed. This resulted in more evidence regarding: (1) what enables actions' **implementation feasibility and longevity**; (2) how effective have actions been in reducing FLW and what were barriers to or enablers for such **effectiveness**; (3) what were and are the main social, environmental, nutritional, and economic **impacts** following from the actions.

This deliverable continues and deepens the abovementioned previous analyses by extracting the main lessons learnt per sector/context (see Table 1) from the actions that belong to each of these sectors/contexts. Table 2 presents the actions and thus pool of data available per sector/context. In total, the following data sources were used for formulating the sector specific guidance presented in chapter 3 of this document:

- D1.2: longlist of previous FLW prevention/reduction actions and report on those 395 actions;
- Interview data (for 46 out of 395 actions);
- D1.3: 2 composite indices to be utilised as a metric to help stakeholders rank the different actions identified in D1.2.

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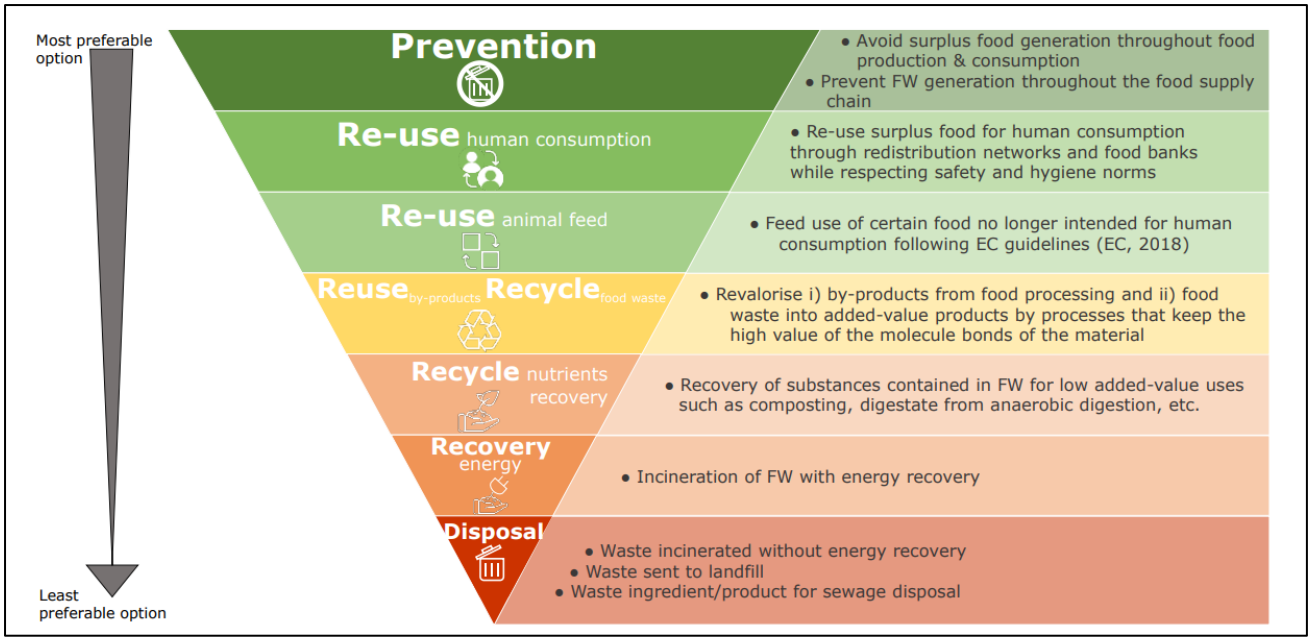

Figure 1 **Food Waste Hierarchy.** *Source: European Commission. (2020) Brief on food waste in the European Union. Brussels: The European Commission's Knowledge Centre for Bioeconomy (page 8).*

Sector/context	Chapter	Number of actions/initiatives	Number of interviews
Primary production	3.1	14	1
Processing and manufacturing	3.2	45	5
Retail	3.3	45	5
Transport and redistribution	3.4	86	9
Food services and hospitality	3.5	66	9
Households	3.6	40	7
Whole supply chain	3.7	19	2
General awareness raising	3.8	80	8
Municipalities	3.9	22	19

Table 2 Overview of sectors and contexts, their respective chapters, and the data sources used to formulate the sector specific guidance

The more in-depth analyses per sector/context followed the methodology as described hereafter. Per sector, first it was explored whether the actions could be **categorised** into several types of actions. As a start, per sector the actions were clustered according to their level in the FW hierarchy pyramid to determine if it could potentially be meaningful to formulate separate advices for prevention vs. re-use vs. re-cycle actions. In practice, the number of actions per sub-category per sector was not always high enough to yield a meaningful discussion per sub-category. In some cases, as for the household context and retail sector, the actions could be easily categorised based on their approach rather than the food waste hierarchy pyramid, and in such cases the respective guidance was structured as such.

Second, following such categorisation or way to distinguish and compare actions within one sector or context, the actions were compared by assessing their:

- scoring for the 2 FLW indices (D1.3);
- potential for replication;
- (expected) economic, environmental and social impacts of the action, for the specific sector or beyond;
- faced barriers (e.g. challenges experienced, implementation feasibility) and demonstrated success factors;
- Which social norms were addressed and how? How do actions address injunctive or descriptive social norms? (see section 2.2.);
- Which MOA constructs were addressed and how? How do actions address Motivation, Opportunity, and Ability? (see section 2.2.).

Based on the above assessments, **key advice for tackling FW in the respective context/sector** were extracted (see chapter 3). For some sectors/contexts (like food services chapter), the results are structured around the above assessment criteria, for others (like primary production), the results are structured by distinguishing actions tackling different food waste hierarchy categories – depending on what fits best based on the pool of actions available within that sector/context of interest.

2.2 The Motivation-Opportunity-Ability Framework

The Motivation-Opportunity-Ability (MOA) framework is the central conceptual framework utilised within the CHORIZO project. In the present deliverable, it is also used to draw lessons from previous and ongoing FLW actions: by assessing how actions utilise(d) motivations, abilities, or opportunities, promising approaches or approaches to avoid are discussed per sector, so that future actions can learn from these approaches. The MOA framework was originally proposed by MacInnis et al. (1991) in the field of marketing and human information processing. In 2016, the EU Refresh project applied this conceptual model to understand consumer food waste behaviour (van Geffen et al. 2016). The theory poses that food waste can be viewed as the result of routine decisions and habitual behaviours that are influenced by individuals' internal motivations but also by their available abilities and opportunities. These three key constructs – Motivation-Ability-Opportunity – are explained hereafter.

Opportunity represents availability and accessibility of materials and resources to change behaviour such as time, technology, and infrastructure. **Ability** refers to capacities – hence skills and knowledge – to perform a certain behaviour or to change habits towards less food waste. This typically encompasses consumers' behaviours related to meal planning, estimating how much needs to be purchased, food storing, correctly interpreting date marking, and cooking skills. **Motivation** covers all aspects related to what drives individuals to conduct a certain behaviour. Key factors that determine motivations include: attitudes, awareness, personality. Importantly, motivations are also impacted by social norms ruling in a certain group (which can

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be the whole society or numerous segments of consumers). **Social norms** are defined as the rules/guides for actions perceived by individuals aspiring/belonging to the norm's target group as expected by others (Bicchieri 2006). A common differentiation among social norms is to distinguish injunctive social norms from descriptive social norms. On the one hand, **injunctive norms** refer to perceptions about normatively appropriate behaviour in a specific context (Cialdini et al. 1991). It relies on the perception that an individual has about what kind of behaviour is approved or disapproved of by the reference group. Often there are reinforcing mechanisms (rewards or punishments) through which such approval or disapproval is expressed. Injunctive norms tend to guide behaviours in situations that are more **private or repetitive settings that are steered by routines and habits**. On the other hand, **descriptive norms** refer to an individual's perception about the likelihood that others engage in the behaviour, and the individual follows such behaviour because it is deemed effective and appropriate (Cialdini et al. 1991). It is based largely on observation of what is prevalent or common behaviour. Descriptive norms tend to largely determine individuals' behaviour when they find themselves in situations wherein (a) their behaviour is very **visible** to others; for example, when hosting guests; and/or (b) they feel uncertain about what the norm would be, for example, new or **unfamiliar contexts** such as having breakfast in a foreign hotel. For example, when having dinner with new acquaintances, individuals may feel compelled to leave some food on their plates if everyone else in the group does so (i.e. one follows the observed norm). Another example of a descriptive norm that could negatively influence food waste practices is a chef demonstrating a new recipe on a TV show who throws away parts of a broccoli in the garbage, thereby inadvertently signalling that such behaviour is acceptable.

3 SECTOR SPECIFIC GUIDANCE

3.1 PRIMARY PRODUCTION

The 14 identified interventions in primary production predominantly focus on measures that prevent food loss (6 activities) and measures that reuse surplus food for human consumption (7 activities). Furthermore, one specific action is dedicated to repurposing food for animal feed. The prevention actions have a national or international character, while the actions for reuse for human consumption are at municipal, regional, and national levels.

3.1.1 Preventative actions: avoiding surplus food generation

Preventative measures in primary production encompass various innovative approaches. One example is the Leaf No Waste project. In this project, silicon-based fortification for various crops (spinach, kale, mushrooms, strawberries) combined with compostable plastic packaging aims to increase the shelf life of fresh products and prevent wastage. On the other hand, the FOLOU project focuses on developing a standard mechanism to measure (using a robust and harmonised methodology and IT technologies), monitor (utilizing a national and EU Food Losses register), and assess the size and impact of food losses. The project also emphasises knowledge transfer by establishing a Learning Centre for critical stakeholders. Further, the SISTERS project focuses on developing a new tool—an easy-to-use app (Short Chain Platform)—for primary production to encourage sales in short chains (direct to customers). Using this direct selling channel, most fruits and vegetables that do not meet the retailer's standards can still be sold and saved from loss. Another prevention action, such as the one taken by the Croatian Ministry of Agriculture, is focused on providing sectoral guides for primary production. These guides help understand the causes of losses in the field and prevent them.

The prevention initiatives cover multiple **MOA aspects** (see chapter 2.2). All the listed initiatives were started due to the need to address the problem of food loss in primary production (**Motivation**) and the need to address it by providing the missing skills/knowledge (**Ability**) but also solutions and tools (**Opportunity**). For example, the actions taken by the SISTERS project by encouraging short-chain sales create the base for changing the consumer motivations to buy more locally (environmental aspect), support farmers (social aspect), and buy food that is out of standardised look (new **social norm**). Moreover, they also provide the right tool (App) to make it possible. The other actions are using skills and knowledge to create particular scientific solutions (Leaf No Waste) or common methodology for measuring FWL (FOLOU) and increasing awareness by providing comprehensive guidance (Ministry of Agriculture in Croatia). Most of these actions aim to provide the right tools to implement the solutions, such as apps (SISTERS), the EU Food Losses Register (FOLOU), and sustainable packaging (Leaf NO Waste).

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Most of these actions started in 2022/2023 and are ongoing for another 2-3 years. These initiatives lay a solid foundation for change. Still, their real-life implementation chances diminish after project completion without subsequent actions or investor interest in the developed solution. In some cases, bigger international consortiums create more opportunities to obtain stable funding and involve diverse partners and stakeholders, fostering a multifaceted approach to the issue by incorporating various perspectives and addressing aspects such as innovation, technology, and socioeconomic and environmental considerations on a broader scale. Moreover, the chance for continuing the work on the developed solution by involvement in follow –up project tends to be higher for EU projects than in the case of national or regional initiatives.

3.1.2 Re-use surplus food for human consumption

The actions that repurpose foods for human consumption primarily focus on saving and **redistributing** fruits and vegetables that do not meet market requirements. They thereby address social norms around suboptimal food quality and ugly foods. Initiatives such as Gleaning Network (UK), Espigoladors (Catalonia, Spain), BARUXKA (Navarra, Spain), and Alimentando (municipal-Pavia, Italy) promote networking between different entities: organisations, farmers, charities, and volunteers. They base their activities on gleaning (recovering unharvest products that remain in the fields), which creates an opportunity for direct redundance of food loss in the farms. These actions strongly focus on the social aspect by **empowering communities** and supporting people at risk of social exclusion (poor people, immigrants, vulnerable individuals) by providing them with healthy, nutritious food (saved fruit and vegetables). The other type of reuse for human consumption focuses on creating a sustainable **business**. Rescued Boxes (Cyprus) and Eat Grim (Denmark) present the same business idea, which includes selling boxes filled with imperfect fruit and vegetables from the local farmers. The Bella Dentro initiative from Italy (Milano) created a network of local farmers and producer organisations to buy the "ugly food" they later sell in their physical shop in Milano. They use the saved fruit and vegetables to support their other businesses, such as producing jams, juices, preserves, and dried products. They have opened a lunch bar where you can buy "all you can mix" bowls, soups, fruit salads, etc.

The underlying principle of these actions lies in capitalizing on **opportunities** presented by underutilised fruits and vegetables. Some of these initiatives, such as the Gleaning Network, offer support by access to their network and provide resources or tools to everyone who would like to be involved in gleaning by volunteering in an existing group or starting up a new project. At the same time, **motivation** serves as the primary driver for these reusing actions, stemming from acknowledging the FL issue and substantial involvement in the social aspect. Besides reducing the FL in primary production, the gleaning actions also focus on increasing awareness regarding the **aesthetically unconventional produce** and its value and the importance of the availability of nutritious food for people in vulnerable situations like poor people, immigrants, and people with mental and physical disabilities. What is more, encouraging and enhancing social awareness regarding "ugly food" and

bringing them on the market as a valuable, sustainable product (Rescued Boxes, Eat Grim) can lead to establishing new **social norms** that encourage to embrace food products with features outside conventional standards to mitigate FL.

The actions focusing on the social aspect more than business seem to evolve into sustainable, enduring programs that establish **supporting networks** and inspire similar efforts in different regions. Most of these initiatives have been active for more than ten years. However, the gleaning initiatives often need help with multiple challenges, such as **infrastructure** issues, including location and the acquisition of necessary equipment, such as suitable storage facilities with fridges. **Workforce** recruitment poses another challenge, as these initiatives often heavily rely on **volunteer** assistance, impacting their stability and operational aspects. On the other hand, the actions that focus on the business are more dependent on **stable financing**; for example, Eat Grim, after 5 years of being active, went bankrupt due to a lack of investors that would support their further growth. Similarly, to all kinds of actions, stable financing is a key to success and further development.

3.1.3 Conclusion

Where the preventative actions tend to centre around **technological innovations**, actions aimed at repurposing food for human consumption (e.g. by reprocessing) primarily rely on **redistribution and gleaning** as main strategies. While reuse actions are more ad-hoc in reducing FLW (and therefore receiving a lower scoring based on the FLW Hierarchy Prioritisation), they are critical for local communities (social aspect), aiding those in need and incorporating vulnerable citizens by creating job opportunities.

Sustained **funding** is crucial to the success of any initiative. Actions relying on innovation, technology, and **collaboration** often face challenges in securing initial financing. If obtained, funding tends to be stable and sufficient for the project's duration.

To enhance the success rate of future initiatives, greater emphasis should be placed on introducing **monitoring systems, data collection,** and **knowledge transfer**. This focus could enhance the accuracy and efficiency of both preventative and repurposing actions. Local authorities should support regional/national/municipal repurposing actions and provide stable and continued financial backing.

3.2 PROCESSING AND MANUFACTURING

Actions identified addressing food waste within the processing and manufacturing sector are largely characteristic of **valorisation**. Valorisation being defined as, “any processing activity whereby food is

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transformed into a range of value-added products"[1]. A prime example is Krut, a company in Austria, which processes over-produced or imperfect vegetables into kimchi and kombucha. Another example is evident in Växjö (Sweden) where the Municipality and the regional waste management company (SSAM) transform food waste into biogas for city buses and passenger cars. While the actions do not rank highest on the Food Waste Pyramid Hierarchy (i.e. prevention level), they do systematically address food waste via re-use (by products) or recycle (food waste or nutrients recovery)[2]. These actions work to ensure that any surplus food already present is utilised rather than simply discarded.

3.2.1 Positive socio-economic impacts despite challenges

There are numerous and varied positive socio-economic impacts that result from actions in this sector. Most often evident is the **creation of jobs and skills**. When valorisation is introduced, it means that essentially another product is being created, and this requires knowledge and skill - not only on the production side, but also when it comes to placing the product on the market. One such example is the Best of Waste project in Flanders (Belgium) where residual fruit is utilised to produce fresh, healthy juice. In order to make the juice, technological challenges had to be addressed, such as ensuring that the juice was safe to drink from a microbiology point of view (i.e. product safety standards). Such **technological challenges** are not uncommon with valorisation, particularly if sourcing, production, and marketing take place over several regions or countries. **Governance and legislation** can vary region to region or country to country, including specific **quality standards** depending on the product, where it is made and sold. It is a challenge, but can also be turned into a positive impact. In the case of Best of Waste, it required more expertise from staff and training. For example, additional people were hired to do the quality control on the field (in the high season, up to 5 people part-time were hired). Such additional jobs and the accompanying training are not only positive for the local economy (i.e. for those in the new employment positions as well as the opportunity to sell an additional product for the seller, and consumers having more choice of products), it can also help create more local support for the product, while obligating staff to become more aware about food waste and what can be done to address it.

Another positive impact of valorisation is that it necessitates input from, as well as **working with multiple partners**, thereby increasing communication along the supply chain. For example, Wholy Greens, a company in the Netherlands which uses left-over vegetables from the primary sector to make pasta and then sells it on-line, needs to be in constant contact with its' supplier(s) in the primary production stage to determine supply capacity. Or the Food from Food project involving chicory valorisation in Flanders, where the right partners

[1] European Commission. (version 2020) Brief on food waste in the European Union. Brussels: The European Commission's Knowledge Centre for Bioeconomy (p. 1).
[2] European Commission. (2020) *Brief on food waste in the European Union.* Brussels: The European Commission's Knowledge Centre for Bioeconomy (page 8).

had to be identified not only in terms of where would the chicory croquettes be sold to, but also which partners to work with on the technical side to find the right recipe for the croquettes, ultimately requiring lab experiments at the Flanders Research Institute for Agriculture, Fisheries and Food (ILVO). Discussions had to take place amongst entrepreneurs, primary producers, food processors, distributors, and consumers. Increased communication and working with partners along the supply chain means that ultimately various actors have a vested interest in seeing the project succeed, and thus provide the needed support - financial, expertise, human resources, technology being a few examples. The project thereby becomes further instilled into society helping to better ensure its **longevity**.

Adequate **funding** is an important component of the overall support. It is important, not only to ensure adequate human resources and expertise as discussed here-above, but is key for valorisation due to necessary technology and equipment. Funding from the inception of the project is a requirement, especially when the valorisation creates energy such as for example with Food Surplus Management (FSM) in Ireland. FSM specialises in the recovery and recycling of short-dated and out of date food products. Servicing over 150 hotels and restaurants nationwide, FSM operates 2 licensed facilities in County Meath, where it de-packs and recovers food waste for anaerobic digestion (energy). As with all valorisation efforts, energy costs play a role not only in the actual processing, but also in the logistics involved to preserve any food or drinks, keeping in mind the perishability of such products.

3.2.2 Difficulty of measuring environmental impacts

While the valorisation actions provided positive socio-economic impacts, it is more difficult in this stage of the supply chain to measure the positive environmental impacts. Most obvious is that surplus food is addressed thereby ensuring that less food is discarded. By addressing the existing surplus food, several environmental benefits may be incurred such as avoiding the **greenhouse gas emissions** that would result from the food if disposed of in a landfill or incinerated. However, the environmental benefits need to be weighed against the environmental impact of the actual manufacturing/processing involved in valorisation as well. For just under a quarter of all the actions identified in this sector (10 out of 45), there was a **clear monitoring system** (including baseline measurement and performance indicators) identified that was systematically incorporated into the action. In order to better ascertain the environmental impacts, the actions researched in this portion of the CHORIZO project demonstrated that more attention and resources need to be invested in monitoring. A demonstration of positive effects on the environment could entail the future support of key and additional strata of society, such as those championing environmental causes.

3.2.3 The MOA Framework perspective

Looking at these actions from a Motivation-Opportunity-Ability Framework (MOA) perspective, there are some clear **motivations** behind the actions, but few of the actions were clearly indicative of injunctive or descriptive social norms. If a social norm was identified, then it was most often the **descriptive norm** (5 actions), with the current political support for the circular economy being the context. These actions mostly provided visible examples to demonstrate best practices concerning the minimisation of food waste. One such example is the Biova project in Italy, an innovative start-up that focuses on reducing food waste through the creation of products that follow the principles of circular economy and upcycling. The City Compost for Sustainable Agriculture project in Sofia (Bulgaria) is another example, where the project aims to create the most optimal compost possible that can be produced from urban food and green waste. This bio-waste is shipped to a testing site owned by the University of Forestry located on the outskirts of the city, and there different compositions and ratios of bio-waste are tested. The compost created by the project is then used by small and medium-sized agricultural producers to boost the production of food, thereby supporting a more circular approach to both agriculture and urban waste. The only example of an **injunctive social norm** amongst the actions identified in this stage of the supply chain was the bio-waste collection project in Paris (France), where by law bio-waste is collected for the purpose of valorisation into energy production. The city of Paris has been addressing the collection of food waste since 2017. Under the law on energy transition, all French cities are to offer a system for collecting food waste at source sites by 2024. Rather, what appears to be largely motivating these actions is related to the **socio-economic discussion**, and the **benefits** that are brought about for government, industry and consumers by creating new products. A large majority of the actions (38 out of 45) were indicative of "opportunity" within the MOA Framework, and 10 out of 45 being indicative of "ability". A clear reason why **opportunity** was prevalent, is that by creating new products, it facilitates the opportunity to purchase a food or drink product that would otherwise go to waste. **Ability** did not resonate as much with these actions because they are for the majority led by industry which is focused in this case on creating a new product, but not necessarily providing individual level ability to address food waste.

3.2.4 Key lessons for the processing and manufacturing sector

There are key lessons that emerge, highlighting what components are necessary in order to increase the potential for success of an action.

- The importance of addressing food waste – even if not at the highest level of the food waste pyramid hierarchy: Although prevention of food waste from occurring is the highest goal, it is understandably not always possible. There will always be some surplus food, and it is paramount that it is not simply discarded or incinerated. **Valorisation** is an **opportunity** to systematically address food surplus via **re-use** (by products) and or **recycle** (food waste or nutrients recovery).

- Working with multiple partners across the supply chain: Valorisation entails working with suppliers and distributors. Valorisation simply cannot operate successfully in isolation. By working with various partners, it helps to solidify the project, especially if it is incorporated into already existing institutional structures. For example, the biogas production in Växjö (Sweden) is a strategic pillar of Växjö's municipal environmental policy. Not only is **communication** across the supply chain increased, but thereby a **greater understanding** of how the supply chain truly operates (including **raising awareness** about what is currently being done to address food waste) and along with it more networking opportunities to apply processing and manufacturing/valorisation to other foods – i.e. to expand and grow.
- The importance of funding: Closely related to working with multiple partners is the issue of **adequate financial support** for a project. When it comes to the processing and manufacturing sector, **technology and equipment** often play a key role, which necessitates monetary investment – not only from the start, but throughout the project in order to ensure maintenance of the equipment over time. Funding is also necessary to ensure that there is **expertise** available to not only create a new product, but also knowledge about how to bring that product successfully to market, especially if the entire process from inception to final destination involves multiple regions or countries. Consequently, **funding from multiple sources rather than one sole source** might help, although it does not necessarily always ensure a consistent flow of funds.
- Ability to demonstrate positive impacts: Being able to demonstrate positive impacts due to valorisation can help stimulate support for the product. One of the most prominent positive socio-economic impacts among the identified actions in this sector was the creation of jobs and additional skills. However, in order to effectively **demonstrate positive impacts**, including environmental ones, a **systematic monitoring plan** including baseline measurements and key performance indicators to track progress over time, can help bring to light those impacts. This may facilitate future support of specific and new strata of society that currently are unaware of the positive impacts of the project.

3.3 RETAIL

This chapter explores 45 actions and interventions addressing food loss and waste in the retail sector across Europe. Researched actions are distributed across the European continent, with Germany being the most represented country with a total of 10 actions. Despite geographical multiplicity, similar trends and analogous typologies of actions can be found across countries.

The diversity of **actors** involved in **implementing** the actions – mostly retailers, wholesalers, technological SMEs; but also producers, and public authorities – highlights the complexity of the retail sector. Interventions themselves are enacted through various **mechanisms** at different stages of the value chain. These can be in-

shop actions, technological apps, monitoring mechanisms or awareness raising actions, impacting at the purchasing, stocking up, shelving, retailing or redistributing stages. While this **heterogeneity** makes direct comparisons across interventions challenging, it also reveals numerous leverage points for addressing food waste reduction in the retail sector and demonstrates widespread commitment to the issue among different actors.

Albeit heterogeneity in actors and mechanisms, the ultimate impacts and effects of the actions demonstrate significant similarities. Most of the actions **target** consumers (37), while in other cases, wholesalers or retailers themselves serve as the intended audience. Interventions act substantially high at the food waste hierarchy, addressing either **prevention** (10) or **re-use for human consumption** (34), with only one action on **recycling**. In terms of influencing behavioural change, the vast majority of the actions address the **opportunity** component of the MOA framework, with 35 occurrences. These include interventions where 1) **new avenues have been created for bringing previously discarded foodstuff into the value chain**, especially by creating new business lines or models around it or 2) by **stimulating the demand for these goods** by making them visible and attractive for the consumers via in-shop actions or technological apps.

To facilitate the analysis, actions have been organised into six primary categories: (1) in-shop actions; (2) apps, platforms, and digital tools connecting retailers and consumers; (3) new value propositions; (4) monitoring actions; (5) awareness raising actions; and (6) commitments. These categories are not mutually exclusive, as some actions may belong to more than one of them.

3.3.1 In-shop actions

In-shop actions involve efforts by retailers and wholesalers to minimise food waste by **actively encouraging consumer purchases of products with various drawbacks** (suboptimal appearance, nearing expiration, overstocked). This is often achieved through incentives such as discounts or reduced prices. For instance, Carrefour Poland provides up to a 90% discount on products with a short shelf life, and Coop supermarkets in Italy have a dedicated "Buon Fire" section with discounts of up to 50% on products with visual defects. Most actions in this category are implemented by retailers (supermarkets) and target consumers (8), with one additional action identified for an online wholesaler serving the gastronomy sector.

These interventions involve in-store stock management, including redistributing food items on dedicated shelves, repackaging, and communication efforts. Consequently, they fall under the **re-use for human consumption** category, taking foodstuff that otherwise would be discarded and making it visible and attractive for purchase and consumption. Generally reactive, these actions pursue the depletion of existing stock before it becomes wasted and may not systematically influence retailer purchasing decisions. However, when combined with monitoring technologies (1 action), they can impact higher in the hierarchy by anticipating

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products nearing expiration. An example is Whywaste's solution Semafor Deli, implemented by Coop in Sweden, which alerts personnel if there are any products on the counter that are at risk of becoming waste so that the personnel can take more proactive, preventative measures.

By making products with drawbacks visible and attractive to consumers, the in-shop actions address the **opportunity** component of the MOA framework. A remarkable exception is the case where monitoring mechanisms are part of the equation (the aforementioned Semafor Deli), which allows knowledge about the status of the product to be manifested in a clearer way and thus impacts on the **ability** component as well. Moreover, these actions thereby exploit **social norms** that relate to consumers' expectations regarding food aesthetic characteristics.

While data is scant for conclusive assessments regarding sustainability, impact, success factors, and challenges, common traits can be identified among actions. They necessitate retailer and worker involvement, are easily integrated into routinary retail operations, and **involve low capacity and low investment**. Although technically straightforward to implement, they address various factors contributing to food loss and waste, primarily appearance and short shelf-life of food products. Some actors have implemented **KPIs** to measure the performances of the actions, which help institutionalise the action beyond one-off occasions and thus ensure their sustainability. The fact that all the actions are still ongoing speaks in favour of these types of interventions.

The primary drawback lies in the **reactive nature** of these interventions, as they may not inform supply chain decisions and purchasing choices of retailers. However, this can be overcome by combining in-store actions with other measures such as monitoring mechanisms. In summary, these interventions are **easy to implement** and involve **low investments**, but their impact is limited as it primarily revolves around current stock management.

3.3.2 Apps, platforms, and digital tools connecting retailers and consumers

An increasing number of initiatives tackling food loss and waste in the retail sector revolves around platforms that match a) the supply of variously crippled or surplus foodstuffs from retailers and b) consumer demand for these. These apps and platforms display food items from nearby retailers that present one or more of the following characteristics: **overstocking, soon-to-be expired, visually unattractive**. As such, all actions on this category fall under **re-use for human consumption**. Generally, retailers can list their items on the platforms and individual consumers can map the offer of these items – this is the case for instance for Foodie Save in Ireland, or Aswell in Latvia. Purchasing these items comes often associated with some form of benefit, such as discounted prices. There are slight variations of the same approach. In Finland, Froodly adopts a strategy that incentivises consumers to report still-fresh discounted products in their local stores. Users share a picture of

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the discounted product along with its price and store details in the app, earning credits towards rewards like free coffee. Meanwhile, the Foodlist app in Norway not only provides a platform for retailers to showcase special deals on food with a short shelf life but also allows them to contribute surplus food to local charities.

These initiatives have a very clear technological component and are often related to the development of online platforms or mobile apps. The predominant majority of actions that can be classified under this category are **third-party platforms**, often developed by SMEs from the IT sector, with an innovative value proposition, as is the case for the popular Too Good to Go platform. In one case – the Gander platform at SPAR supermarkets in the United Kingdom – these tools have also been adopted in-house by retailers and fully deployed as part of their business strategy. For this later case the initiative works in combination with in-shop actions and contributes to increasing the effects of these.

In terms of social impact, these initiatives shed light on the issue of food loss and waste, offering **visibility to the problem**. More saliently, by providing discounted food items, they serve as a support for individuals facing economic challenges and offer a means to address **food insecurity** in vulnerable households. Some additional best practices can be remarked concerning societal impact: Foodie Save integrates a practical and **educational** approach by offering tips on the environmental cost of food waste, as well as guidance on how to plan, shop, store, cook, and compost, providing users with valuable information that contributes to awareness raising. It thereby efficiently address **abilities**. This offers a simple way of multiplying the impact of the action through the addition of an informative guide. From an economic perspective, these types of actions not only prevent the loss of valuable food resources, but also foster the emergence of **new business models** and entrepreneurial ventures around it.

Actions falling under this category primarily address the **opportunity** aspect of the MOA framework. They establish a new infrastructure that facilitates the meeting of demand and supply. However, these actions tend to be somewhat **reactive**, seeking outlets for soon-to-be-expired or surplus food. Beyond the aspect of discounted prices, some platforms such as Froodly, through its nudging effect, provide additional incentives and rewards, explicitly addressing the **motivation** axis and **injunctive social norms**. The app structures the choice environment by rewarding users with points for purchasing surplus food, acting as positive reinforcement to encourage sustainable and socially responsible choices. These points can be exchanged for discounts.

Implementing actors have reported the obtention of a critical mass of users as the main hurdle for the medium- and long-term **viability** of these initiatives. Market penetration is not always easy, and making the value proposition sustainable requires great effort. Furthermore, initial investments are considerably high and the success of the business model is considerably susceptible to external factors, such as the pandemic that

resulted in (temporarily) changed consumption habits. These risks are mitigated when the platform is developed in collaboration with a big retailer name.

3.3.3 Retail actors and new value propositions centred around food susceptible to being wasted

These are initiatives that leverage the potential of soon-to-perish, overproduced, wrongly-marked or visually imperfect foodstuffs sourced from various stages of the food chain to establish dedicated retail lines or entire retail businesses around them. While the previous category of actions (apps, platforms, and digital tools connecting retailers and consumers) acted as a bridge between existing retailers and potential customers, these initiatives take a further step: they either establish whole retailing businesses or dedicated retailing lines that exclusively offer food items at risk of being lost or wasted.

An additional defining characteristic of these actions is their tendency to retail food items from various stages of the food chain, including wholesalers, processors and manufacturers (e.g. Best For in Norway), and even primary producers (e.g. "Die etwas Anderen" by Kaufland in Germany). As a result, they can contribute to addressing food loss and waste earlier in the food chain. Eleven actions have been identified in this category, encompassing both physical retailers and online stores. All of them target their actions at consumers and show an even distribution around Europe, with 2 of the initiatives (Motatos and Matsmart) being affiliated among them.

Two distinct types of initiatives can be distinguished here. On the one hand, there are existing actors (3 have been identified) that create new product lines focusing on food items vulnerable to loss or waste, often due to suboptimal aesthetics (e.g. “Perfectly Imperfect” by Tesco or "Die etwas Anderen" by Kaufland). By this, producers have a new opportunity to market food that otherwise would not make it to market without additional processing. On the other hand, new business actors are emerging that exclusively operate in this space (e.g. Motatos in Austria, Matsmart in Sweden, or Foodello in Belgium). This latter category also includes foodstuff coming from overproduction, with damaged packaging, with incorrect labelling etc.

When examining the food waste hierarchy, a common thread is visible: all of the actions focus on repurposing edible items for human consumption. Consequently, these initiatives offer new avenues and new outlets for food that otherwise would be lost, not only at the retail stage but beyond it, thus addressing the opportunity component of the MOA framework. Regarding impacts, from a societal perspective, this category of actions brings attention to the issue of food loss and waste. Additionally, by facilitating access to discounted food items, they serve the less privileged and provide a means to combat food insecurity in the most vulnerable households. Certain initiatives explicitly focus on addressing the social economy, as exemplified by We-Food in Denmark, which channels profits towards social work. In economic terms, apart from preserving valuable food resources and preventing their wastage, these initiatives stimulate the emergence of new businesses,

both online and physical, and also more business lines for existing businesses. In contrast to matchmaking apps, they offer an added advantage by incorporating food items from diverse sources into the market, encompassing wholesalers, processors/manufacturers, and, in some instances, primary producers.

As for the sustainability of these initiatives, the available data is limited, hindering the formation of a conclusive analysis. However, it is noteworthy that all initiatives are currently ongoing, with several of them tracing their origins back to 2016. The most veteran actions have strong KPIs in place, suggesting a correlation between effective performance measurement and sustained impact over time.

As highlighted also in the analyses of other sectors, these initiatives often compete with non-profit food redistribution actions carried out by charities or NGOs. While it is true that initiatives such as We-Food cooperate with the social economy, altruistic redistribution platforms have voiced their concerns about the more for-profit oriented initiatives – see this addressed in more detail on the Municipalities chapter of this report.

Actions belonging to this category present in general a variable investment, from relatively minor for already-existing businesses that want to include an additional product line (e.g. around “ugly vegetables”) to a high one for completely new businesses. In any case, finding a constant supply of products can be a challenge, and requires a mapping of suppliers from different stages of the food chain. On the other side of the coin, actions like these are in principle more capable of marketing susceptible products than actions belonging to the categories above. Nonetheless, the presence of the non-profit sector – whose social impact is obviously manifested – is a variable to take into account, although there may be formulas that avoid competition and offer avenues for collaboration.

3.3.4 Monitoring actions

Several actions aim to combat food loss and waste by monitoring various parameters of foodstuff (expiring dates, supply and demand, weight of previously wasted items) at different stages of retail. These actions feature a very prominent technological component and often have the goal of informing better purchasing and stocking decisions for retailers and optimising their supply chain management. For example, retailer BIO COMPANY reduces leftover baking goods by introducing new controlling software FoodTracks to optimise purchasing and modifying the production range. Scan2Save, developed by various actors that include the University of Copenhagen, has developed a QR barcode that facilitates to identify the sell by date for retailers.

In general, implementing actors show a wide heterogeneity, with a notable presence of SMEs and research institutes, a fact that reflects the R&D character of these actions. On the other side of the coin, all actions are targeted at retailers. Of the 5 actions identified in this category, one of them is implemented in conjunction

with in-shop actions (Semafor Deli). This speaks in favour of the complementarity of monitoring actions and their capacity to bring about positive food tackling effects in conjunction with other levers. Monitoring actions are generally preventative actions, leveraging high in the food waste hierarchy and thus avoiding the production of food loss and waste. From a behavioural change point of view, monitoring tools open up new abilities by providing various actors with the information and the knowledge about the status of the foodstuff along the supply chain.

A remarkable characteristic of monitoring actions is that their influence extends throughout the supply chain, transcending the immediate intervention point. Economic and environmental consequences stem directly from the reduction in food waste at each instance and more indirectly from the insights shaping future decision-making processes. This also affects the sustainability of actions, as actions that inform supply chain management and make it more efficient are prone to be kept in place. Nonetheless, as is the case with all actions with a technological component, monitoring requires the unfolding of infrastructure and the implementation of a set of new procedures for different actors that are part of the value chain. Due to the variety of individual actions that fall under this category, efforts and investments to set these up are variable.

3.3.5 Awareness raising in retail, including date marking

Various of the actions mentioned in the categories above raise awareness about food loss and waste. Nonetheless, they do so in a tangential manner – awareness raising is not their main purpose. In a more direct manner, out of all the researched interventions, there are 8 actions that explicitly aim to raise awareness among different actors participating in retail. They do so by bringing forward different factors that contribute to food loss and waste. Primary actors involved in implementation exhibit significant diversity, predominantly led by retailers and producers. However, collaboration is frequent, involving various stakeholders such as To Good to Go, research institutions, and in certain instances the public sector.

A clear subcategory can be identified around actions that aim to raise awareness around date marking. Out of the 8 awareness raising actions, 4 belong to this category. These interventions can include communication campaigns around best before dates in supermarkets (e.g. Spar in Hungary) or the modification of the 'best before' label to say 'also good after' (e.g. producer Arla in Denmark). These date marking actions have a very salient preventative spirit, while the rest of the actions fall under different categories of the food waste hierarchy, with one of the actions situated at the recycle stage. This is consistent with the nature of awareness raising as a lever to act in various points of the hierarchy.

Regarding the **MOA framework**, ability is a common denominator for all awareness raising interventions, as these aim to develop skills or knowledge. Simultaneously, motivation plays a pivotal role in these actions. The **impacts** of awareness raising actions are difficult to estimate and in no case should they be limited to the most

immediate effects of the interventions. Raising awareness often requires sustained actions. This can also be a challenge, as effects might not be immediately quantifiable. Implementation-wise, these interventions are generally straightforward and entail low investment costs. Notably, interventions around date marking, exemplified by Arla's incorporation of messages like "also good after," demonstrates ease of **implementation** with substantial potential to influence consumer behaviour.

3.3.6 Commitments and other uncategorised actions

Finally, there is another set of actions that could be categorised under the “others” category. These include actions that do not fit under any of the previous typologies. One recurring subcategory is that of actions that often take the form of non-binding or voluntary commitments that different actors of the food chain abide by around food waste reduction. These are many times connected to surplus food redistribution. Three of the four actions that involve some kind of commitment mechanism are around food redistribution. The fourth one is put forward by a Ministry (Austrian) and is a voluntary agreement with the goal of halving the food waste for all signatories - multiple private companies from the retail and distribution sector. Signatories are asked to implement measures and start a detailed reporting of the generated food waste by mass.

For the food redistribution actions, these are implemented by retailers and the target audience is either that of the organised redistribution platforms, as in the case of Alnatura in Germany, that has a commitment to redistribute 100% of their surplus food, or the employees of the retailer themselves (the case of Lehmann Natur in Germany). The former collaborate with various redistribution options, such as Too Good to Go, but also local actors. Redistributed food can alleviate food poverty if it is correctly channelled and directed to those in need. In the case of collaborating with external partners, it is important to map a network of possible collaborators and beneficiaries. For more information regarding redistribution, it is recommended to refer to the dedicated chapter.

3.3.7 Concluding remarks

As seen above, the retail sector is actively addressing the issue of food loss and waste through several interventions and initiatives. Most actions act high on the food waste hierarchy, primarily focusing on prevention and re-use. A majority of the actions address the opportunity component of the MOA framework, for example, by making the food products more affordable and visible to the consumers or by visualising that food is still good after the best before date.

In-store measures are not costly and are easy to implement. They are also able to act higher on the food waste hierarchy. However, they are somewhat reactive in that they only manage existing stocks without necessarily preventing future waste. These characteristics are shared with apps and online platforms, albeit they can reach

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out to consumers in a more widespread way. New business models addressing potential food loss or waste can integrate goods from various stages of the food chain, but this often entails competition with the non-profit sector. Understanding the trade-offs, particularly the balance between social and economic impact, becomes crucial for these actions. Monitoring actions are aimed at improving the management of the value chain at different stages of retailing. Hence, they can inform future decisions on production, purchasing, stocking, supply and redistribution, anticipating food loss and thus fostering proactive measures to address it. The awareness-raising component is implicitly present in many of the actions. In a more salient manner, several actors are raising awareness around date marking.

Comparing actions from different categories remains a challenge, as goals and motivations behind them are different. However, some of the actions demonstrate that the combination of actions from several categories can foster a more preventative approach, also contributing to a higher social, economic and environmental impact, as well as informing motivations, opportunities and abilities of target users in a more holistic way.

3.4 TRANSPORT and REDISTRIBUTION

3.4.1 Key lessons learnt

From the evaluation of the interviews, we found that there are **many similar activities** taking place in different cities/countries, but they operate isolated (like Babaco Market, Talkual and Wasteful to Tasteful). **Collaboration** and knowledge-sharing among these projects and organisations, both at local and international levels, would be beneficial as it would allow for more effective food saving activities. Furthermore, in recent years several **electronic tools (apps, online platforms)** have been developed (Food-Surplus (Madoverskud) in Denmark, HopHop Food in France, BringTheFood in Italy), and have paved the way for more efficient and streamlined food surplus redistribution processes. These technologies enable the identification, collection, and distribution of surplus food, minimizing food waste and ensuring fast redirection of resources to where they are needed most. However, despite the advancements made in technology, the lack of standardised baseline measurements, Key Performance Indicators (KPIs), and process monitoring approaches poses a significant obstacle to **accurately measuring the impact of redistribution efforts**. Without a comprehensive framework for evaluation, it becomes challenging to assess the effectiveness of different initiatives, hindering the ability to optimise strategies for maximum impact.

It was observed that **cities** in particular are increasingly becoming key players in the redistribution landscape. Urban areas such as Milan (Italy), Tartu (Estonia), Antwerp (Belgium), Valencia (Spain), and Schaerbeek (Belgium) are actively engaging in efforts to address food surplus within their communities. The involvement of cities signifies a shift toward localised solutions, where the unique challenges and opportunities of urban environments are taken into account. By leveraging local resources and infrastructure, cities can play a crucial

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role in developing innovative models for food surplus redistribution that **can be replicated and adapted** globally.

3.4.2 Main challenges/barriers observed or expected

The redistribution of food surplus faces numerous challenges and barriers that span social, economic, logistical, and regulatory dimensions. One significant hurdle is the **competing** nature of **social impact created by food surplus donations and corporate economic goals**. Organisations involved in food surplus redistribution often grapple with striking a balance between achieving positive social outcomes as part of their corporate social responsibility, such as reducing food insecurity, and at the same time ensuring economic goals of the company, where profit creation is the dominant driver of decision making.

In many cases, the surplus food redistribution relies heavily on volunteer efforts, and securing consistent **financial support** is essential for sustaining operations – Gratix had to end its operation due to lack of money. The unpredictable nature of volunteer availability and the constant need for resources can hinder the reliability and scalability of redistribution initiatives (Budapest Bike Maffia, Aprofita València. Furthermore, **logistical challenges** (e.g. at Foodsavers Antwerp) are also significant, as coordinating the efficient collection, transportation, and distribution of surplus food demands sophisticated logistics solutions that are often lacking or underdeveloped in many existing food systems. As a matter of fact, the **unpredictable** (and decreasing) **supply of surplus food** poses additional challenges. Fluctuations in the availability of surplus food make it difficult to plan and optimise redistribution efforts efficiently. As supply becomes more uncertain, organisations must adapt their strategies to address the dynamic nature of the surplus food landscape. Additionally, **food safety** is a paramount concern in the redistribution landscape, particularly in scenarios like food donation boxes handled by for example Nevera Solidaria in Spain or wegEETbox Sint-Maartensdal in Belgium, and the hospitality (HORECA) segment (e.g. La Tablée des Chefs in France). Ensuring that donated food meets stringent safety standards is essential for building trust among both donors and recipients.

Preserving the freshness of donated food during transportation is becoming a key factor, as this food is normally close to the end of its shelf life, and on the other side the people in need who receive it, are generally not in good health. One of the latest developments ensure not simply just cooling the food during delivery, but in case the food received from HORECA it can be cold shocked and so deterioration minimised. The other new possibility is monitoring and controlling the environmental conditions (e.g. humidity) during transportation in order to prevent food loss.

Last but not least, there is a noteworthy trend in **business-to-consumer (B2C) discounted resale**, while free B2C redistribution remains relatively underexplored. The growing prevalence of discounted sales done by Talkual in Spain or Sirplus in Germany can create competition with free redistribution initiatives, potentially

diverting surplus food away from those who need it most. Addressing this imbalance and promoting free redistribution models is crucial for ensuring equitable access to surplus food resources.

3.4.3 Observed or expected impacts of different types of actions

The redistribution of food surplus yields positive impacts across various dimensions. Socially, it serves as a beacon of **financial support** for beneficiaries who may struggle to afford any or healthy meals. By channelling surplus food to those in need, this practice not only alleviates economic burdens on individuals and families but also promotes **well-being** and a sense of dignity. The redistribution of surplus food contributes to **improved dietary diversity and quality** among recipients. Access to a variety of fresh and wholesome foods enhances the nutritional level of people in need, addressing issues of **food insecurity and malnutrition**. Beyond individual beneficiaries, the redistribution of food surplus fosters **community cohesiveness, Recup in Italy is a good example of this**. Collaborative efforts to collect, distribute, and share surplus food create a sense of solidarity, strengthening community bonds. This communal engagement not only addresses immediate food needs but also establishes a foundation for sustained social support networks.

On the **environmental** front, surplus food redistribution plays a pivotal role in **mitigating greenhouse gas emissions**. By redirecting food that would otherwise end up in landfills, where it decomposes and produces methane, these initiatives contribute to reducing the carbon footprint associated with food waste. This aligns with broader sustainability goals and climate preservation action, making surplus food redistribution a key player in environmental conservation efforts. Simultaneously, surplus food redistribution significantly diminishes the overall amount of food waste generated. This reduction in food waste not only conserves resources but also lessens the environmental impact associated with the production, transportation, and disposal of uneaten food.

Economically, the impact of surplus food redistribution extends to the prevention of monetary loss. For businesses, farms, and other entities along the food supply chain, redirecting surplus items to those in need mitigates potential financial losses associated with unsold or unused products. This economic efficiency contributes to a more sustainable and **responsible** approach to **resource usage** and allocation within the food industry.

3.4.4 MOA

The redistribution of food surplus represents a unique **opportunity** where the availability of surplus food intersects with the pressing need from both environmentally conscious consumers, often referred to as "green customers", and individuals with mid to low incomes. This dual demand creates a symbiotic relationship

between those seeking sustainable consumption options and those facing economic constraints (e.g. Wasteful to Tasteful, Meal of Joy, etc.).

Motivation behind surplus food redistribution is multifaceted, encompassing both **profit-driven and socially conscious objectives.** From a waste perspective, the motivations converge, as redirecting surplus food benefits both economic efficiency and social welfare. Businesses driven by profit find an opportunity to minimise losses and contribute to environmental sustainability, while socially driven entities prioritise the well-being of communities by addressing food insecurity and reducing waste.

However, the **ability** to capitalise on this opportunity faces several challenges. Facilitation of integrated organisations and processes, coupled with related technology, are missing. The social side of surplus food redistribution, represented by organisations like food banks, often don't have the necessary technological infrastructure to streamline operations and maximise impact. Conversely, initiatives with advanced technology, such as HopHopFood, may encounter challenges in integrating the social aspect effectively.

3.4.5 Key success factors from previous actions

The success of the redistribution of food surplus hinges on several key factors that contribute to the sustainability and effectiveness of these initiatives. One crucial aspect is the availability of sustainable **financial support**. Amongst several possible solutions it can be ensured with the involvement of local or national municipalities, as Aprofita and Invendus pas Perdus projects did. This emphasises the importance of optimizing resources to ensure long-term viability and scalability. Besides, building and nurturing relationships with various stakeholders is another pivotal success factor. **Collaboration** with local partners, including municipalities, industries, and civil society is vital for creating a cohesive and interconnected network. Such partnerships, seen at Excellents Excedents and BringTheFood, facilitate the pooling of resources, knowledge-sharing, and a more holistic approach to addressing the complex challenges associated with surplus food redistribution.

Effective impact calculations (economic, environmental, and social) and communication of them play a central role in the success of these initiatives. Establishing a baseline and implementing monitoring mechanisms would give us a tool to evaluate the effectiveness of different redistribution efforts. Economic considerations involve assessing Return on Investment (ROI) and cost/benefit ratios, providing stakeholders with a clear understanding of the financial viability and efficiency of the initiative. On the environmental front, impact calculations should address factors such as greenhouse gas emissions prevented and the overall reduction in food waste. Social impact measurements, including improvements in nutritional outcomes or community cohesiveness, contribute to a comprehensive understanding of the initiative's success.

Furthermore, transparent and accessible communication helps in demonstrating accountability, fostering public engagement, and encouraging continued support for surplus food redistribution efforts.

3.4.6 Key success factors for future actions

The redistribution of food surplus has evolved with the integration of digital solutions, expanding the reach and efficiency of these initiatives. Actions employing digital solutions leverage technology to connect surplus food providers with recipients in real-time, streamlining the process and reducing waste (Sirplus, BringTheFood). This digital approach not only enhances the speed of redistribution but also allows for a more precise matching of supply and demand.

There is still room for improvement at the business-to-consumer (B2C) models. The actions should directly engage end consumers, offering discounted or free surplus food through various channels. Some initiatives shall combine both business-to-business (B2B) and B2C elements through digital matchmaking. These platforms serve as intermediaries, connecting surplus food suppliers with both businesses and individual consumers. This combination creates a dynamic ecosystem where surplus food can be redirected efficiently across various segments, maximizing impact and minimizing waste. Cross-segment cooperation could help successful surplus food redistribution. Collaborating with municipalities provides essential support, including reliable funding, infrastructure (such as warehousing), wider networking opportunities, even involvement of schools. Municipal cooperation extends to addressing regulatory aspects, like taxation considerations, and fostering educational initiatives (e.g. forklift truck driver licensing).

Discounting and redistribution initiatives, exemplified by companies like the Company Shop Group and Community Shop, play a significant role in the cross-segment cooperation model. These organisations leverage surplus food to provide discounted products to individuals facing economic challenges, bridging the gap between surplus food availability and consumer needs while simultaneously addressing food insecurity.

In summary, the evolution of surplus food redistribution is marked by the integration of digital solutions, the expansion of B2C models, and the synergistic combination of B2B and B2C matchmaking with traditional "food banking" actions. Cross-segment cooperation, particularly with municipalities and innovative discounting/redistribution models, further enhances the effectiveness and sustainability of surplus food redistribution initiatives.

3.5 FOOD SERVICES

The 66 food services actions identified within the CHORIZO D1.2 long list show that there is a diverse array of action types that can help the fight against food waste within the food services sector. Depending on which segment of the population was targeted and from which food service it was implemented, a different

approach can be executed. For example, one approach will be implemented for children at schools and another approach conducted for adult consumers. Yet, the actions have in common the aim of implementing a new behavioural pattern in the population.

Many examples of actions tackling food waste in the food services industry can be found mainly in Denmark, Belgium, Sweden, Germany, and Italy. More than half of the actions were implemented at municipality level, about 36% at national level, about 14% at a regional level and only one single action ("ResQ Club" launched in Finland) at an international level.

In what follows, we highlight some promising ways of addressing FLW in the food services sector. To structure the best practices, we follow the logic of the MOA model, as was explained in chapter 2.2.

3.5.1 Social norms as motivational levers

Several actions leveraged **injunctive social norms** by either employing rewards to encourage behaviours that reduce FLW or by implementing punishments to discourage behaviours that contribute to FLW. Some examples for the rewards are mobile apps such as "YourLocal" in Denmark that offer discounted prices on surplus or food which is about to expire. Some other examples for the punishments are the German buffet restaurants Yuoki in Stuttgart and Okinii in Düsseldorf, which charge consumers for leftovers. Other actions are built on **descriptive social norms.** The first group of them was situated in the educational context and focused on children in schools. Such actions aimed to raise awareness by using educational material and/or involving children throughout the whole process of reducing food waste. This process includes quantifying the food waste, evaluating and adapting the menu, creating an action plan to fight food waste, and celebrating after food waste was reduced. The main idea of these actions was to create a holistic food culture, as it was done for example in all schools participating in the "School Food 4 Change" program in Hungary. The second group of actions building on descriptive social norms targeted different food services, such as hospitality industry, restaurants, hotels or caterings. These included measures such as training kitchen staff, obtaining a "ReFood label" in Denmark to showcase their commitment to reducing food waste, or distributing packaging to motivate food service guests to take their leftovers home.

3.5.2 FLW actions exploiting opportunities and abilities

Regarding **opportunity**, previous and ongoing actions enhance the availability and accessibility of resources in order to waste less food in various ways. First, some in the food services enable consumers' access to more affordable food. Within this context, initiatives like "NiLasMigas" in Spain or "ResQ Club" in Finland exemplify establishments such as restaurants, bistros, bakeries, confectioners, or cafes that provide their unsold or soon-to-expire food to consumers at a discounted rate through a mobile app. Second, several actions created menus

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or revalued products from surplus food, like in the projects "SPILL" in Sweden, "Instock" in the Netherlands or "Soepcafes" and "Rekub", both in Belgium. Third, leftovers from food events were in some cases directly donated to a food bank, for example by the "JótéKonyha" social catering initiative in Hungary. Last, one action called "Meal Canteen" provided the opportunity to French customers to book their meal the day before so that the catering staff could plan only the amount of food they would need. These food reservations happen through a mobile app, which subsequently significantly enhances the management processes in the catering industry.

Regarding **ability**, many previous and ongoing actions aim to improve knowledge and skills to enable the shift towards zero food waste. Some actions simply raise awareness and consciousness among the general public or staff members of different food services, thereby activating their attitude and attentiveness towards avoiding and reducing food waste at all times. Other initiatives proactively establish networks to facilitate collaboration between different projects, recognizing the importance of such connections. This significance was underscored by projects like "LaRiso," where diverse stakeholders were involved, and the main challenge encountered was fostering constructive collaboration among them. Another way to increase abilities is the creation and distribution of concrete guides to reduce food waste, as was done in the "Guía para restaurantes" in Spain and the "Hrana nije otpad" project in Croatia. An even more participatory method is the organisation of workshops, activities and educational resources – for example in schools, like in the "Jemy, nie marnujemy" project in Poland. Finally, the training of food service kitchen staff has showed to be an effective way of enabling abilities of 'the people at the source', as in the "Food Waste Mitigation Strategy" in Denmark or the "Mediterranean Season School Meals" in Portugal.

3.5.3 Challenges

Overall, the importance of measuring and monitoring food waste was largely emphasised as a way to lever abilities, as this is essential for precisely evaluating the effectiveness of measures and how they reach the targeted food waste reduction or not. Yet, in practically all of the actions this measurement and monitoring of food waste was found as a **challenge or barrier**. First of all, many actors in food services industry, e.g. catering companies, tend to be resistant to measuring and reporting on their food waste, since this requires them to "admit" or acknowledge that they generate food waste in the first place, which makes them vulnerable to criticism. Second, sometimes the focus on avoiding food waste is so strong that it leads to overconsumption, for example, as was the case of the "Ekošola" project in Slovenia where the children were aware that the food waste was being monitored, so they deliberately ate more food to avoid food leftovers. Such conflict mechanisms between FLW reduction and nutrition status should be avoided. Another such conflict mechanism is illustrated by the aforementioned "JótéKonyha" action in Hungary, where the biggest challenge was to

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create a business activity within the activities of a non-profit organisation in an area where normally for-profit enterprises operate.

Another significant challenge related to **ability** arises when, despite the ambition to reduce food waste, kitchen staff find it challenging to prioritise waste reduction among the multitude of tasks demanding their attention in their daily work. On the other hand, in projects in which there were different stakeholders as in the case of "LaRiso" in Italy, the biggest difficulty was to get them to agree with each other.

Evidently, the COVID-19 pandemic and the related socio-economic crisis have executed a strong impact on certain previous FLW actions in the food services sector. Take, for instance, the Belgian project by "Sodexo". It reported numerous kitchen and company closures or bankruptcies. For those enterprises that managed to survive, other priorities took precedence over addressing food waste.

3.5.4 Impacts achieved

Despite the above challenges, a series of significant positive impacts were achieved at different levels, socially, environmentally and economically. Regarding **social impacts**, almost all actions raised awareness and contributed to disseminating knowledge and new skills towards reducing food waste and loss, as well as promoting a sustainable and healthy way of eating. Regarding **environmental impacts**, the general or underlying aim of multiple actions was to reduce food waste in landfills or incinerators, to promote better recycling or to reduce food production to help conserve natural resources and reduce greenhouse gas. In addition, some actions sought to reduce the carbon footprint by consuming local and seasonal food, thus avoiding long way transports. For example, in the "Dose Certa" project in Portugal, they focused on raising awareness among restaurants to develop more sustainable menus using seasonal and local products. Similar projects targeted at school services such as "Sustainable School Meals" in Belgium or "Mediterranean Season School Meals" in Portugal focused on the promotion of this type of products in order to achieve more sustainable and environmentally friendly consumption. Furthermore, there were other actions focused on producing biogas, such as the "Sustainable Acquisition of Foodstuff" project in Sweden, or on creating compost from food waste in a more efficient and less polluting way, as in the case of "We eat responsibly" in Latvia. Finally, in terms of **economic impacts**, the reduction of food waste in food services allowed companies to save money from the wastage of raw materials or already prepared food that hadn't been consumed by selling this surplus food to consumers through mobile apps such as "Komefy" in Spain or "Squiseat App" in Italy. In some cases, these savings have even made it possible to invest the savings made from avoiding or reducing food waste in the purchase of organic and ecological food.

3.5.5 Conclusion

Out of all the actions, it was observed that what worked better to ensure their success was the involvement of the food service staff and the broader public. In addition, identifying the causes of food waste and applying specific measures proved to be key to target each action according to the situation and the circumstances of the particular food service. Moreover, the follow-up of the project, as well as the recognition of the progress, seemed to be helpful to keep the goal of each project in mind and to continue prioritizing the topic of food waste reduction.

Some of the best practices consisted of preventing the food loss and waste. This prevention in food services was carried out through the education of future generations in school canteens, as well as through the implementation of measures both within kitchens and towards consumers in other services such as restaurants and caterings. In conclusion, education and awareness-raising among all sectors of the population proved to be the actions that had the greatest effects.

3.6 HOUSEHOLDS

3.6.1 Actions' geographical and temporal coverage, implementors, objectives and approaches

This chapter reports on the lessons learnt and best practices from 40 initiatives aiming to reduce household food waste. These actions geographically covered 22 EU Member States. Most of them (23 actions) were implemented at the national level, 9 actions at a municipality level, 6 at a regional scale (the level of a province in Belgium, Portugal or Italy), and 2 actions even had an international span (namely the Waste Watcher International Observatory and the Horizon Europe SISTERS project). The initiative "Stop Food Waste Ireland" stands out as the longest-running action, commencing in 2004 and continuing to date. While 10 actions took place between 2010 and 2016, more than half of the actions started only after 2017. Fifteen actions are still on-going. This temporal distribution suggests that addressing food waste at the household level has predominantly gained attention in recent years. The actions have been initiated in most cases by government agencies, very often in collaboration with one or several other types of (non-)profit entities, such as food retailers or NGOs.

The 40 initiatives can be categorised into 3 main types of actions:

(1) Actions aimed at **gathering data or creating better insight into food waste generation and/or FW related habits** (6 actions).

(2) Actions focused on **awareness raising and education** (13 actions). These include regional and national campaigns; the publishing and distribution of recipes, cookbooks, or handbooks about sustainable food management with for example tips and tricks on how to plan, process, share,

store food at home, or handle left-over ingredients or meals. The actions from this category clearly target **motivation** as well as social norms related to the fight against food waste, but they also address **abilities**, since they provide household members with knowledge and enhance the build-up of skills that help to reduce household food waste.

(3) **Practical hands-on tools** facilitating household food management (21 actions). This category includes guidance to help household members to better organise their food management activities. In many cases, these tools' main instruments are mobile phone apps. An example is the successful Danish "For resten app" which proposes recipes or usage strategies for the food that is currently present in the users' cupboard, fridge and freezer. A similar one is the "Kitche app" available in the UK, which also allows users to scan their supermarket receipts to keep track of exactly what they have bought. The app will then help plan meals and suggest recipes based on what is in the cupboards. It can also send reminders when certain foods at home are nearing their use-by dates. These actions directly enhance **abilities** of households to reduce their food waste by supporting them to improve their food management.

The 40 actions addressed 3 categories from the **FLW hierarchy pyramid.** The majority of the actions (31 actions) were **preventative** (level 7); of which 15 were hands-on tools, 11 awareness-raising and education activities, and 5 actions geared at creating insight in either FW generation or habits related to FW behaviours. The second largest group of actions (8 actions) addresses level 1 of the pyramid, which is the **recovery of nutrients by recycling** – which manifests in the case of households in composting practices. One out of these 8 merely focuses on information allocation (i.e. the *Irish Report on the Food Waste Recycling Pilot Project*), another one (i.e. *Biojäätmete kohtkompostimine pilot project* from Estonia) researches the best ways for on-site composting systems that are tailored to the contexts of the respective sites (e.g type of housing, kindergartens). The remaining 6 recycling actions provide hands-on tools for supporting community or home composting. Finally, only one action (*No lo tires - Don't Throw It Away campaign* from Campaña de FACUA) tackles the fifth level of the pyramid; **re-use for human consumption**. This was a campaign wherein supermarkets and hypermarkets were urged by consumers to donate safe food they can no longer sell.

3.6.2 Impacts from previous and on-going actions tackling household food waste

Regarding **environmental and economic impacts** achieved by the previous and on-going actions targeting household FW, it should be noted that this is very difficult and costly to measure. As a result, a trustworthy, accurate monitoring of actions' impacts has not been administered so far. Interestingly, some hands-on tools **adjusted their approach to their specific target group** in order to increase the action's potential impact, for example, by more effectively increasing **motivations** to tackle household food waste, or by addressing **abilities** in a way that is the most appropriate for the target group. For example, *Portami a casa con te* was a project

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in which Italian pupils were provided with an anti-waste, thermal, washable and reusable bag for taking home any parts of their meal not consumed in the canteen. This introduction of a physical tool helped to extend the educational topic of fighting food waste to the household context, which was necessary to enable the children to convert the lessons learnt into practice (in this case, creating the habit of taking the lunch leftovers home to consume it later). Similarly, awareness-raising initiatives can use a different **framing** of the FW problem depending on which consumer segment they want to address (e.g. people facing financial difficulties versus people who highly value sustainability).

Regarding **social impacts**, 3 major types of impacts have been mentioned by the initiative representatives or as reported on the respective websites. First, **awareness-raising** and improving household members' knowledge and skills were the explicit intended outcomes of 13 of the actions (as mentioned above), but this was also achieved by several other actions which did not have awareness-raising as core target yet nevertheless indirectly fostered it. Second, **job creation** was mentioned several times as an important side-impact from the actions. Third, it is observed that all the actions hold some potential for addressing **social norms** related to FW. How different actions exactly relate to one or more social norms is very case-specific, however, some general trends could be observed. First, regarding prevalent norms and attitudes towards the issue of FW, multiple actions have increased knowledge and awareness about environmental, economic, and/or social impacts of FW. An example is the *Less Food Waste calculator* that Finnish households can use to get insight into their amount of food waste, but also the respective monetary value and the carbon footprint (GHG emissions) related to this. Second, about 3/4 of the actions were hands-on tools that supported household FW management practices (groceries, meal planning, leftover handling, stocking and preservation, home composting); and hence had the potential to shift descriptive norms around habits and practices related to food waste. In this regard, some respondents noted that the hands-on tools (such as the *Sprecometro wastemeter* app) foster a widespread idea that FW is being addressed together, wherein many households are doing their bit, thereby these actions are feeding an injunctive social norm of disapproving food waste and motivation to tackle this problem. Last, 3 actions directly related to social norms around ugly foods and suboptimal food quality that tends to be associated with food products deviating from the standard. These actions (the German *ALDI NORD/SÜD Communication campaign*; The Dutch initiative *Kromkommer*; and the Spanish *No lo tires campaign*) put into the spotlight the shortcomings of date marking margins adopted by certain brands and that the of aesthetically suboptimal foods should not be (nutritionally) undervalued.

3.6.3 Challenges encountered by previous and on-going actions tackling household food waste

The **apps** aiming to support household food (waste) management (in place in various countries; e.g. the *Plan-eet* in Flanders and the *For resten* in Denmark) encountered some common challenges. To start, the technological **development of an app** is a costly undertaking, and to optimise the app and make it user-friendly

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for all people can be a lengthy process too. A considerable initial budget is thus a first prerequisite to designing and creating a high-potential app. Importantly, apps tend to have an early spike in subscribers and downloads because, sometimes due to a launching campaign. A subsequent key challenge is then to **keeping people engaged** to keep using the app. It was noted that in several cases, a lot of resources go to the development of an app, but after the app was in place, a lack of following-up and further promoting its use prevented prolonged impact. Lastly, oftentimes the content spread through the app extends the topic of food waste to a more broader theme such as sustainable and healthy food habits as a strategy to keep people engaged and excited to keep using the app. However, content providers may encounter challenges in striking a suitable (strategically smart) balance among the diverse recommendations presented by the app, such as promoting a plant-based diet.

Actions focused on measuring food waste encountered significant challenges related to accuracy and reliability of methods, such as low credibility of self-reported food waste amounts or the lack of accounting for seasonal fluctuations when evaluating actions' impacts. Remarkably, it was observed that having well-defined **targets** and an established **monitoring system** did not necessarily guarantee the achievement of impact. For instance, in the *Food Waste Fighters Ireland project*, despite having clearly formulated targets, the absence of subsequent monitoring hinders having evidence of being on track for achieving the foreseen impacts (in this case, having householders reduce their food waste by 50 percent by 2030).

3.6.4 Key success factors

Some key success factors observed from the previous and on-going actions are listed hereafter. First, as was touched on above, some **apps have broader themes than just FW**; for example, they also actively support the adaptation of food habits to increase health benefits and sustainability of consumption patterns. This enlarged scope can aid to engage a larger number of app-users, which may be more cost-efficient and more prone towards creating impact in changing consumer habits towards more holistic sustainable food behaviours. Second, some of the identified actions were very much designed around a **specific context**; thereby smartly integrating orchestrated effects from descriptive norms. For example, the *Buono oggi e anche domani project* delivered anti-waste kits (consisting of a 100 percent biodegradable plastic re-sealable container and a paper shopper bag) to festival visitors so that they could easily collect and take home leftover food during the Venetian village festivals. Third, various initiatives involved **ambassadors** who developed skills regarding how to engage people in the fight against food waste. Last, sometimes **multiple complementary measures** were implemented **in 1 region**, leading to synergistic effect. This was for example the case in Ireland, where the *Stop Food Waste* aimed towards better prevention by information consumers and providing tips and tricks to avoid FW; the *Report on the Food Waste Recycling Pilot Project* aimed at recycling and nutrients recovery

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through awareness-raising awareness and education; and the *Food Waste Fighters* by organizing workshops to test various interventions to find the simplest and most straightforward means of reducing food waste.

3.6.5 Conclusion and key lessons for future actions addressing household food waste

Since already a lot of resources have gone to app development, in various countries, we suggest to rather invest into better **exploitation and scaling of already existing apps** rather than invest into the development of new, similar apps. Ensuring a continued use of apps would be a strategy of making people aware of their existence. Being able to keeping people engaged for a long period holds potential to raising awareness and changing social norms towards less FW. Different ways of keeping household managers (members responsible for groceries/cooking) engaged to use or keep using tools that help reducing FW should be tested. Naturally, guaranteed or stable **financial support** to ensure continuity of action is especially important for the hands-on tools.

A big opportunity lies in **collecting FW data at household levels** and link this with habits and food management behaviours. Few actions are in early stage and hence starting point or inspiration for future actions; e.g. the *Italian App Sprecometro Wastemeter*.

In conclusion, implementing simultaneous complementary actions seems to be needed to address both motivations, opportunities, abilities, and social norms. For instance, people who are already using apps are already motivated to address FW, so they might need better opportunities or improved abilities, whereas people who do not use apps may need more motivation to address FW. As the examples of the Venice festivals (Buono oggi e anche domani project) and the Italian pupils (Portami a casa con te project) projects illustrated, specific initiatives targeting specific needs - e.g. improving abilities of particular subgroups (e.g. workshops targeting household managers) – the importance of small-scale tailored project should not be underestimated to reach synergistical effects from different actions. Indeed, tackling social norms related to food loss and waste (FLW) demands a tailored approach for distinct consumer groups. For instance, targeting social norms pertaining to cooking skills is essential for those who take charge of meal preparation in a household. Meanwhile, addressing social norms within supermarkets is crucial for those responsible for grocery shopping, with a focus on monetary motivations for the primary purchasers. Tailoring initiatives to address social norms surrounding aesthetically imperfect foods is key for children, while emphasizing portion sizes is important for the elderly. Additionally, promoting leftover re-use can be a logic focal point for students. A smart usage of ambassadors (representatives of consumer segments) to reach and engage different subgroups of population (children, parents, single-person households, elderly, etc.) and address the appropriate social norms in this group is recommended.

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3.7 WHOLE SUPPLY CHAIN

Actions identified addressing food waste throughout the entire supply chain had several characteristics in common. Predominantly (17 out of 19), they ranked as high as possible on the Food Waste Hierarchy Pyramid, coming in as "**prevention**" actions, meaning that they are geared towards preventing surplus food generation throughout the supply chain from production to consumption[3]. Since these actions cover the whole supply chain, they involve **working with multiple partners along the supply chain** over several years, and also complement the European Commission's Circular Economy Action Plan introduced in 2020, whereby the entire life cycle of a product is paramount – from production all the way to sustainable consumption – to ensure that waste is prevented as much as possible along the entire supply chain[4]. Examples include national action plans such as the "Estratégia Nacional de Combate ao Desperdício Alimentar" in Portugal, the French national action plan "Le pacte national de lutte contre le gaspillage alimentaire", and association and industry led plans addressing food waste such as Unilever's Future Food initiative to halve food waste in Unilever's direct operations from factory to shelf by 2025.

3.7.1 Challenges and Opportunities

Covering the entire supply chain brings forth various challenges – the most prevalent due to the large scope of the actions, is the multitude of **laws and regulations** that need to be adhered to, from sourcing to reaching the consumer, to "post-life" of the product. This is especially the case for actions that cover multiple geographic regions as is often the case for industry working at the international level, such as "Glanbia's Pure Food + Pure Planet Sustainability Strategy" which aims for zero waste to landfill at all operational sites by 2025 and 50 percent reduction in all food waste by 2030. The strategy uses the U.N. Sustainability Goals (SDGs) as a reference point and thus covers a multitude of issues from responsible sourcing, food safety and quality, packaging, greenhouse gas emissions, water use, to food waste.[5]

While the large scope of the actions can be a challenge to effectively implement due to varying governance structures and legislation, it is also an opportunity to work with multiple partners. For these actions it is impossible to not work with other actors. For example, the "Partnerships on Food Waste" initiative in Denmark is a national partnership on food waste to increase the cooperation across the food value chain between the private sector, government authorities, and civil society. Such **cooperation** necessitates communication throughout, while increasing awareness about food waste at different points across the supply chain, which is a necessary first step to possibly affecting behaviour regarding food waste. Working with various actors does

[3] European Commission (2020) *Brief on food waste in the European Union.* Brussels: The European Commission's Knowledge Centre for Bioeconomy (page 8)
[4] https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en
[5] https://sdgs.un.org/goals

not only mean increased communication and awareness, but it also brings with it a vested interest by all parties involved in seeing the project succeed. Consequently, there is not only one actor in the chain supporting the project, but rather various actors providing different types of support such as financial, subject matter expertise, and technology being a few examples. The project thereby also becomes further instilled into society helping to better ensure its **survival over the long-term**. Another example is Spain's national initiative "La alimentación no tiene desperdicio", which brings together more than 600 companies and distributors, the Ministry of Agriculture, Food and the Environment, the Ministry of Health and Social Services, and the Spanish Federation of Food Banks.

Addressing the entire supply chain requires **different levels of expertise in particular subjects** – such as national legislation pertaining to production, logistics of distribution, and marketing, to name a few examples. This is on the one hand a challenge, however, it is at the same time also an opportunity to have a positive impact and provide training as well as **create additional skills and jobs** across the supply chain in multiple contexts. For example, "Hrana ni odpadek", an analysis project where the Slovenian Research Agency (ARRS) provides a comprehensive analysis of food waste in the country, highlights that a prominent form of action introduced in the HORECA (Hotel, Restaurant, Café) sector was the creation of additional jobs where employees managed the waste generated by the company. Employees were trained on the causes and consequences of food waste, the importance of monitoring and measuring food waste in all links of the food chain, as well as food safety.

Funding is paramount for actions covering the entire supply chain. In order to ensure that the action is a success, every stage of the chain must receive adequate support. It is a complex process which is costly and requires time. Consequently, for these actions funding often is and must be secured over the time-period of several years and in high quantities. For example, the municipality of Paris' current action plan to address food waste, includes a strategy to overhaul public school canteens in the city by changing the catering service and meal production. It involves moving from a single central kitchen to several local kitchens, through the re-development and/or construction of sector kitchens supplying "satellite" schools, and entails an investment budget of €24.2 million spread over the years 2022-2029[6].

3.7.2 The MOA Framework perspective

Looking at these actions from a Motivation, Opportunity, and Ability Framework (MOA) perspective, motivation and opportunity are most often identified. **Motivation** is identified in 12 out of the 19 actions. Due to the broad scope and inevitably working with actors across the supply chain, these actions often address

[6] https://cdn.paris.fr/paris/2022/12/26/plan-alimentation-durable-2022-2027-version-finale-19-decembre-2022-light-plus3-QgJx.pdf (page 39)

awareness, and/or work to change **attitudes** and **behaviours** when it comes to food waste. One such example is the on-going Norwegian Model, a historic agreement negotiated in 2017 between the Norwegian government and industry. The goal of the agreement is to reduce food waste in Norway by 50 percent by 2030. The agreement was signed by 5 ministries and 12 industry organisations. The participating businesses agreed on joint efforts on reduction targets for food waste throughout the supply chain, including implementation of specific measures in their companies and in collaboration with government and civil society. In addition, they also agreed to work on how best to facilitate and help consumers understand the repercussions of food waste, and what can be done to encourage them to throw away less food. **Opportunity** was also often identified (in 12 out of 19 actions) among the interventions covering the entire supply chain. Understandably, at some point along the supply chain, these comprehensive actions provide the accessibility to materials and resources (such as technology, storage capacity, equipment, access to stores) to address behaviour related to food waste.

There are key lessons that emerge, highlighting what components are necessary in order to increase the potential for success of an action that covers the entire supply chain.

- Chance to prevent food waste before it occurs: Interventions that cover the entire supply chain are looking at the chain from the very start up until end consumption, and consequently are in the unique position to attempt to **prevent food waste** from the very start and **address it at every stage along the chain**.
- Importance of funding: Due to the large scale of the projects, time and adequate financial backing is needed to achieve objectives. Without the **necessary funding**, there is a risk that a particular portion of the supply chain may not receive the attention it deserves, being consequently detrimental to the success of the project as a whole. Funding goes towards the **expertise**, as well as any **necessary equipment**, **technology** that is required at various points so that the project is not stalled at one stage of the supply chain.
- The necessity of working with multiple partners across the supply chain: Due to the inherent nature of these projects, it is unavoidable that **partnerships with other actors** is established. This makes the project more complex, but also helps **ensure longevity**, **increases communication**, and **raises awareness** about food waste throughout the supply chain - with a real chance to reach many and varied actors.
- Tap into the global political climate: The broad scope of the actions provides the opportunity to tap into popular global movements such as the "**circular economy**" approach, and the international **Sustainable Development Goals** (SDGs). By aligning a project with these initiatives, they can garner not only political and financial support, but also possibly support from other key strata of society.

3.8 GENERAL AWARENESS RAISING

3.8.1 Actions' geographical coverage, implementing actors and target groups

This chapter reports on the lessons learnt from previous and on-going actions that aimed to raise awareness about the problem of FLW and strategies, for several types of actors, to avoid or reduce FLW. The discussion is based on a total of 80 actions, of which 62 are still on-going and 18 are finalised. More than half of these actions (45) focused on the national level, 23 on municipality level, 9 on regional level and only 3 on international level. For some of the Member States which have actions being executed at the regional level, this might be related to the country's political structure, such as in Spain, Portugal, Italy and Belgium. The list of actions indicates that FLW is being addressed in many Member States, however, some Member States, like Denmark, Spain, France, Luxembourg, Portugal and Belgium, seem to have more actions on FLW already rolled out. It should be mentioned that this observation might be biased because of the CHORIZO's consortium partners' locations across Europe. The lion's share of the awareness-raising actions (75 out of 80) is aimed at preventing FLW from being generated. Further, 3 actions addressed FLW through recycling (nutrient recovery), and 2 addressed these both levels of the FLW hierarchy pyramid.

Table 3 shows how the actions differ with regard to their implementing actors and target audience. Regarding initiative-takers, the majority (33) of the actions are implemented by actors who belong to Non-Profit Organisations, followed by 20 actions implemented by a governmental unit, such as a Ministry or a Department. Interestingly, 15 actions were organised by a kind of association or co-cooperation among stakeholders. Regarding target audiences, more than half of the actions (45) aimed to reach the general public (citizens), 15 actions had a particular focus on pupils and teachers, 13 actions took a specific attention to food chain stakeholders. Three actions targeted employees from food companies, three other actions targeted the consumer when he is in the retail environment and only one single action was addressed to policymakers. It is interesting to note that most of the actions that were targeting young people were not coming from ministries or local government but rather from NGOs.

	Target audience					
Category of implementing Actors	**Citizens-General public [45]**	**Citizens-Retail consumers [3]**	**Policymakers & Civil society [1]**	**Food chain stakeholders [13]**	**Pupils & their Teachers [15]**	**Employees from the company [3]**
Social enterprises [2]	2					
Non-Profit Organisation (NGO/INGO) [33]	18			4	9	2
State level government (Ministries) [20]	13			5	2	
Local government (Municipality) [4]	3				1	

Category of implementing Actors	Target audience					
	Citizens-General public [45]	Citizens-Retail consumers [3]	Policymakers & Civil society [1]	Food chain stakeholders [13]	Pupils & their Teachers [15]	Employees from the company [3]
Private or Retail service [3]	1	1			1	
Association or co-cooperation among stakeholders [15]	7	2	1	2	2	1
Bottom-up Citizen initiatives [3]	1			2		

Table 3 General awareness-raising actions according to their implementing actors and the target audience

3.8.2 Actions' main objectives and focus in relation to MOA framework perspective

The 80 actions aimed at raising awareness can be divided according to 10 more precise objectives that they pursue, as presented in Table 4. Many actions address motivations to lower FLW by providing information to citizens (the general public) or teaching best practice solutions with a main focus on young people, pupils and their teachers in some kind of educational setting. Two other frequent objectives were the provision of tools and materials, and the facilitation of community activities around food, thus both addressing abilities and opportunities. In addition, the food chain stakeholders' group seems to be one of the important target audiences which allows initiatives to get various stakeholders engaged and committed to lower FLW.

Objectives categories from totals of 80 actions	Target audience						Focus of action relation to MOA		
	Citizens-General public [45]	Citizens-Retail consumers [3]	Policymakers & Civil society [1]	Food chain stakeholders [13]	Pupils & their Teachers [15]	Employees from the company [3]	Motivation [92%]	Opportunity [25%]	Ability [50%]
Provide information on best practices solutions [16]	13	1		1		1	13	0	11
Teaching best practices solutions [12]	2				9	1	11	0	11
Provide tools, materials & technologies [11]	8				3		10	6	11
Facilitate stakeholders' engagement [8]	3		1	4			7	1	2
Campaign with motivational message [6]	3	1		1	1		6	2	1
Community activities around food [8]	8						8	5	3
Virtual community platform / Forum [7]	4			2	1		7	3	1
Stakeholders´ commitment /agreement [5]		1		3		1	5	1	0
Campaign with activities to highlight FW impacts [4]	3			1			4	0	0
Citizen science activities to engage with citizens [3]	1			1	1		3	2	0

Table 4 General awareness-raising actions according to their objectives, their target audience, and whether they address Motivation, Opportunity and Ability

Apart from a few exceptions, almost all of the actions focused on Motivations and social norms. Almost half of the actions focused on facilitating ability of the target audiences. Only some actions enhanced opportunity factors. How exactly the motivations of the target audiences were influenced differed, ranging from exploiting or trying to change a social norm to highlighting environmental impacts from FLW and hence influencing attitudes towards FLW. In what follows, we discuss what kind of social norms are included in the actions, and how the abilities of the target audience are addressed.

First, strategies to address **Motivations** employed by the actions varied substantially, and future actions can draw inspiration from this diversity and determine which focus best fits their context:

- Highlight food waste as a challenge and emphasise the consequences it could bring in relation to **economy, environment and health**. A Finish nationwide action [“Adopt the Ugly Foodling”] tries to bring elderly people to tell the story around food waste and its consequences to young people. Furthermore, a Lithuanian nationwide action [“Sincerely Food”] includes a variety of activities for school children, a citizen-science type of exhibition, articles in the mass media, and an interactive map of an eco-farm to guide people towards sustainable food consumption. Importance of **Sustainable and responsible consumption and production**. One of the actions called “No Leftovers Malta”, through a platform/forum, tries to foster and create an open dialogue among various stakeholders, allowing them to engage and participate in the reduction of food waste.
- Create **urgency** of addressing food waste as a common challenge with the need for a combined effort. Various actions across Europe are able to bring relevant actors together to act upon FLW by creating networks, champaigns, and stakeholders' communities for instance; Spanish nationwide network for the knowledge and prevention of FLW called “Red sin Desperdicio”.
- **Environment and social consequences** by reflecting the current consumption model. A Spanish action [“La manduca no cadua”] enforced in a municipality, encourages people to devise strategies for harnessing food across the entire supply chain to reflect on the current consumption model and its consequences. Highlight the existence of **hunger** in society to create a value and appreciation towards having food available. A Spanish action [“Feeding Zaragoza”] implemented in the municipality, tried to enhance attitude towards food (the way it produced, distributed, and consumed) considering the presence of hungry individuals in the city.
- Highlight the **proper management of food** and promote responsible consumption. With the help of informative talks, trainings (including materials) and advice for responsible habits in the management and use of food.

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- Reduction of food waste as a potential for **"valorisation" possibilities**. A French nationwide action ["Eqosphere"] has designed various CSR/RSO concepts for food companies which can be applied to the prevention of FLW.
- Emphasise the current **challenges within the food ecosystem,** encompassing concerns like issues of climate change and gastronomical heritage of the regions. Training and support for the food organisations on various themes related to food: taste, education, food waste climate change, food identity and so on. Encouraging the **financing of innovative project ideas** to reduce food loss and waste. A French action targeted to food chain stakeholder sets up open calls for innovative ideas and projects directed to the food sector and FLW as a part of an integral food policy of a municipality.
- Highlight the needs and potential solutions for food loss and waste in the market. A Europewide action ["ZeroW"] targeted to food chain stakeholders through the forum/platform to create opportunities to network and exchange information about needs and potential solution for FLW to the market.
- Provide an overview of **FW** with **reports, analysis and facts** from the market. A Danish NGO carried-out a nationwide action ["Knowledge centre on food waste"] to provide best practice solution to reduce FLW in a form of reports, analytics, and project examples.
- Project-oriented **education to young people** on the issue of FW. Various actions, especially through Denmark [e.g. "Food waste workshop", "Food waste school", "Youth stop food-waste", "Surplus food the school", "Food school", and "SESAM"] are trying to engage with young people through schools, with various project-oriented activities and themes around: surplus food, cooking demonstrations from surplus vegetables, sustainability, responsible consumption, and environmental impact from food waste.
- Highlight the importance of choosing **climate-friendly food** and how it connects to less food waste. Some of the actions choose to work with the concept of climate-friendly food [e.g. Danish action: "less food waste-More ecology and climate-friendly meal"] as a holistic approach towards reducing food waste, as well as maintaining healthy meals.
- Highlight the importance of relevant **UN´s global goals for sustainability**, such as SDG-12.3. A Danish action ["Denmark against food waste"] initiated by the food ministry, targeted to food-chain stakeholders, enforced a voluntary agreement for companies and organisations based on the UN´s Global Goal 12.3 for sustainable Development, with the aim of reducing half of their food waste by 2030 and reducing food loss in the Danish food industry.
- Encourage active citizenship and spreading the **ethical value of food**, solidarity and cooperation to encourage the culture of conscious consumption. To encourage active citizenship behaviour,

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an Italian action across the Puglia region [“NoiConMente”], focuses on encouraging a culture of conscious consumption and limiting food waste among high school students.

Secondly, some of the actions have included **Social Norms** in order to maintain and increase the motivation of the target audience to reduce food wase in their daily life. Notably, many actions facilitate the use of “Suboptimal food”, highlighting the ability to address social norms relating to undesirable food quality. Below, we list some strategies from previous actions that have incorporated social norms cleverly into their approach:

- Highlight the fact that some foods are “too good to be thrown away” by challenge the minimum aesthetic standard on fruits and vegetables. Some of the actions make reuse of fruits and vegetables that otherwise will be wasted, to prepare and serve meals or to repack and sell as souvenir food, in order to increase the acceptability of fruits and Vegetables that do not look ”normal”, but rather “ugly”. The international movement “Feeding the 5000” yearly event is one of the good example of this.
- “Collaborative cooking” activities to influence each other in the community. The French action [“Solidari Food”], implemented on a municipal level, initiates information days including “collaborative cooking” among consumers, to demonstrate the value of the food and possible reuse practices.
- Encourage and facilitate the donation of leftover food in different stages in the food chain. A Portuguese movement enforced nationwide [“Unidos contra o Desperdicio”] brings together relevant actors working to reduce FLW to highlight the use of surpluses, warn of FLW, and encourage responsible consumption.
- Cooking demonstrations with ugly vegetables and surplus food items. A nationwide yearly event from Denmark [National food waste day], with a virtual live event for all the country´s elementary schools, demonstrates cooking practices to reduce food waste, especially targeted to school kids.
- Charitable events to highlight the ethical importance of the reuse of surplus food. A Danish yearly charity dinner , supported by the Danish Crown prince and Crown Princess, has a focus on surplus from Christmas food to emphasis the importance of sharing surplus food.
- Demonstrating the possibility of delicious meals from the food items which otherwise would be thrown out. This concept has been applied in some Danish schools [in the municipalities] in close collaboration with local food retailers [“Overskudsmad til skoler”] to exhibit the reuse possibility of food items that can no longer be sold because of best-before labels, but which can still be eaten. Students collect surplus food items from the local retailer, prepare meals at the school and taste them together with the rest of the class. There are also actions across Europe which

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carry out music events together with cooking and serving soup prepared from surplus vegetables.

- Provide an opportunity for the food industry to show to the public their involvement in addressing food waste. A yearly global event also takes place in Denmark ["United Against Food Waste"], demonstrating various activities to reduce food waste and serving free food to the public in the city centre. The event is very successful in bringing various actors from the food value chain together to act to reduce FLW.
- Facilitate stakeholder commitment through measuring, reducing and reporting their food waste, which might influence other people to act upon the challenge. Nationwide actions from Denmark and Ireland ["Denmark against food waste", "Food waste charter Ireland"] focus on bringing stakeholders together to make a public commitment and pledge to take positive actions toward reducing FLW as well as to be transparent by measuring, reducing and reporting.

Thirdly, the way in which actions have lifted their target audiences' **abilities [skills and knowledge]** in order to help individuals to have better food management, is exemplified in the actions through various form of activities:

- Provide knowledge about how food is produced and how to identify seasonal produce. In order to facilitate behaviour changes towards reducing FLW, knowledge about various aspects of food and food waste, including how to choose fresh produce, are some of the activities that seems to have a good impact on the target group, especially the general public.
- Provide better understanding on FW and techniques to reduce FW. To emphasise the understanding of FW; information about how the food waste is generated and how one can reduce it is key. Furthermore, to reduce food waste in real life, tips and techniques like how to reuse surplus food, how to make soup out of surplus vegetables, and how to save food properly, are all practices seen in some of the actions that targeted the general public.
- Facilitate vegetable growing, composting techniques and valorising of own bio-waste for home-growing. One of the prominent areas that some of the actions [e.g. "Kokoza" from Chech Republic; "Jardins Collectifs" from France; and "Urban kitchen garden project", "Terra a Terra", and "Horta a Porta" from Portugal] focus on is urban gardening, that allows target groups to engage in growing activities and to be exposed to a form of food production.
- Skills building for food preparation and healthy cooking. Food preparation and cooking activities are used as a tool for building community and a way to demonstrate the reuse of surplus food items that otherwise would be wasted. These kinds of activities worked most often with either young people, vulnerable groups or company employees as team building activities.

- Facilitate problem-based learning for young people to develop ideas and proposals for how food waste can be reduced. As already mentioned in the motivation section [e.g. “Food waste workshop”, “Food waste school”, “Youth stop food-waste", “Surplus food the school”, “Food school”, “SESAM”], young people through the school setting are challenged to work with the topic of food waste in a problem-based learning approach to address food waste as a challenge and to suggest some sort of solution. It not only helps young people to learn about food and food waste but also increases their understanding of the topic.
- Facilitate learning about food, nutrition, food-waste and food sustainability issues through engagement with young people. Some of the actions that target young people focus on facilitating learning to the various topics in the food either through hands-on activities, online quiz, gamification, and reading materials.
- Facilitate the organisation of competitions to identify various solutions for future of food including reducing food waste and maintaining healthy consumption. Some of the actions, for instance *YouFoo-Young Food Waste Fighters Club*, facilitate learning about FLW as well as discovering potential solutions to reduce FLW; and increase sustainable and healthy consumption.
- Provide learning tools, gamification techniques, educational materials and digital teaching tools to facilitate learning about healthy food and climate friendly consumption and reduce food waste. Learning and educational materials including digital teaching tools and gamification techniques are rooted to information like healthy and climate-friendly meals. Italian nationwide action [“Noi, il cibo, il nostro pianeta”], and a Danish action [“Educational Portal”] are some of the obvious examples which target young people and their teachers to facilitate learning about food and food waste through the educational portal.
- Provide tips for proper food management: purchase, prepare, consume, and reuse. Providing tips on buying just the food you need, reuse of surplus food, making delicious meals from leftovers, saving leftover meals and reusing leftovers are some of the crucial skills appeared in some of the actions that targeted to general public.

3.8.3 Expected impacts and implementation feasibility of the actions.

Based on interviewed actions, impacts of the actions can be summarised within 4 main themes of the Social, Economic, Environmental, and Food waste impacts. Most of the actions focused or resulted on social impact followed by Environmental impacts. Yet, most of the actions highlighting the importance of reducing FW due to the environmental consequences through awareness-raising programs focus on putting a “sense of urgency” by informing various aspect that relate to Food Waste. **Social impacts** mainly resulted from

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awareness forming activities, awareness of consequences including skills to address the challenges (how one can address it best), and providing knowledge of connection between food and the SDGs. Furthermore, the social impacts can be listed as increasing community collaboration by food chain stakeholders, addressing the food waste challenges by citizens in daily life such as reducing household waste via direct action at home, and young people´s involvement in various activities to reduce food waste in schools. **Environmental impacts** are mainly resulting from activities focused on awareness of climate, nature, ecology related topics that influence climate-friendly and responsible food consumption, including environmental impacts from the food system. Furthermore, the environmental impacts can be listed as reflecting the understanding of climate-friendly diets and an increase in knowledge of footprint methods including climate change-GHG emissions. **Food Waste and economic impacts** resulted from activities focused on direct reduction of food waste and measurement of the changes to reflect the actions. By addressing the food waste, economic benefit incurred in terms of resources to produce, store, distribute and disposal of the surplus food.

3.8.4 Main challenges and barriers observed or expected to implement the actions

Many actions have expressed some sort of difficulties during the implementation of the action. Difficulties in **involving relevant partners** in the action can be overcome by finding common goal among actors for collaboration. For those actions implemented by multiple actors, it can be difficult to balance communication, collaboration and the investment among stakeholders. Another generally cumbersome thing to achieve is to stimulate the **motivation** of the target group/audience of an action in the **long run**. Also, formulating the proper messaging to create awareness is not straightforward due to the **ever-changing context of the target audience**. Furthermore, sometimes it appeared hard to **get schools involved** in FLW initiatives, which can be a missed opportunity due to the loss of engagement with young people – who are the future generation of food managers. Lastly, a recurring challenge happens when addressing ability rather than motivation and relates to the difficulty of **turning knowledge into skills** that actually help to reduce food waste in practice.

3.8.5 Performance indicators factors and key lessons

What are the key factors that make actions successful to achieve their goals and objectives?

Based on actions interviewed, it is evident that the timeframe of the action, financing, partners, and impact monitoring systems are some of the most crucial aspects. Some other key success factors are:

- Proper source of funding and financial support. Public funding seems to be the most reliable and consistent source in many cases.
- Enough time to plan the execution of the action. Actions, especially for awareness raising, needs proper implementation plans as they aim to have long term impact.

- Well-motivated and relevant stakeholders to support the actions. Public organisations appear to be in many cases a consistent stakeholder to support the actions. However, food chain actors role cannot be neglected.
- Measurable and relevant objectives of the actions. Many actions appear not to have measurable objectives, and so it is not possible to quantify the success of the intervention.

Which type of actions have the highest potential and why/under which circumstances?

Based on the impacts, performance indicators, and implementation feasibility, some main characteristics that lead to a higher social impact, and therefor benefit the action's success are:

- Actions targeting young people [educational activities], and activities with citizen science [involvement] seem to have higher social impacts. An Italian-only nationwide awareness campaign ["Campagna precoZero"] targeted at the general public reported a 13% reduction in food waste over the past 3 years. The campaign increases awareness and also increases skills by providing information about how to reduce household waste, also produced and distributed an anti-waste kit for schools (educational and practical kits). The campaign has very balanced and well-distributed impacts and a possible reason could be its well-defined campaign materials and target group.
- Inspiration from a Hungarian nationwide stakeholder forum on food waste ["Food Value Forum"] shows that solely aiming to increase knowledge and exchange information seems to have not any direct impact, but can have an indirect effect on maintaining social standards and behaviours linked to food waste.
- Actions focusing on communicating best practices solutions for reducing food waste, knowledge and ideas that can result in increased skills for reducing food waste, show that combining communication with practical hands-on activities can help to improve these skills.
- Evidence from Danish actions focused on food waste workshops and educational activities to young people, shows that long-term social impact can be expected. Due to the involvement of vulnerable group (youth) a proper implementation plan should be needed. Multi-Actor approach [involvement of multiple relevant actors] in the process. Some of the actions indicate that challenges in engaging key partners, especially businesses and public institutes and NGOs could play a role in the level of success of first-movers.
- Growing and cooking activities as tools to engage citizens and community. As indicated, growing and cooking activities can play multiple roles in the actions, for example facilitating engagement of people and community at the same time, help to increase the food related skills.

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Furthermore, actions that have used Climate, Ecology, Sustainability, Nutrition as some of the key words to generate attention seem to have higher environmental impacts.

3.8.6 Conclusion

About 77% of the actions within "General Awareness Raising" are on-going. Almost 50% of the actions have national level focus whereas about 25% have municipal focus from the actions. About 41% of the implementing actors belong to the category of Non-Profit Organisations (NGO) whereas 25% are state-level government and 18% belong to co-operation among stakeholders. The majority (about 56%) of target audiences are the general public, 18% are pupils/young people, and 16% are food-chain stakeholders.

The primary motivating factors driving these actions are clearly rooted in raising awareness about the challenge and its far-reaching consequences. The Social Norms appear, through the actions, to facilitate the use of “Suboptimal food/Undesirable food quality”. The Abilities of the target audience are lifted through actions which are mainly focused on better understanding of food waste and its reduction techniques, including environmental aspects.

Overall, the actions have positive impacts: primarily social impact, followed by environmental impacts. The main challenge observed in the implementation of the actions is difficulties in involving relevant partners in action towards common goals. Timeframe of the action, financing, partners, and impact monitoring systems are identified as some of the most crucial aspects for the action to be successful. So those actions that focus on a Multi-Actor approach [involvement of multiple relevant actors] in the process seem to accordingly have multiple positive impacts.

3.9 MUNICIPALITIES

This chapter looks at 19 actions initiated, carried out or supported by municipalities, from different countries, mostly in Northern, Western and Southern Europe. It covers 2 main categories: **food waste prevention actions** (with 9 actions), and **food redistribution actions** (with also 9 actions). One action only covers food waste valorisation, namely composting. This chapter will analyse challenges, impacts and key success factors for the 2 main categories of actions; first of food waste prevention actions, followed by the food redistribution actions. A shared challenge across all actions in both categories is the lack of resources, encompassing funding, personnel, and equipment. Conversely, common success factors include institutional support, community engagement, and stakeholder buy-in. All actions contribute to raising awareness and ultimately to changing behaviours.

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3.9.1 Food waste prevention actions

Food waste prevention actions are measures aiming to reduce the amount of waste generated at different stages of the value chain, towards different targets. Waste reduction can be achieved by raising awareness and implementing a wide array of strategies, either focused on **efficiency** (doing the same with less) or on **sufficiency** (consuming less). The majority of food waste prevention actions analysed in this section are carried out in school canteens or directly towards the public, i.e. citizens. In school canteens, efficiency can for instance be increased by improving planning or storage, while sufficiency can be achieved by serving smaller portions of food.

The main **challenge** faced by food waste prevention actions is the lack of resources, including funding and staff. The lack of funding comes first, particularly for community-led actions, but also for actions carried out by municipalities or by affiliated organisations, in a context of pressure on municipal budgets. This was for example the case in the *Madvaerkstedet Madspild* project (in various Danish cities), where the schools have to fund 20% of the program, which is difficult for them (while the municipality funds the remaining 80%). Beyond funding, staffing issues are another issue; with staff shortages being a recurrent challenge particularly in kitchens. As a result, capacity for training and implementing new processes get limited, in a context where food prevention is perceived as another priority added to an already long list, as was noted in Copenhagen city (Denmark). The lack of skills related to food waste prevention is also often mentioned as a barrier. Developing food waste prevention skills and processes requires dedicated training and requires additional steps (e.g. accustoming kitchen staff to provide weights and measures), which needs to be repeated over time due to a high turnover rate for personnel in kitchens. This connects to another major challenge for food waste prevention actions: the ability to engage with and convince key stakeholders in the long run. This is often the case for school kitchen staff, given the aforementioned reasons. When it comes to school canteens, this also applies to end-users, e.g. citizens or children. In Ballerup, pupils' resistance to learn about food waste prevention was a significant challenge, made worse by the activity's time frame, aligned with the school schedule and term. Additionally, for projects involving households, such as *Food Winners* in Brugge (Belgium), dealing with large numbers of participants and creating long-lasting change has proved to be difficult. Finally, the lack of monitoring frameworks, of standardised indicators and of tools to make food waste data collection easier are also a barrier, for both assessing food waste that is prevented and related impacts, as was emphasised by the city of Paris (France).

Food waste prevention actions can have several **impacts**, which are nevertheless difficult to assess. Firstly, in terms of environmental impacts, the most obvious one is the reduction of food waste produced in different settings, either pre or post-consumer, in households, school canteens, catering, etc. This is something that is well assessed across actions: 15,177 tons of food waste prevented by *LIPOR* in metropolitan Porto in 2022

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(Portugal), 44,400 kg in *Food Winners* in that same year. In most actions, the type of waste is also categorised (kitchen or plate waste, fresh or preserved food, vegetables or dairy, etc.). Dedicated targets are set, and progress is monitored regularly, like in Umea, with a target of 20 g reduction per meal in 2023. However, the different sizes of actions, and the diversity of contexts in which they are carried out limit the ability to make comparisons, on the amount or the characterisation of waste avoided. This would improve the ability to assess actions' efficiencies and hence support prioritisation of types of actions. As mentioned before, standardised monitoring frameworks are needed to enable such comparisons. Food waste prevention mechanically creates a number of environmental co-benefits, such GHG emissions reductions, but this is generally not calculated directly in projects. Other environmental impacts are not taken into account, despite likely positive impacts of food waste prevention on resources use and pollution in food systems. No LCA of these actions has been undertaken. Second, in terms of social impacts, all actions contribute to raising awareness not only on food waste, but also on adjacent topics like sustainability and food poverty. Using the Motivation-Opportunity-Ability (MOA) framework, it can be argued that food prevention actions analysed cover the full spectrum. Actors are made aware of the issue at stake (food waste) and are encouraged to act (motivation). In specific contexts (in kitchens, at school, at home, etc.), they are provided with conditions to act (opportunity), including dedicated processes, strategies, or equipment. Ultimately, these actions aim to develop both knowledge and skills, empowering stakeholders to act (ability). Finally, economic impact is usually not measured. One can assume that reducing food waste would lead to some savings in kitchens, but this is not demonstrated, except in Copenhagen. This presents a potential avenue for future work, as showcasing the economic benefits derived from FLW prevention actions may serve as a compelling incentive for cities to invest in this domain.

A couple of common **key success factors** were identified across food prevention actions at municipality level. The most important can be described as municipal support: community-led initiatives benefit enormously from municipal backing, in the form of funding, equipment or infrastructure, staff, but also increased legitimacy; making it easier to connect with various stakeholders. Within municipalities, the integration of food waste prevention within wider food or environmental policies is also a key success factor, such as in Ballerup (Denmark), where the action is one of many under a broader sustainability strategy that benefits from a strong political commitment. Another one is stakeholder engagement and citizens buy-in. For instance, actions like Food Winners rely on "ambassadors", trained or experienced volunteers whose role is to raise awareness and train their peers, enabling them to target certain categories of population (e.g. students or, the elderly). Among staff, skill development is crucial to generate buy-in and demonstrate benefits associated with preventing waste. The project SmartMat Helsingborg (Sweden) provides a good example on how skill development can be achieved. Finally, having robust monitoring systems in place also appears as a driver for

successful waste reduction, as showcased in Umea, Sweden, where all datasets are made available publicly, to communicate and share results with all stakeholders.

3.9.2 Food redistribution actions

The other category of actions considered are related to food redistribution, which aims at redistributing food surplus before it becomes waste. Most actions are **redistribution platforms**, where collection of surplus food - from retailers, caterers or other actors is centralised and redistributed to "frontline" charities, who in turn distribute it to beneficiaries. Examples include Voedselhub in Mechelen (Belgium), Budapest Bike Maffia (Hungary) or Foodsavers in Antwerp (Belgium).

Food redistribution actions face common **challenges** and, just as for waste prevention actions, the lack of resources appears as the most prevalent one. Infrastructure and equipment, especially storage spaces and collection trucks – crucial for redistributing fresh food – are costly, as put forward by Food Savers or Yhteinen Poyta (in Vaanta, Finland). Moreover, collection, storage and redistribution lead to high operational expenses, which is why funding doubly appears as a challenge, which was especially the case for Budapest Bike Mafia and Voedselhub in the city of Mechelen. For one project however, Hub di Quartiere contro lo Spreco Alimentare in Milan, access to land rather than funding was mentioned as an issue: "funding and sponsors are not currently a problem, which is likely helped by the activity's high profile due to having won the Earthshot Prise". Similar to waste prevention actions, trained staff and capacity are often lacking, while the reliance on volunteers can create skill gaps, such as in Aprofita (Valencia, Spain) or Foodsharing Tartu (Tartu, Estonia). Another major challenge is food safety, mentioned for most actions and especially by Let's Save Food! (Ghent, Belgium), as preserving safety of surplus food is paramount. As other actors of the food value chain, redistribution platforms must respect strict procedures and conditions to protect the quality of food and the health of beneficiaries – often vulnerable populations. They have to incur costs related to acquiring and operating dedicated infrastructure and equipment but, compared to other actors, they are not profit-seeking; as a result, these costs can seem high compared to available budgets. This is particularly the case for fresh food, whose redistribution relies on a well-functioning logistic system and trained staff. Redistributing only canned or preserved food reduces safety risks, at the expense of environmental and nutritional benefits. For Budapest Bike Mafia, competition with a growing number of for-profit redistribution platforms was also seen as a challenge.

Many likely **impacts** are identified in food redistribution actions, but they are rarely quantified. First of all, these actions all contribute to avoiding that surplus food becomes waste. Surplus food collected and distributed is generally weighed and characterised, with categories such as fresh food (including dairies, fruits and vegetables, bread and meat) and preserved food. This **data is available from most projects but not**

necessarily standardised, making comparisons difficult. Other (mostly positive) environmental impacts include reduction of negative impacts associated with waste treatment, however they are usually not quantified. More generally, no Life-Cycle Assessment of food redistribution has been made, therefore the extent to which food redistribution has a positive environmental impact, or whether it is merely a by-product of overproduction, can only be assumed. It should be emphasised that social impacts of food redistribution are high, moreover, are usually the main justification for redistribution actions. Social impacts include food poverty action and occupational integration. As such, all actions have collected data on their beneficiary count, whereby for example Let's Save Food! supports approximately 1000 individuals weekly, and Voedselhub Mechelen has each week 9 new families benefitting from food redistribution. Once again, comparisons are not straightforward, as beneficiaries can either be households or individuals, and as the size of each initiative varies greatly. Another major social impact is occupational integration, i.e. the provision of jobs and the development of skills for unemployed or poorly educated workers. This impact was particularly high for Foodsavers Antwerp (so successful that it is paradoxically leading to a higher turnover rate) or for Voedselhub, which provides full-time jobs for 15 employees with families. Another impact is social cohesion, which is reinforced within otherwise vulnerable communities, as for example achieved by Voedselhub and its social grocery store. Finally, the economic impact is mostly connected to the previous point: food redistribution contributes to creating local jobs. It relies however on public funding and/or donations. Considering the MOA framework, Opportunity applies as redistribution platforms make it possible to redistribute surplus food.

Key success factors are similar to those from food waste prevention actions. Municipal support is crucial for actions initiated by community groups, as it brings legitimacy (particularly when it comes to approaching private sector actors like retailers) and significantly increases sustainability of actions. For municipal-led actions, a strong political mandate or commitment to food waste redistribution, as well as the integration within larger policies or strategies on food and sustainability - or anti-poverty policies, are both determinant success factors. This is once again illustrated by Voedselhub, for which the "*municipality is as a major source of funds, with additional funds coming in from partnering with other European projects, giving the initiative a buffer for sustainability as the topic of food waste is very high in the political agenda of the government at the municipality level and European level*". Aspects for which municipal support matters the most are funding, infrastructure and equipment. Another crucial success factor is community and citizen participation, with several actions - like Aprofita or Foodashaing Tartu - partly or entirely relying on volunteers, is crucial for the long-term sustainability of actions. Likewise, stakeholder support is crucial to ensure a continuous and high quality supply of surplus food, particularly from supermarkets and caterers. Finally, having monitoring frameworks has also been seen as a success factor by Invendus Pas Perdus in Schaerbeek: "*the activity's monitoring framework is very mature, and the action is highly systematised and integrated into city-level food policy*".

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4 DISCUSSION AND CONCLUSION

4.1 Success factors

Although the actions identified pertain to various supply chain sectors, there are several common characteristics that have emerged which influence success.

- **Stable financing mechanisms:** The source of the funding varied from public, private, to civil society sources (charities, NGOs, for example), but what proved necessary was a stable, financial resource. In order to implement a project, at least some funding was necessary to commence and ensure continuity of the activities to make progress in achieving objectives. For actions that were large in scope - such as those covering the entirety of the supply chain - this was particularly important, due to the complexity of such actions, and the need for diverse types of **human resources and expertise**, **equipment** and **technology**.

- **The involvement of diverse stakeholders or partners**: Another common feature which played a key role in an action's success was collaboration with multiple and diverse partners. Such collaboration not only promoted dynamism, versatility, and innovation, but also helped to ensure longevity of the project. With more partners involved, more entities thus had a vested interest to ensure the intervention's success, and this helped to solidify the project, especially if working with partners that were already **incorporated into already existing institutional structures**, such as the public sector. This not only meant support in terms of funding or other resources, but also played a role in **increasing communication** and **knowledge exchange** between partners and the sectors they represented. One example is in redistribution, where open dialogue between the HORECA sector and charities was vital in order to ensure that food be donated to those in need or to food banks in a timely manner.

- **Evidence of positive impacts via a robust monitoring system:** Demonstration of positive impacts – social, economic, or environmental – can help to stimulate support for an action. One of the most prominent socio-economic impacts across the actions identified was the creation of jobs and skills, such as in the processing and manufacturing sector where valorisation required particular expertise for production, but also to place the new product on the market. However, in order to effectively **demonstrate positive impacts**, a **systematic monitoring plan**, including baseline measurements and performance indicators to track progress, was essential to bring to light impacts. Moreover, the incorporation of a robust monitoring system allowed for systematic feedback about the action and thus the possibility for continuous improvement. It provided actors with information and knowledge about what was operating successfully and **where new abilities and training were needed.** Without

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such a system in place, it is difficult to **quantify success of an action,** which can affect the **level of support** it receives and ultimately its' **longevity.**

4.2 Impacts

There were a variety of social, economic, and environmental impacts resulting from the actions. The most prevalent are discussed here below.

Social Impacts

- **Awareness:** By simply being interventions geared towards addressing food waste, the predominant social impact across all the actions was raising awareness about the issue. Not all actions were specifically geared towards measuring a reduction in food waste. Rather, they were geared towards **raising awareness** and knowledge about the issue and **generate discussion as a starting point**. Becoming aware of the situation is a vital first step before being able to actually address it. The increase in awareness was accomplished in a variety of different ways, such as educational workshops for children evident with 'Stop Madspild' (Stop Food-Waste), a free educational campaign for primary schools on the issue of food waste in Denmark, or communal eating experiences, such as Feedback's 'Feeding the 5000' - a national event in the United Kingdom where the public is served a delicious communal feast for 5000 people made entirely out of food that would otherwise have been wasted.

- **Community collaboration:** Another social impact that was often witnessed, was the increase in cooperation between actors – not only within a sector, but also across sectors. Examples of this were particularly evident in redistribution, retail, processing and manufacturing, and interventions covering the full span of the food supply chain. While more cooperation could also be a challenge since it necessitated time and communication with actors of varying expertise and experiences, it also facilitated greater **understanding** of how different sectors operated and **promoted skill and knowledge-exchange**. Additionally, collaborative efforts have the potential to propagate new social norms or organically shift existing social norms regarding food waste.

- **Access to food:** Many interventions, particularly in redistribution, food services, and retail, focused on what could be done with surplus food. These actions provided surplus food to consumers in inventive ways. One way was via **apps**, where consumers could purchase excess, uneaten, but safe to eat **food from retailers at a discounted price,** such as the 'Foodie Save' app in Ireland. Other examples include projects where the food services industry and retail sectors worked with NGOs and other charitable organisations to redistribute excess food to the **poor and socially excluded groups**, that were struggling from **food insecurity**.

Economic Impacts

- **Reduction of monetary costs associated with food waste**: From an economic perspective, food waste essentially equals lost money for all actors across the supply chain, including consumers. Thus for the interventions which actively addressed reducing the amount of food waste, there was an economic benefit. Putting in place an intervention that complements and is part of an overall supply chain strategy to address food waste can **prevent monetary loss,** in terms of **production, storage, transportation / distribution, and consumption** of the product.

- **Additional products for sale:** A cornerstone of many of the interventions across various stages in the supply chain – redistribution, retail, food services, processing and manufacturing – was to encourage the sale and consumption of surplus food. There were varying reasons why there was extra food – either it was not appealing in appearance although still safe to eat, close to an expiration date, or perhaps simply over-produced. **Valorisation** initiatives played a key role in developing **new products which could be sold, providing thus economic benefits**. Similarly, **unaesthetically appealing products** provided another opportunity to sell food which otherwise might have simply been discarded due to appearance. **Apps** played a key role by providing a platform where over-produced meals in the food services industry, or overstocked items soon to expire in stores could still be sold to consumers. Examples include the mobile apps 'Komefy' in Spain or 'Squiseat App' in Italy.

- **Job creation:** Particularly when it came to interventions where new products were developed from surplus food (such as valorisation), or where the project covered multiple stages along the supply chain, added benefits were often job and skill creation. A common factor in these interventions was that **more expertise was needed** – either due to a new product being formulated and put on the market, or because the intervention spanned several stages of the supply chain (and perhaps even across different regions or countries).

Environmental Impacts

- **Greenhouse gas emissions (GHGs):** What these actions were overwhelming looking at was the amount of greenhouse gas emissions (GHGs) prevented due to addressing food waste in their initiative. Similar to monetary benefits incurred by addressing food waste, this also applies when looking at the supply chain with an environmental perspective. By addressing food waste, this de facto already has positive environmental impacts including those outlined in the European Commission's Environmental Footprint Method – such as **water and land use, as well as GHG emissions** - which

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occur at production, storage, transportation and distribution stages[7]. Moreover, addressing food waste prevents excess food from entering landfills or being incinerated which produces **methane.** There were also interventions that focused on a "softer" environmental approach, by encouraging **local sourcing** (i.e. less transport), or for example eating more "climate-friendly" by consuming **commodities in season** rather than out of season. One such example is the 'Less food waste - More ecology and climate-friendly food' initiative in Denmark, which encompasses short, entertaining presentations that prepare students for a sustainable future in the kitchen with a focus on ecology and how to choose climate-friendly food.

4.3 MOA framework

Within the MOA Framework, both ability and opportunity are necessary to provide the support needed to bring about a change in food waste behaviour. Without ability, regardless of the amount of motivation, an individual is unable to effectively generate behaviour to ensure less food waste. Interventions that address ability usually include some type of training about the purchase, preparation, and storage of food. Likewise, actors need to be given opportunity (i.e. access) to the necessary materials and resources to put into motion the ability. **Ability was identified in 138 actions.** It was evident most often within the food services and households supply chain stages, in the form of **workshops, trainings,** and **educational guides**, in an effort to increase skills to address food waste. A good example is the 'We eat responsibly' project in Latvia, which teaches children about how to address their food waste, by teaching them for example monitoring efforts, how to evaluate menus, and creating an action plan. Another example is the 'Future Kitchen Essen' project in Germany where training is given by the municipality and local nutrition council to canteen centres and caterers on utilizing sustainable and local food. **Opportunity was identified in 240 actions**. It was mainly concentrated in the primary production, processing and manufacturing, redistribution, and retail stages of the supply chain, in the form of **more access to affordable food** via charities (NGOs, food banks), increased access to **tools such as equipment (software, apps, on-line platforms)**, and **collaboration networks**, such as Feedback's 'Gleaning Network', which to date has worked with farmers, volunteers, and charities to rescue fruits and vegetables that would otherwise go to waste. Another example is 'Bio Company', which reduces leftover baking goods by introducing new controlling software FoodTracks with the goal of reducing food waste in bakeries, by optimizing the purchasing and editing the product range.

Per the work done in the CHORIZO project, and outlined in WP3 (D3.1), social norms are defined as the rules/guides for actions perceived by individuals aspiring/belonging to the norm's target group as expected by

[7] European Commission Recommendation on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations (C(2021) 9332 Final): https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:C(2021)9332

others (Bicchieri 2006). A common differentiation among social norms is to distinguish injunctive social norms from descriptive social norms. Injunctive norms refer to perceptions about normatively appropriate behaviour in a specific context (Cialdini et al. 1991). It relies on the perception that an individual has about what kind of behaviour is approved or disapproved of by the reference group. Often there are reinforcing mechanisms (rewards or punishments) through which such approval or disapproval is expressed. There were **14 actions deemed to be driven by injunctive social norms**. These actions involved either **voluntary agreements, legislation** (such as the mandated bio-waste collection for energy production law in France), **punishments** (being charged for any leftover food at buffet restaurants in Germany, such as Yuoki in Stuttgart and Okinii in Dusseldorf), or **rewards** such as Froodly's mobile app in Finland, which rewards consumers for reporting still-fresh discounted products in their local stores. Consumers share a picture of the discounted product, price, and store details in the app and gain credits towards rewards such as free coffee. Meanwhile, descriptive norms refer to an individual's perception about the likelihood that others engage in the behaviour, and the individual follows such **behaviour** because it is **deemed effective and appropriate** (Cialdini et al. 1991). It is based largely on observation of what is prevalent or common behaviour. There were **66 actions classified as driven by descriptive social norms**. Most of these actions took place within a **community context** such as LIPOR's promotion of home and community-driven composting in the Porto region of Portugal.

From the analysis, both abilities and opportunities were evident in the actions, providing the skills and tools needed to bring about a change in food waste behaviour. In addition, the most prevalent type of social norm driving behaviour was descriptive rather injunctive, demonstrating the power of an individual engaging in a behaviour based on perception of what others are doing – i.e. that it is considered appropriate. For these social norms the community setting was often brought to the fore – understandably - as it is perhaps the best manner to encourage collective efforts.

4.4 Challenges and implementation barriers

There were several challenges which emerged across the supply chain when implementing an action. This section discusses those challenges and notes the relevant sectors.

a) **Partnerships:** While the involvement of multiple and diverse partners is a positive element in that it provides additional support (financial, expertise, as well as other resources such as technological or equipment) for an intervention, it can also be a challenge. This was valid across **all sectors** where actions involved more than one partner. It was particularly evident in the **redistribution sector**, where there emerged at times **diverging interests** – namely the growing competing nature of social impact created by food surplus donations (helping to reduce food insecurity) versus corporate economic goals and deciding at which point the surplus food might rather be still sold for profit (although at a

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discounted rate) via apps or on-line platforms. In this respect, **keeping all partners actively engaged** and not diverging from the common-binding interests requires constant attention, especially as complexity and length of time of the intervention increases.

b) **Food safety:** Guaranteeing food safety was a challenge in **all sectors**, in particular when food was being transported, stored, and distributed from one location to another, such as in **redistribution, retail, food services** and **primary production**, or the creation of a novel food product (**valorisation**). There are often strict procedures and conditions that must be met to protect not only the **quality** of the food, but also its' **safety for consumption**. This often incurs **costs** related to acquiring and maintaining infrastructure and equipment, in particular when it comes to fresh fruits and vegetables.

c) **Scarcity of resources:** Within **all sectors** a recurring challenge was obtaining enough resources to be able to carry out the intervention from conception to achievement of its' objectives. The more complex the action, the more challenges understandably were present. Where technology played a role, such as with innovation of apps and on-line platforms for example, **maintenance and regular upgrade** of the technology required not only **funding**, but also specific **skill-sets**. Interventions that involved **varying governance and legislation**, such as international interventions and/or those involving more than one sector, were particularly susceptible.

d) **Covid:** When Covid-19 broke out globally in 2020, it had an effect on **all sectors** in the food supply chain. The detrimental health effects of the pandemic mandated **individual isolation** and consequently the regular, every-day work necessary across the supply chain was disrupted. From diminished and/or delayed production of food, to retailers that could not obtain enough systematic supply of food products, to the food services industry suffering from lack of work force and clients, the results were felt all across the supply chain.

4.5 High-potential actions

Taking into account the previous chapters, and the afore-mentioned discussions in this chapter, there are lessons that emerge which highlight what components are necessary in order to create an intervention that has a high potential of success in addressing food loss and food waste.

- **Addressing surplus food at some point along the food waste pyramid hierarchy.** The hierarchy necessitates a fundamental approach of prioritizing prevention and addressing food waste before it occurs, and if it is occurring, to address it then in the most resource-efficient manner. From the 395 actions identified across the supply chain in D1.2 of the CHORIZO project, approximately half of them (196 actions - i.e. 49%) were "prevention" actions, when classified in accordance with the food hierarchy. This demonstrates a proactive approach to addressing food waste. However, although prevention of food from occurring in the first place is the highest goal, understandably this is not

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always possible, and thus other manners of addressing food waste are a necessary reality. There will always be some surplus food and it is important that it is not simply incinerated or discarded in a landfill. There are a **wide range of interventions lower on the pyramid hierarchy** which also play **effective roles in addressing food waste** and should be seized when the chance is there. This is evident in examples such as valorisation of new products, redistribution of food via apps, or making consumers aware of the benefits of utilizing food products that otherwise might be discarded due to their physical appearance, although they are still safe to eat.

- **A multi-pronged approach:** Developing actions that reduce food waste is important, but review of the identified interventions and the afore discussion on success factors in section 4.1, also highlights the importance of addressing other key aspects - such as increased collaboration within a community or attainment of new skills and jobs - in order to help facilitate **support** and **longevity** of an action. It is important for actions that are being developed to look at what **other objectives** can be achieved that **will complement and bolster the overall initiative of reducing food waste.** A good example is the 'Espigolador' project in Spain. The gleaning of fruits and vegetables that are not suitable for market but still safe to eat, raises awareness about suboptimal ("ugly") food, but also promotes community collaboration in bringing together farmers, volunteers, charity organisations in the gleaning and redistribution effort, while providing a positive social impact of making food available to those in need.

- **Monitoring system:** Directly related to the implementation of a multi-pronged approach is the incorporation of a robust monitoring system. It is very difficult to quantify the success of a project if a system is not in place to demonstrate **progress over time** in achieving specific objectives, as well as **complementary positive impacts**. Not only are success and positive impacts a manner to garner **support** for the initiative, but monitoring also provides much-needed **insight and knowledge** by highlighting what does and does not need to be addressed to facilitate success.

- **Converting awareness into something tangible:** By being interventions that strive to address food waste, all of them raised awareness about the issue. While awareness-raising is a necessary first step and vital in providing motivation to address the issue, the possibility to also convert that awareness into something tangible and practical which can be utilised in every-day life, is key to making that next step in **promoting behaviour** that actually does address food waste. In this respect, interventions that promote **ability** (knowledge, skills) and/or **opportunities** (resources) are key. An example is the 'Portami a casa con te' initiative in Italy, where pupils are provided with a thermal, washable, reusable bag for taking home meals not consumed in the canteen. Not only does the initiative raise awareness about food waste, but also provides students with an actual resource (i.e. the thermal bag) to safeguard and bring home the left-over food for later consumption. In addition, the most prevalent

type of social norm driving behaviour was descriptive (rather injunctive) with the community setting playing a central role for encouraging active and tangible collective efforts to address food waste.

- **Multiple partners:** By working with multiple partners on an intervention, not only is communication bolstered and knowledge-exchange possible, but there are thus also more sources to provide **support for the project** – whether that be financial, subject matter expertise, technology, equipment, or human resources. There is not just one actor in the chain supporting the project, but rather various actors. The project becomes further instilled into society thereby helping to better ensure its' survival over the long-term. This is especially so if working with a partner that is already incorporated into an existing institutional structure, which provides increased **legitimacy** for the initiative. In this respect, **cities** are unique in terms of their potential to address food waste due to their multifaceted nature, and stakeholders across the supply chain are in proximity to each other, providing opportunities to tackle the issue from a variety of angles.

- **Adequate funding:** Closely related to working with multiple partners is the issue of ensuring adequate financial support for a project. Financial resources are important for all projects, but for interventions which relied heavily on **technology** (apps, digital platforms) and **equipment** (such as those in the processing and manufacturing sector) or which are **complex covering various stages** in the supply chain, securing funding was paramount. This applies not only for the commencement of an initiative, but **throughout the project** in order to ensure maintenance of technology and equipment over time, as well as assurance that the correct expertise is being applied at each stage of the supply chain.

- **Better implementation feasibility:** By pre-identifying and addressing the current and potential **challenges** that might arise during the execution of the action, there is a better, faster learning curve and a higher potential for success. In this respect advanced **market research** as well as **cost-benefit analysis** will provide much needed **data** and **context.**

Even though the results of this report are subject to data limitations, it serves to provide a broad overview of key lessons learned across the supply chain sectors, and ultimately what **key factors are needed** to facilitate **high potential for success** in addressing food waste. In this respect, the reader is encouraged to please take note not only of section 4.5 (High-Potential Actions), but to also weigh it against sections 4.1, 4.3, and 4.4 which outline key success factors and implementation challenges, but also what is required (via abilities, opportunities, and social norms) to affect behaviour towards food waste. Within the CHORIZO project, the information in this deliverable will be utilised to inform work in subsequent WPs, including that of WP4, which will focus on communication and education about food waste for external stakeholders, based on the project's results.

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The results of this document will inform CHORIZO T4.1, developing actor-, context- & gender-specific guidance to change social norms.

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