LOWINFOOD

Multi-actor design of low-waste food value chains through the demonstration of innovative solutions to reduce food loss and waste

GA No. 101000439

D2.5 Guidelines for surplus food redistribution

WP2 - Type of deliverable: Report - Dissemination level: Public - Due date: 29th Feb 2024

Contact(s) of the deliverable's lead beneficiary:

Silvia Scherhaufer — BOKU. Email: silvia.scherhaufer@boku.at
Cornelia Diesenreiter — UNV. Email: cornelia@unverschwendet.at

Authors

Silvia Scherhaufer (BOKU), Cornelia Diesenreiter (UNV), Elisabeth Schmied (BOKU), Nadine Brunnhuber (BOKU)

LIST OF PARTNERS THAT HAVE CONTRIBUTED TO PRODUCE/REVISE THE DELIVERABLE

BOKU, UNV, JHI, LUKE

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

LOWINFOOD Consortium

N.	Full name of the organisation	Short name	Country
1	Università degli Studi della Tuscia	UNITUS	Italy
2	Alma Mater Studiorum Università di Bologna	UNIBO	Italy
3	Sveriges Lantbruksuniversitet	SLU	Sweden
4	FH Munster University of Applied Sciences	ISUN	Germany
5	The James Hutton Institute	JHI	United Kingdom
6	Universitaet Fuer Bodenkultur Wien	BOKU	Austria
7	Tampereen Korkeakoulusaatio SR	TAU	Finland
8	Charokopeio Panepistimio	HUA	Greece
9	Osterreichisches Okologieinstitut	AIE	Austria
10	Elhuyar Fundazioa	ELH	Spain
11	Matomatic AB	MATO	Sweden
12	Unverschwendet GmbH	UNV	Austria
13	Akademie Deutsches Baeckerhandwerknord GGmbH	ADB	Germany
14	Foresightee (terminated on 30/01/2023)	FOR	Belgium
15	Leroma GmbH	LER	Germany
16	Mitakus Analytics UG	MITA	Germany
17	Kitro SA	KITRO	Switzerland
18	Regione Emilia Romagna	RER	Italy
19	Pianeta Cospea srl	PICO	Italy
20	Cogzum Bulgaria OOD	COZ	Bulgaria
21	Uppsala Kommun	UPP	Sweden
22	Recuperiamo srl	REG	Italy
23	Antegon GmbH	FT	Germany
24	Confederazione Nazionale dell'Artigianato e della piccola e media impresa Associazione di Viterbo e Civitavecchia	CNA	Italy
25	Assemblee des Regions Europeennes Fruitieres Legumieres et Horticoles	ARE	France
26	L.V.L Anonymi Emporiki Toyristiki Kksenodoxeiaki Kataskevastiki Etaireia	BLU	Greece
27	Iridanos-Inabelos Anonymi Etaireiatouristikes Ksenodoxeiakes Kai Agrotikes Epixeiriseis	THA	Greece
28	Luonnonvarakeskus (started on 01/11/2023)	LUKE	Finland

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Table of contents

Summary

The amount of food that is currently being redistributed in the EU is only a small part of the total edible food surplus available. Besides food donations to social organisations and redistribution to people in need, other options need to be explored for the utilization of surplus food and thus prevent food from being wasted.

The aim of this guideline is to help organisations keep as much fruit & vegetables as possible in the food supply chain by establishing a network of intermediary services for surplus food redistribution in a business-oriented approach, based on the concept of Unverschwendet GmbH in Austria.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Introduction to the deliverable

LOWINFOOD is a project committed to co-design, together with actors of the food chain, low-waste value chains by supporting the demonstration of a portfolio of innovations in a set of value chains particularly concerned by food loss and waste (fruits & vegetables, bakery products and fish), as well as in at-home and out-of-home consumption. Each of these value chains corresponds to a single Work Package (WP) of the project.

The innovations are selected among promising solutions that have already been developed and tested by some partners of the consortium, with the aim to provide the necessary demonstration and upscale to allow market replication.

The LOWINFOOD consortium comprises 28 entities, located in 13 different countries, and ranging from universities and research institutes to start-ups, foundations, associations, and companies working in the food sector. During the 52 months of the project, the partners are committed to complete 30 tasks and to deliver 60 outputs (deliverables).

Deliverable 2.5 (D2.5) provides a guideline for surplus food redistribution in the context of the innovation of Unverschwendet GmbH (Beneficiary No. 12, Task 2.2). The aim of this guideline is to help keep as much fruit and vegetable as possible in the food supply chain by establishing a network of intermediary services for surplus food redistribution in a business-oriented approach based on the concept of Unverschwendet GmbH in Austria (called hereafter UNV business concept). The guideline covers the technical framework of the UNV business concept, including legal considerations, functions, and actors as well as the type of surplus food that is redistributed. Furthermore, it explains basic requirements for a successful implementation and describes effective solutions to potential barriers. Finally, the environmental benefits of surplus food redistribution are shown on the example of the reduction potential of greenhouse gas emissions and occupied land. The guideline is complemented with examples from practice shown in separate boxes.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

1. Introduction to the guideline

One of the main challenges in the food supply chain is the lack of predictability. Food industry and retail are demanding the right product at the right time and in the right quantity. This often leads to surplus production at farm level to be able to meet unforeseen changes in demand for suppliers to compete on the market. Up to 25% of the fruit and vegetables produced by Austrian agriculture are lost. At the same time up to 80% of the goods that do not end up in supermarkets would have been perfectly edible (Obersteiner et al., 2019). This food is called surplus food.

Surplus food is defined by the European Commission (2017) as follows:

"Surplus food consisting of finished food products (including fresh meat, fruit, and vegetables), partly formulated products or food ingredients, may arise at any stage of the food production and distribution chain for a variety of reasons. Foods that do not meet manufacturer and customer specifications (e.g., variations in product color, size, shape), as well as production and labeling errors, can generate a surplus in the agricultural and manufacturing sectors for instance. Difficulties in managing supply and demand can lead to over-ordering and cancelled orders."

The redistribution of surplus food for human consumption is one of the key recommendations in the fight against food wastage (EU FLW platform, 2019a). Intermediary organisations, such as food banks in the social sector or businesses like Unverschwendet GmbH, can facilitate the process of food redistribution.

Food redistribution is defined by the European Commission (2017) as follows:

"Food redistribution is a process whereby surplus food that might otherwise be wasted is recovered, collected and provided to people, in particular to those in need."

Although the redistribution of food surplus is "a growing phenomenon", the amount of food that is currently redistributed is only a small share of the overall edible surplus food available in the EU (EU FLW platform, 2019a). Guidelines for food redistribution are already existing, but in the context of food donations from consumer goods industry to charities and social organisations. One of the first guidelines in Europe was published by the Austrian ministry for agriculture and environment in 2011 (Schneider, 2011). Based on this publication, the German ministry for food and agriculture also published a similar guideline for food donations (current version BMEL, 2022). More information and links to published guidelines in various EU Member States can be found in a summarizing document prepared for the EU food loss and waste platform (EU FLW platform, 2019b).

Food donations to charities work well for certain types of surplus food and from certain food business operators (especially from retail), but there are problems when surplus food occurs at farm or industry level. The reasons are manifold. Some challenges from practice are exemplified in Box 1. Guidelines for food redistribution in the agricultural and industrial sector could help redistribute surplus food if a donation is not possible.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Box 1: Example from practice – Challenges for surplus food redistribution from farm and industry (based on UNV's experience)

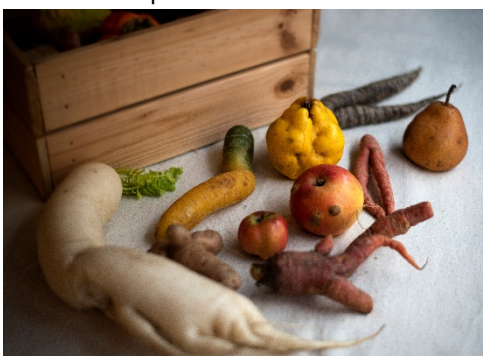
What are the challenges of redistributing surplus fruit and vegetables?

When surplus food arises at farm level, it usually occurs at irregular intervals, outside of urban areas and in a fresh state (easily perishable food such as fruit and vegetables demand a fast redistribution).

When surplus food arises at industrial level, such as from deep-freeze warehouses or manufacturing industry, it usually occurs at irregular intervals, often in processed form e.g. as fruit puree or pulp) and in large quantities (e.g. industrial containers such as tanks).

These circumstances make a further utilization of surplus food from farms and manufacturing industry difficult. High logistical and time efforts are necessary to redistribute surplus food from food business operators supplying surplus food to business operators that could utilise the surplus food. Social organisations have limitations in terms of workforce and logistics (storage facilities, transport vehicles) and can only accept the amount of surplus food that are feasible within their scope of available resources. Food business operators themselves have time pressure which reduces the time for searching of potential (irregular) buyers.

An intermediary service provider covering the aspects of transport, storing, processing, and offering knowledge of potential business partners is necessary to utilize surplus food and to keep surplus fruit and vegetables in the food supply chain.



CC BY Unverschwendet GmbH

2. Aim of the guideline

"The crooked cucumber" is one of the better-known examples of food that is not or not very marketable. Fruit and vegetables may not end up on the usual retailer shelves for a variety of reasons: Products that measures a few grams or millimetres too much or too little are usually not accepted by retail companies because products are often sold per piece and not per weight. When selling by piece, the fruits must be very similar in size/weight so that people don't rummage through them to find the best/largest ones, causing a lot of damage to the vulnerable fruit. Also, products with damaged peel or skin are usually not marketable. Pretty or not, these foods are still perfectly edible and valuable. Finding suitable buyers for them,

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

however, often comes up against logistical and economic limits (lack of transporting possibilities, lack of buyers due to irregular occurrence). The company "Unverschwendet GmbH" (UNV) from Vienna (Austria) has developed a business concept to close the gap between suppliers and buyers of surplus food. UNV exclusively buys surplus food, i.e. food that do not meet manufacturer or customer specifications or that is produced in excess for various reasons (e.g. due to difficulties in managing supply and demand).

This guideline shows effective and economic solutions of redistributing surplus fruit and vegetables based on the UNV business concept (see definition of the concept in Box 2). The guideline is in English to enable replications in other countries of the European Union and even beyond.

The aim of the "Guidelines for surplus food redistribution" is to help organisations keep as much fruit & vegetables as possible in the food supply chain by establishing a network of intermediary services that enables bridging the gap between supply of surplus food and demand for food products (fresh or processed).

Target audience of this guideline are start-up companies, food companies and any other businesses with the motivation of keeping edible fruit and vegetables in the food supply chain.

Box 2: Example from practice – Food redistribution in an economic scale

How can the UNV business concept be defined?

The concept of Unverschwendet GmbH in Austria (called UNV business concept) involves a network of partners that enable bridging the gap between supply of surplus food and demand for certain food products (fresh or processed). UNV buys surplus food, transports, stores and potentially processes surplus food to sell to suitable buyers. UNV is not a charity and manages this network and organises services to enable transaction between supply and demand of surplus food for profit. The business is focused on a target-group delivery; meaning that the surplus food is processed in a way that is demanded by potential buyers (e.g. there is a demand for apple pulp instead of fresh apples, or there is a demand for sliced apricots instead of fresh ones). That also means that surplus food in larger quantities and in larger packaging sizes (e.g. tanks) can be taken over. UNV only buys the quantity of surplus that can also be redistributed (sold) and exclusively food that can be classified as "surplus food" (see EU guidelines on food donation in European Commission, 2017).

UNV started with a small association at the beginning of 2015, but quickly realised that the potential was much greater, and that one association was not enough. UNV has been in business since 8 March 2016 and is run by siblings Cornelia and Andreas Diesenreiter from

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Schwendermarkt in Vienna (Austria), together with their team (https://www.unverschwendet.at/) .

3. Legal considerations for redistribution

Food business operators have the primary responsibility for ensuring food safety and need to comply with the **food law** (Regulation (EC) No 178/2002). Food law means "the laws, regulations and administrative provisions governing food in general, and food safety in particular, whether at Community or national level; it covers any stage of production, processing and distribution of food, and also of feed produced for, or fed to, food-producing animals" (Regulation (EC) No 178/2002). Food business means "any undertaking, whether for profit or not and whether public or private, carrying out any of the activities related to any stage of production, processing and distribution of food" (Regulation (EU) No 178/2002). Key obligations of food (and feed) business operators are published from the EU Health & Consumer Protection Directorate-General, that are:

- SAFETY: Operators shall not place on the market unsafe food or feed
- RESPONSIBILITY: Operators are responsible for the safety of the food and feed which they produce, transport, store or sell
- TRACEABILITY: Operators shall be able to rapidly identify any supplier or consignee
- TRANSPARENCY: Operators shall immediately inform the competent authorities if they have a reason to believe that their food or feed is not safe
- EMERGENCY: Operators shall immediately withdraw food or feed from the market if they have a reason to believe that it is not safe
- PREVENTION: Operators shall identify and regularly review the critical points in their processes and ensure that controls are applied at these points
- CO-OPERATION: Operators shall co-operate with the competent authorities in actions taken to reduce risks

Food shall not be placed on the market if it is unsafe, so if it is injurious to health or unfit for human consumption (Regulation (EU) No 178/2002).

Annex II of Regulation (EC) No. 852/2004 defines general **hygiene regulations** for food business operators. In addition, Regulation (EC) No. 853/2004 of the European Union defines the handling of food of animal origin within the EU hygiene package.

In accordance with the EU hygiene package, hygiene guidelines (e.g. BMG, 2017) have been issued in Austria for various types of companies that work with food. In addition to protecting the health of consumers, they also include measures for good manufacturing and commercial practice. Additionally, according to the **Product Liability Act** (Austrian Federal Law Gazette I No. 98/2001): The entrepreneur who places a product on the market is liable for the damage or the defective product. This is a no-fault liability for damages. Apart from

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

product liability, companies must also comply with administrative law provisions, such as maintaining appropriate liability insurance.

Regulation (EC) No 178/2002 regulates the **traceability** of food for food business operators. Under EU law, "traceability means the ability to track any food, feed, food-producing animal or substance that will be used for consumption, through all stages of production, processing and distribution" (EU factsheet, 2007). This enables rapid action if food turns out to be not safe. Guidelines, traceability tools and labels have been drawn up for practical implementation. More detailed traceability requirements are laid down for certain specific sectors: e.g., for foods of animal origin (Commission Implementing Regulation (EU) No 931/2011) and for sprouts and sprout seeds (Commission Implementing Regulation (EU) No 208/2013).

Products that are sold to end consumers are subject to the provisions for the statutory minimum information for **food labelling**. This also includes the best-before date. The best-before date (BBD) is the date until which the product retains its specific properties if stored correctly. It is set by the manufacturing company.

Box 3: Example from practice – Compliance with food law

How is food security implemented in practice in UNV?

According to the Regulation (EC) No 178/2002 Unverschwendet GmbH is defined as a food business operator and therefore needs to comply with food safety legislation. So, staff at UNV needs to comply with the same hygiene requirement as staff at other food manufacturers to always ensure a safe handling of food. A strict documentation of all the surplus that is redistributed is required, as well as an analysis of certain products on a regular basis when there is any doubt about the quality. Moreover, UNV has developed a "surplus transfer form" that is signed for every single purchase to ensure food safety and quality. The supplier needs to sign this form to guarantee that the surplus was always treated hygienically. When the surplus is delivered to food producers in the next step, there is another quality check. UNV signs corresponding forms to be fully liable for the safety and quality. Additionally, many products of UNV are freshly produced and sold on the market as jam or spreads, all obligations to food labelling must be met.

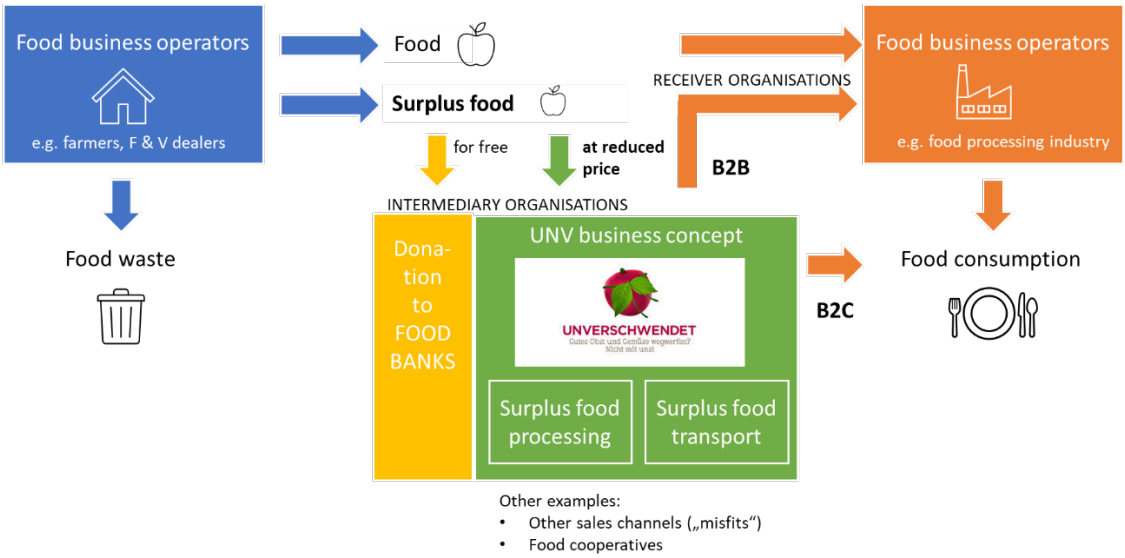
CC BY Unverschwendet GmbH

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

4. How does the business concept of redistributing surplus fruit and vegetables work?

The food redistribution scheme involving the UNV business concept is illustrated in Figure 1. UNV acts as an intermediary organisation.

Figure 1 – Illustration of food redistribution on an economic scale based on the example of UNV business concept

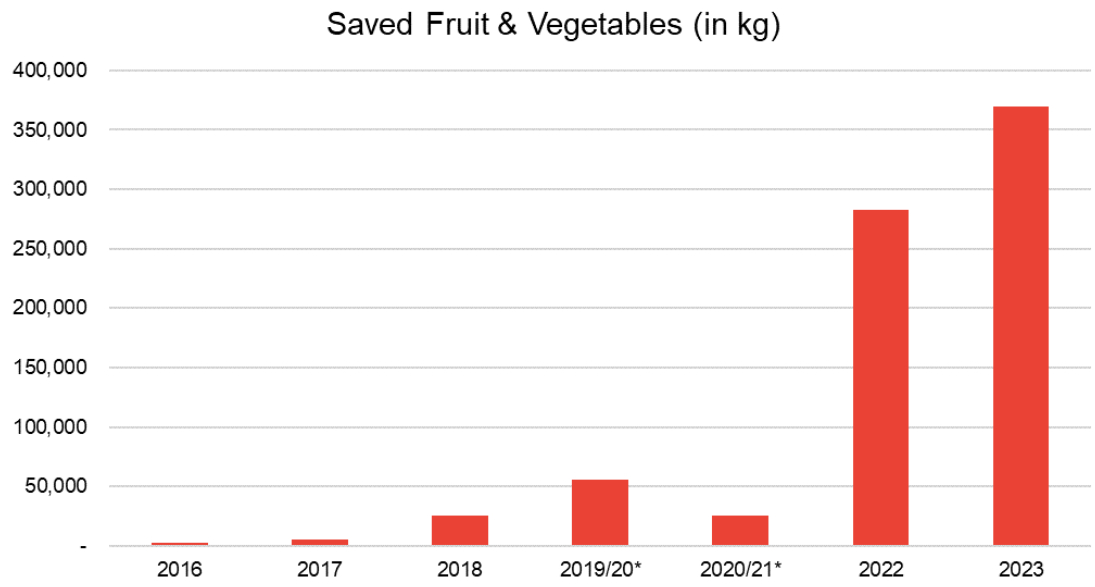


Intermediary organisations are defined by the EU guidelines on food donations as organisations that "facilitate food redistribution by provision of services to enable contact between Food Business Operators (FBOs) and receivers and the matching of the supply of surplus food with potential demand" (European Commission, 2017). UNV is an example of such an intermediary organisation. UNV was founded in March 2016 by siblings Cornelia and Andreas Diesenreiter. The first products were sold in 2015, back then as an association. However, a clear mission was quickly defined: To have the greatest possible impact in food surpluses.

In the years since 2016 UNV have already been offered over 15 million kilos of top quality fruit, which are thrown away for a variety of reasons: the fruit is too big, too small, ripe at the wrong time, not the right colour or simply too much. UNV transforms surplus fruit and vegetables into delicious products such as jam, syrup, chutneys, sauces and much more. The culinary solution to food waste. Those products are either directly sold to consumers (B2C) at UNV shops in Vienna or online or are redistributed between partner organisations (B2B). Figure 3 shows how much food has been redistributed since 2016. Getting a large retail chain as client in the year 2022 was a big milestone for UNV that increased the amounts of transferred food from a few tons per case to 10 to even 30 tons per case. While back in 2016 about 2 tons were redistributed, UNV managed to redistribute about 370 tons in 2023.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

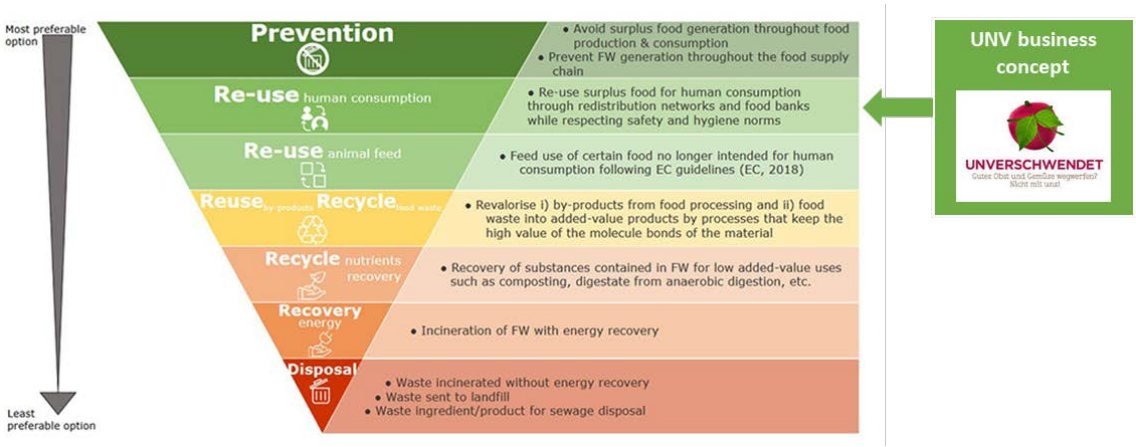
*Figure 3: Surplus fruit and vegetables that were redistributed by UNV business concept 2016-2023 (*deviating financial years)*



UNV buys surplus food from **Food Business Operators (FBOs)**. FBOs "may provide surplus food from each stage of the food supply chain, i.e. primary production, food processing and manufacturing, retail and other distribution, as well as the catering and hospitality sectors" according to the EU guidelines on food donation (European Commission, 2017). If food cannot be sold on the market (because of e.g. cosmetic standards), this food would leave the food supply chain and is disposed in different food waste management systems. Figure 3 shows the food waste hierarchy in accordance with the revised waste framework directive (European Commission, 2020). The least preferable option is the disposal in a waste incineration plant without energy recovery or landfilling. The most preferable option is prevention (e.g. avoid surplus food generation by better planning/forecasting). The re-use of surplus food for human consumption (e.g. through redistribution) is the second most preferable option and the level at which UNV can be assigned. If food can be redistributed for human consumption, it can reduce the amount of food waste and thus supports the targets of the Sustainable Development Goals (SDGs) of the United Nations.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Figure 2 – Hierarchy for prioritisation of food surplus, by-products and food waste from the European Commission's Knowledge Centre for Bioeconomy (European Commission, 2020) and the level at which UNV can be assigned



Examples of FBOs' that supply surplus food in the UNV business concept are:

- Farmers
- Fruit & Vegetable dealers
- Sorting and packaging plants
- Logistics organisations
- Deep-freeze warehouses
- Main/intermediate storage areas of supermarkets

UNV buys surplus food from FBOs that are primary producers at reduced price. The rates of price reduction are between 20-40% compared to market prices. However, UNV does not want to set up a new business segment for food at reduced price, but stick to real surplus food only. UNV wants to provide food suppliers with a fair price for their efforts, but on the same time do not want to compete with market prices. Depending on the type and condition of the product, UNV either directly redistributes the surplus food bought from primary producer FBOs (e.g., farmers, fruit and vegetable dealers) to the receiver organisation (e.g., food processing companies) or have the surplus processed by the processors in the network and then sell it to the receiver organisation (e.g. food industry).

Receiver organisations are involved in the redistribution of surplus food in the sense that they accept and buy fresh, prepared, or semi-prepared products out of surplus food. UNV sells the surplus food to receiver organisations, that are food business operators, such as the food industry and food manufacturing companies (B2B). For companies, organisations, and associations, UNV offers individual gift combinations in the own desired design for every occasion (e.g. christmas presents for staff or business partners).

A large part of the transferred surplus food by UNV is processed to respond to the needs of processing industry which demands a certain level of processing (e.g. there is demand for

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

sliced apricots and not for whole apricots) or if the condition of the product makes it necessary (e.g. for highly perishable fruits and vegetables). This service is essential in the UNV business concept and differentiates it from other intermediary organisations (such as food banks in the non-profit sector or 'Leroma' marketplace in the for-profit sector). UNV has spent years building up a pool of potential service providers (e.g., processing, transporting, storing) for this purpose. The processing steps that are currently used are the following (an example from practice is explained in Box 4):

- Pre-cleaning (washed, sorted, brushed, cut out…)
- Frozen to whole or cut food (berries free-rolling, stone fruit halved & pitted,…)
- Frozen to pureed food (block)
- Frozen semolina
- Processing to strained form: Mush or purees "Bag in Box" aseptic
- Processing to juice or concentrate

Additionally, UNV makes use of large warehouses for dry, chilled and frozen goods, in which they temporarily store surpluses for short periods (up to 12 months), e.g., until production date (an average of 300 pallet spaces per month).

Consumers are involved in the redistribution of surplus food in the sense that they directly buy fresh, prepared or semi-prepared products out of surplus food from shops of the intermediary organisation (products of Unverschwendet: https://www.unverschwendet.at/produkte-sorten) or from retail market (e.g. "Rettenswert" at HOFER). In October 2022, UNV took an important step and launched a cooperation with a retail chain under the brand called "Rettenswert" (English: salvageable). "Rettenswert" products are available exclusively in all HOFER shops throughout Austria (https://www.rettenswert.at/).

Other possibilities for utilizing surplus food, apart from the UNV business concept, are:

- Establishment of other sales channels by the FBOs (e.g. "misfits"/"Wunderlinge")
- Direct distribution to cooperative members (e.g. via food cooperatives or to associates
- Utilization in food service (e.g. catering service operator in Austria called "Iss mich")
- Direct sale at local markets
- B2B market places, for instance the LOwINFOOD partner Leroma (https://www.leroma.de, Task 2.3)
- Regional surplus redistribution facilitated by digitalisation (Software implemented in the Emilia Romania Region (Italy), LOWINFOOD partner, Task 2.1)

The redistribution of surplus food to social organisations, such as donations to **food banks**, is preferred by UNV to give people in need priority. Yet, social organisations are often depending on voluntary staff, that have limited time capacity. Next to shortcomings in staff, they also have limited transport and storage facilities. There is currently more surplus food

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

available than can be donated. This is why, also other possibilities of food redistribution are needed to re-use surplus food for human consumption.

Box 4: Example from practice – Services

How an intermediary organisation such as UNV can help with the redistribution of surplus food?

A part of a farmer's apple harvest is slightly damaged by hail. So, it is not possible to sell it via the usual sales channels of the farmer (fresh food chain). On the other hand, the processing industry doesn't work with fresh food, but would demand apple pulp instead and thus, the hail damage on the fresh apples is not concern for them. Farmers usually don't have contacts to organise the processing of their food in line with food industry's processing demands in due time. An intermediary organisation is therefore necessary to organise the processing of fresh apples to apple puree (or pulp). The apple is bought from the producer, made into apple pulp, and then sold to the food industry by intermediary organisations like UNV.

CC BY Unverschwendet GmbH

5. What kind of surplus food is suitable for redistribution?

Food products that are **suitable for redistribution** are conventional and organic food products that are still edible but leave the food supply chain for various reasons and can be classified as "surplus food" (as defined in European Commission 2017; see also chapter 1). Those food products must meet the legally prescribed basic specifications for food for fresh consumption and/or for processing and/or the general marketing standards in force.

Reasons for leaving the supply chain can be:

- Goods that are overproduced or overordered due to errors in the ordering systems
- Side streams and residual streams from food production/industry
- Residual stocks due to abandonment of individual articles
- No storage space (warehouses must be emptied with the start of the new harvest season)
- Wrong size or shape (i.e., broken or damaged goods, big falling, small falling, etc.)
- Too close to the best-before date or to the end of shelf life
- Other reasons: Logistics failures, short notice cancellations by supermarket chains.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

The UNV business concept deals with surpluses of the following food products shown in Table 1.

Table 1: Surplus fruit and vegetables that are currently accepted at UNV business concept (Status 2023, illustrations by BOKU)

FRUIT:	**VEGETABLES:**
Various stone fruit varieties	**Various fruit vegetables varieties**
 e.g., apricots, peaches, cherries, sour cherries, plums	 e.g., cucumbers, tomatoes, pumpkins, melons, peppers, eggplants, zucchini
Various berries	**Various root vegetables varieties**
 e.g., currants, gooseberries, strawberries, raspberries, blackberries, elderberries	 e.g., carrots, beets, horseradish, parsnips, celery, celeriac, sweet potato, radish
Various pome fruit	**Various onion vegetable varieties**
 e.g., apple, pears, quinces	 e.g., onion, garlic, leek, wild garlic
Other fruit:	**Various cabbage vegetable varieties**
 rhubarb, grapes, ready-made fruit mixtures (e.g., ready-made smoothie mixtures)	 e.g., cabbage and cabbage varieties, cauliflower, kohlrabi, broccoli
	Other vegetables:
	artichokes, spinach, legumes, fennel, asparagus, potato, ready-made vegetable mixes (free of seasonings, oils, ...)

Food products that are **limitedly suitable for food redistribution** are those of animal origin. Due to stricter requirements regarding storage and hygiene standards, these products have so far not been accepted by UNV. The origin of food products is another limiting factor. Food products that are not from national origin have been so far only taken over upon consultation. Exemptions are made for products that are close to the national border or are surplus at warehouses that trade with imported goods. Also, the identification

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

of surplus food which is still salvageable is important. For this the environmental impacts of saving specific surplus products from being wasted and transporting them to the country of the receiving organisation need to be considered. The question is, if it is still sustainable to transport surplus apples from France to Austria for the sake of food waste reduction. Yet, as the amounts of products from Austrian origin offered to UNV are still exceeding the amount that can be redistributed by UNV; therefore, there is currently no capacity to expand the geographical region.

Food products that are **not suitable for food redistribution** are products that do not comply with current marketing standards (i.e., rotting or any other deterioration that make them unsuitable for consumption).

6. What are the basic requirements for a successful and economically viable redistribution?

The following success factors were determined on the example of the UNV business concept.

Passion and enthusiasm: The primary factor why the concept is working, is the passionate and enthusiastic way of connecting to businesses and people. The food industry is a very challenging partner. Because of the high-cost pressure, the transactions need to be fast and efficient. The surplus food needs to be adapted to the specific industry needs and not vice versa. So, a lot of persuasive and persistent efforts are necessary for winning people over to an idea. Working with surpluses is currently still pioneering work and awareness in the sector itself is very low. This work also causes a lot of drawbacks for organising surplus food redistribution. Without personal commitment and authenticity, it can hardly be maintained.

A large product and service portfolio: The ability to offer products in different aggregate states (i.e., pulp instead of raw) and different packaging sizes (i.e.,200 l barrels or 10 l boxes) is beneficial when looking for potential receiver organisations. Food processors are therefore key network partners.

Dynamic but stable network of business partners: Trust and willingness to cooperate are essential in setting up a functioning network of partners that may provide surplus and services? and take over surplus food in short time notice. A sustainable network between supply and demand of surplus food is the basic requirement of fast and efficient redistribution. The intermediary organisation such as UNV

Marketing strategy: Maintaining a network and acquiring new partners require a good marketing strategy. The good thing is from a marketing point of view that food waste has still limited awareness, but it easily generates attention in media. There is great interest in the UNV business concept that leads to a lot of press inquiries (about 1-3 enquiries of media outlets every week for stories, videos, articles etc.). This stipulates attention and generates additional marketing for the concept.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Inclusion of larger companies in the network: The acquisition of large companies that may buy large amounts of processed (or fresh) surplus food facilitates the planning and the matching between supply and demand. The repetition of product transfers in particular is a success factor. If initial hurdles have been overcome and a process can be established for recurring deliveries, then large quantities can be processed quickly. The effort for the first delivery is extremely high (synchronisation of specifications, requirements for the delivery, inclusion in the supplier pool, etc.), after that it is quick and easy. Getting a large retail chain as client was a big milestone for UNV that increased the amounts of transferred food from a few tons per case to 10 to even 30 tons per case.

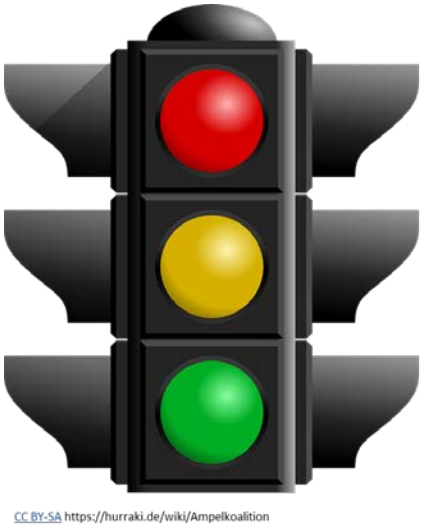
The redistribution of surplus food in larger quantities clearly differentiates the UNV business concept from social (non-profit) organisation. While social organisations can usually only accept small quantities of perishable food (because they have no processing facilities and can only cook in small kitchens), UNV only accepts larger quantities (1,000 kg or more). Larger quantities make the processing more profitable and ensure a more stable business environment for buyers.

Clear communication on product specifications and product condition: A quality management protocol was established by UNV and needs to be followed by the business partners to ensure a trade in line with the corresponding food laws.

Appropriate pricing: Transparent pricing is a basic requirement for successful trade. As the price for surplus food is orientated on the actual market price and the condition of the offered food product, it is challenging to determine the price. The market price needs to be determined first and then a reduction (about 20-40%) is given based on the level of condition, type and shapeof the product. To facilitate this process, UNV invented a classification system (see Figure 2).

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Figure 2 – Classification of surplus food in a traffic light system ranging from A-grade surplus products (green colour) to excluded surplus food (red colour) (invented by Unverschwendet GmbH, Status 2023, illustration by BOKU)



Food not suitable for human consumption

Edible surplus food with gross defects
.... that is still edible but cannot be sold as fresh food because of gross defects or advanced degree of ripeness; they can still be processed.

Fresh surplus food with light defects
... that is edible, but is not accepted at retail market due to light defects (e.g. defective skin).

Fresh surplus food without defects
... that do not fulfil specifications of the retail market (e.g. some millimetres or grams too less or too much), but can be sold as fresh fruits on markets or smaller shops.

A-grade surplus food
... that would be suitable for the retail market, but the available amount succeeds the demand which is surplus.

7. Which effective solutions can be implemented to overcome barriers?

Organisations acting as intermediaries for surplus food redistribution can come across a range of barriers. These are the barriers and solutions identified by UNV business concept:

Unpredictable quantities: Although business cooperation on the supply side is quite stable (clients who distribute once to UNV, often do so in future), the quantities are not regular. So, the difficulty when economically redistributing surplus food is to predict types and amount of surplus food to distribute. However, this is of great importance to find clients on the demand side. So, UNV switched from rather small receiving organisations, such as restaurants, to larger receiving organisations, such as processing industry (see success factor in chapter 6 “Acquisition of large companies”).

International disruptions influencing the market: The war in the Ukraine and the related energy crisis in 2022 influenced the quantities transferred. An increased amount of food that did not find a market was observed during this period, that led to an increased demand for intermediary organisation such as UNV (see Box 5). The ability of UNV to act fast and flexible and to resort to a stable network of business partners was beneficial during these difficult times.

LOWINFOOD has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101000439.

Box 5: Example from practice – External factors

How the war in the Ukraine and the energy crisis influenced the surplus food redistribution in 2022?

The war in Ukraine caused damages to facilities in the areas involved in the conflict, such as a glass factory, which led to a shortage of glass packaging. Large food industry companies are not flexible enough to change the type of glass/bottle that their customers are used to. Consequently, fruit and vegetable juice manufacturers had problems selling their products without sufficient packaging. This led to increased requests to UNV by asking for appropriate business partnerships which could use processed food in large containers.

The energy crisis in summer 2022 followed by the price increase, led to changes in consumer preferences (e.g. cheap meat and eggs instead of premium meat and eggs) and consequently to unpredictable sales quantities. This led to an increase of surplus of mainly premium products (e.g. organic products: the market for organic products decreased by 40% in that period). The cooperation of all existing intermediary organisations, such as food banks as well as UNV, was essential in this situation. Despite the situation, UNV was not able to apply a larger price reduction than usual, because everyone was even more price sensitive at the time due to the chaos on the market and increased costs for energy.

High standards in specific business segments: The norms and standards at kitchen canteens hindered a direct and economically feasible distribution of surplus food to food service sector. Additionally, surplus food of animal origin needs to be traded with stricter hygiene requirements which increases the efforts of redistribution that affect the price and thus diminish the number of potential receiving organisations. These business segments are at the moment not economically feasible and therefore not considered in the UNV business concept.

Conflicting interests: There is the risk of competing with social organisations (such as food banks) that redistribute surplus food to people in need. Therefore, UNV holds good contacts to social organisations and if FBOs give away their food surplus for free and a transport can be organised by the social organisations, it is donated to them rather than sold to UNV.

Additionally, there is a risk that FBOs sets up a new business segment for surplus food at reduced price that leads to higher amounts of surplus food rather than trying to diminish it. UNV wants to ensure that their business area deals only with real food surplus. They want to provide food suppliers with a fair price for their efforts, but on the same time do not want to compete with market prices. UNV elaborated a code of honour for their business that needs to be signed by FBOs providing surplus food.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Customer acceptance: A prerequisite that products can compete on the market are the consumer preferences. The growing desire for sustainable practices and goods can accelerate market acceptance of products made from surplus food.

Rejecting offers: As surplus food can only be redistributed economically if a receiving organisation can be found in good time because of lacking or costly storage capacity, it can happen that more surplus food is offered than can be accepted. These rejections may affect business relationships. An open exchange with business partners and trust are therefore of upmost importance. A careful maintenance of business contacts is key in the UNV business concept. A lot of efforts are therefore dedicated to fostering the network (see chapter 6).

Logistics and storage: Logistics and storage (especially cooling or freezing units) are currently the main drivers of the price (often more than the value of the goods). So, UNV is interested in making use of existing logistic systems of their clients. Suppliers often deliver the food directly to the customer in the course of their regular transports (e.g. farmers deliver one to two times per week to Vienna, so they take also surplus food to customers). If suppliers cannot arrange the transport, UNV deals with forwarding agents Storage areas are rented, if needed.

8. What are the benefits of surplus food redistribution in this business concept?

The production of food requires the use of resources such as fuels, land, water, and raw materials that have associated economic and environmental impacts. A major source of impacts are agricultural processes such as fertilizer application, which creates direct emission of nitrous oxides from soil processes. In combination with the energy and fuel used for processing, transport, storage, and cooking of food, this contributes to climate change.

When food is wasted, all the efforts related to its production, processing, and transport along the food supply chain (FSC) are in vain. Greenhouse gas (GHG) emissions, such as carbon dioxide, methane, and nitrous oxides (measured in CO_2 equivalents, CO_2e), occur in the FSC from the burning of fossil fuels, from enteric fermentation of ruminants, or from agricultural practices. It is estimated that 186 million tonnes CO_2 equivalents (CO_2e) can be attributed to food waste in Europe (Scherhaufer et al., 2018). This equals to the yearly national GHG emissions of the Netherlands (2022, 170 million tonnes CO_2e).

When surplus food is redistributed instead of wasted, emissions can be reduced. The surplus food redistributed replaces food that was meant to be purchased by consumers and thus saves emissions from the FCS of the replaced product (e.g. if surplus apricots can be used to make jam, they can replace apricots from primary production for making jam). It is assumed that the quantity that is consumed stays the same, so the same quantity is replaced.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

The overarching goal of the European climate plan is to limit the rise in global temperature below 2° C. To reach this goal, each member state must drastically decrease its GHG emissions. One possible strategy is food waste prevention, in this case through the redistribution of surplus food. Box 6 shows an example when 1 ton of surplus apricots are redistributed within the UNV business concept.

Box 6 – GHG savings due to the redistribution of surplus apricots for jam production (simplified calculation by BOKU using aggregated LCIA data from Agribalyse 3.1 and Ecoinvent EF 3.1)

How much GHG emissions could be saved with UNV business concept?

Apricots which cannot be sold on the market are surplus apricots. Through the UNV business concept these surplus apricots are transformed into jam. This reduces the amount of fresh products from primary production needed for jam production. Thus, saves emissions from agricultural production of fresh apricots (around -230 kg CO_2e/t jam). Additionally, emissions from waste management practices can be prevented, as food that is saved from being wasted, e.g., it does not need to be composted (around -80 kg CO_2e/t biowaste for composting and application of compost incl. credits for nutrient supply). On the other side, the additional efforts of redistribution need to be accounted: e.g., transport from source of surplus to manufacturing plant (around 10 kg CO_2e/t jam). The emissions add up to approximately -300 kg CO_2e. Negative environmental impacts imply that more credits than emissions can be accounted in this case study. Thus, 300 kg CO_2e can be saved when producing 1 ton jam out of surplus apricots. If jam consists of 75% of apricots, the following quota applies:

CC BY Unverschwendet GmbH

➔ Due to food redistribution of 1 ton surplus apricots for jam, around 230 kg CO_2e can be saved. This equals to 610 km driven by a passenger car.

More results on the enviornmental performance of the UNV business concept as well as the social and economic impacts and the efficacy will be published in LOWINFOOD deliverables of WP1 in October 2024.

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

9. References

Agribalyse 3.1: French agriculture and food database. Ademe, Angers, France.

BMEL (2022): Leitfaden für die Weitergabe von Lebensmitteln. www.zugutfuerdietonne.de

BMG (2017): Hygiene-Leitlinie. https://www.verbrauchergesundheit.gv.at/Lebensmittel/buch/hygieneleitlinien/LL_Grosskuechen__Kuechen_des_Gesundheitswesens.pdf?96txa3 . accessed on 29th January 2024.

Crenna, E., Sinkko, T., Sala, S., 2019. Biodiversity impacts due to food consumption in Europe. J Clean Prod 227, 378-391.

Commission Implementing Regulation (EU) No 208/2013 of 11 March 2013 on traceability requirements for sprouts and seeds intended for the production of sprouts Text with EEA relevance.

Commission Implementing Regulation (EU) No 931/2011 of 19 September 2011 on the traceability requirements set by Regulation (EC) No 178/2002 of the European Parliament and of the Council for food of animal origin Text with EEA relevance

Ecoinvent EF 3.1: Ecoinvent database 3.10. Ecoinvent, Zurich, Switzerland

European Commission (2017), EU guidelines on food donation, OJ C 361, 25.10.2017, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C_.2017.361.01.0001.01.ENG&toc=OJ%3AC%3A2017%3A361%3ATOC Accessed on 29th January 2024

European Commission (2020): Brief on food waste in the European Union. The European Commission's Knowledge Centre for Bioeconomy

EU Factsheet (2007): Food Traceability. https://food.ec.europa.eu/system/files/2016-10/gfl_req_factsheet_traceability_2007_en.pdf. Accessed on 29th January 2024

EU FLW platform (2019a): Recommendations for Action in Food Waste Prevention. Developed by the EU Platform on Food Losses and Food Waste. https://food.ec.europa.eu/document/download/7143f94e-600f-4df5-acef-5b332e7e44ec_en?filename=fs_eu-actions_action_platform_key-rcmnd_en.pdf. Accessed on 8th February 2024.

EU FLW platform (2019b): Redistribution of surplus food: Examples of practices in the Member States. EU platform on Food Losses and Waste. Food https://food.ec.europa.eu/system/files/2019-06/fw_eu-actions_food-donation_ms-practices-food-redis.pdf, Accessed on 29th January 2024

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.

Obersteiner, G., Hrad, M., Luck, S., Mayerhofer, J., Ottner, R. und Schmied, E. (2019) Food Losses in Austrian Agricultre and its Potential of Prevention. n: Cossu, R; He, P; Kjeldsen, P; Matsufuji, Y; Stegmann, R (Eds.), Sardinia 2019 - 17th International Waste Management and Landfill Symposium, ISBN 978-88-6265-0144/ISSN 2282-0027

Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.

Scherhaufer, S., Moates, G., Hartikainen, H., Waldron, K., Obersteiner, G., 2018. Environmental impacts of food waste in Europe. Waste Management 77, 98-113.

Schneider, F. (2011): Leitfaden für die Weitergabe von Lebensmitteln an soziale Einrichtungen. Rechtliche Aspekte. ECR-Austria. file:///C:/Users/abfuser/Downloads/leitfaden_weitergabe_lebensmittel-2.pdf. accessed on 29th January 2024

LOWINFOOD has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000439.