



HANDBOOK

reducefoodwaste

2019

Title: #REDUCEFOODWASTE Handbook

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Publisher: STREFOWA, www.interreg-central.eu/STREFOWA, www.reducefoodwaste.eu

Publication date: June 2019

Graphic design and elements: František Dečman

This project is supported by the Interreg CENTRAL EUROPE Programme funded under the European Regional Development Fund.



TAKING **COOPERATION** FORWARD

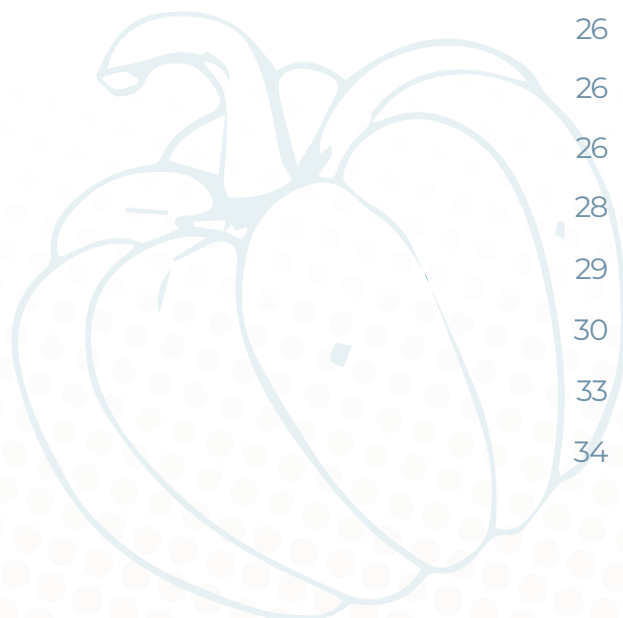
ABOUT THE PROJECT

STREFOWA – Strategies to Reduce and Manage Food Waste in Central Europe is a three-year project in Central Europe to find and design new ideas dealing with food waste. Our aim is to reduce food waste or to treat it in a better, more useful way, along the whole supply chain.

>>> reducefoodwaste.eu

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A. INTRODUCTION

The lifecycle of food ideally follows a continuous circle. Food gets produced, harvested, processed, marketed, distributed, purchased, consumed and after all managed as waste. All discarded food is either spread directly on the fields or as compost and start a new cycle. This entire lifecycle is also called food supply chain, with each step in the chain represented by a separate sector: primary production, food processing & marketing, retail, food service, consumers and waste management.



Figure 1: Food Supply Chain

Along the entire food supply chain – in each step and each sector – food is wasted, e.g. on the field during harvest, broken or spilled in the processing, left over in retail and food service and not consumed by final consumers. Food waste is therefore not a problem of one single sector; it is rather the cumulative effect of interlinked conditions. As the sectors often work hand in hand and interact in many ways there is a high potential to tackle the problem of food waste. Solutions encompassing several sectors or even across the entire food supply chain should be considered. Food, which might not be able to be used in one sector, could be an interesting resource for another one. This cross-sectoral cooperation is a core aspect within this handbook.

THE HANDBOOK AIMS TO:

- show internal and external reasons and problems causing food waste in each sector;
- point out the individual responsibility and possible approaches among each sector and by cross-sectoral cooperation;
- summarize transnationally approved solutions.

All presented information, sector specific and cross-sectoral, shows possible solutions how food can be used and treated instead of being wasted.

THIS HANDBOOK IS WRITTEN FOR ANY PERSON, WHO:

- is aware of the issue of food waste;
- wants to deal with food waste;
- wants to learn about new approaches;
- wants to improve his/her impact.



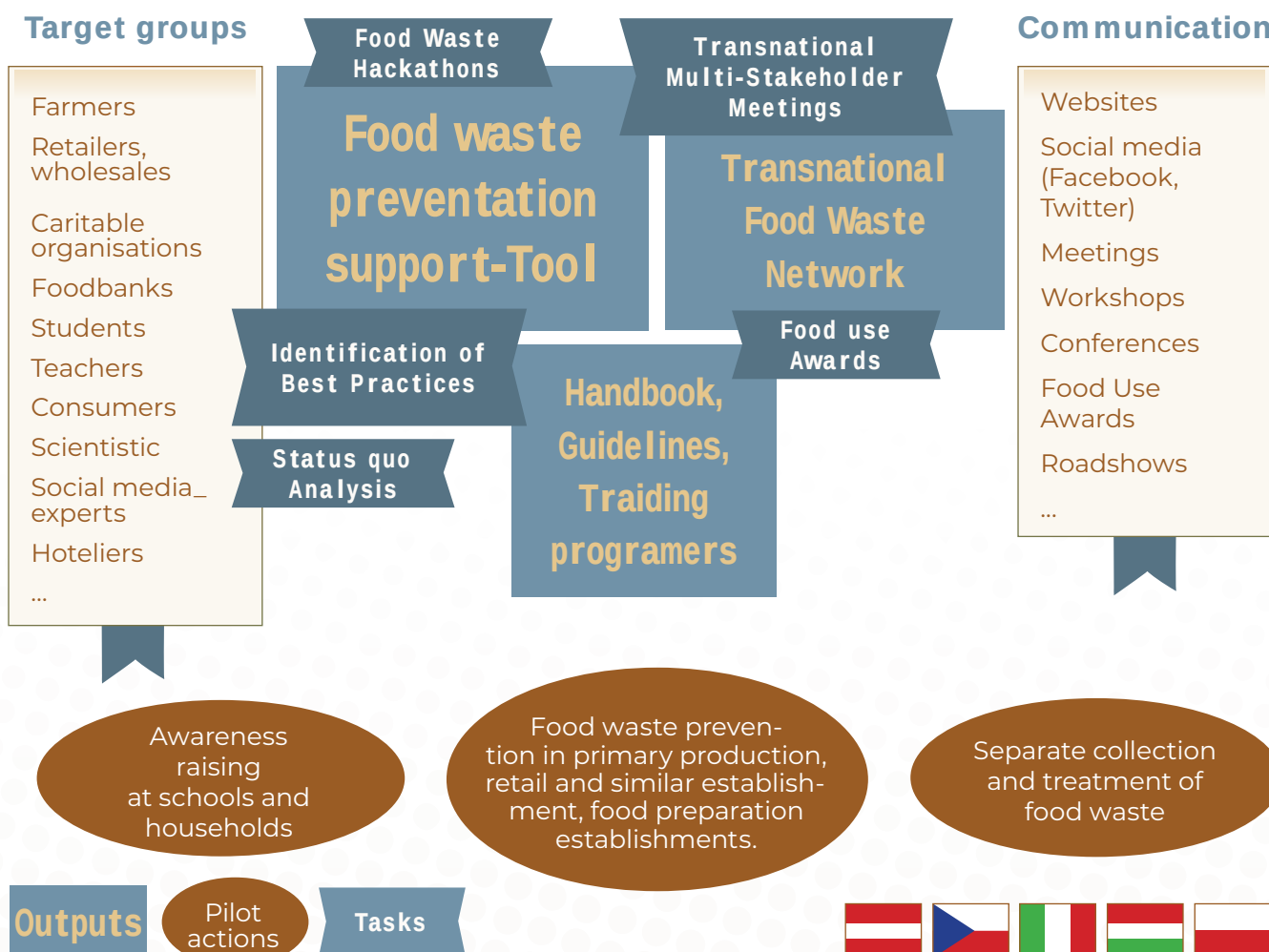
ABOUT STREFOWA

>>> interreg-central.eu/STREFOWA >>> reducefoodwaste.eu

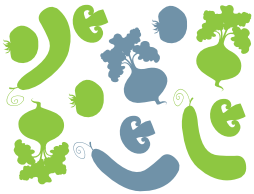
Strefowa (**S**trategies to **R**educe and **M**anage **F**ood **W**aste in Central Europa) is a three-year project implemented in the Central Europe region funded by the Interreg CENTRAL EUROPE Programme that encourages cooperation shared challenges in central Europe. Therefore nine partners in five different Central Europe Countries (Austria, Hungary, Poland, Czech Republic, Italy) are working together. The aim is to reduce food waste or to treat it in a better, more useful way as well as to connect relevant actors in order to achieve a reduction of environmental impacts (e.g. GHG emissions) along the whole supply chain.

The most relevant outputs of this project are:

- **Food waste prevention support** – Tool (<https://tool.reducefoodwaste.eu/#/>)
Based on best practice examples and project outcomes, a tailor-made web based software tool provides specific information for different stakeholder groups to prevent and treat food waste.
- **Implementation of Pilot and Demonstration Action**
Food waste prevention measures as well as the feasibility of food waste separation and separate collection have been tested and evaluated within 16 pilot actions taking place in different partner countries. Newly acquired knowledge will now be accessible for others.
- **Establishment of an appropriate Transnational Stakeholder Platform**
Stakeholders that are willing to work together are identified and connected through a Transnational Stakeholder Platform.
- **Best Practice Guidelines and Training Programmes**
Guidelines and training programmes in regard to prevention, reduction and treatment of food waste have been developed and tested for relevant stakeholder groups along the food supply chain. They are based on current scientific findings and best practice examples.



About The Food Waste



Food waste

20 % of food produced for human consumption (= **88 million tonnes of food**) is wasted in Europe, while 795 million people globally suffer from hunger.



Food waste also amount to a major squandering of resources, including **water, land, energy, labour and capital** and needlessly produce **greenhouse gas emissions**, contributing to **global warming and climate change**.

4 % of EU-28 greenhouse gas emissions (GHGs), or **186 million tonnes per year** are due to food waste – carbon footprint of food.



34%



21%



21%

..... **4%**



Food wasted by consumers

in Europe
and North America

95–115 kg / year / person

in Sub-Saharan Africa
and south eastern Asia

6–11 kg / year / person

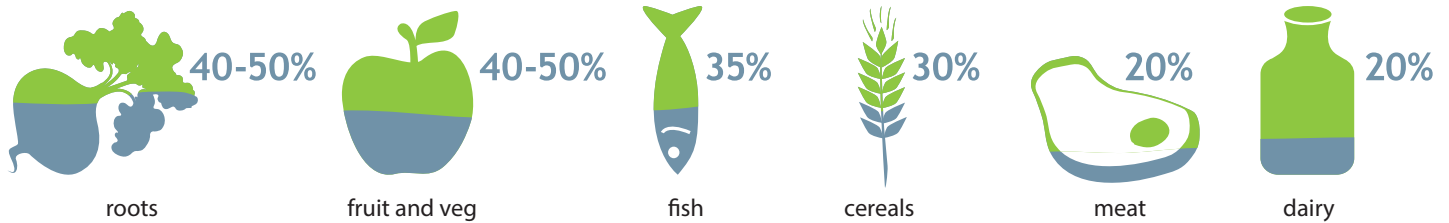


US\$ 680 billion

US\$ 310 billion

Food is lost or wasted throughout the food supply chain, from initial agricultural production down to final household consumption. **Food losses** in developing countries are more than **40 % at postharvest and processing levels**, in industrialized countries more than **40 % occur at retail and consumer levels**.

Global quantitative food losses and waste per year



Food Waste in Europe



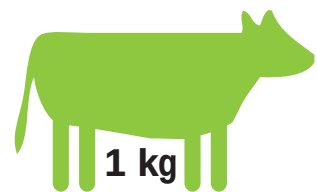
Resources are not infinite



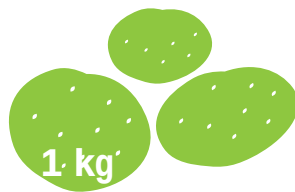
water: 3.8 trillion m³ of water are now withdrawn for human use each year (1.5 billion Olympic sized swimming pools)

70% is taken by the agriculture sector

- production of 1 kg of beef requires 15,415 litres of water
- 1 kg of potatoes – 287 litres of water
- 1 kg of apple – 822 litres of water
- between 500–4,000 litres of water are required to produce 1kg of wheat vs. 5,000–20,000 litres to produce 1kg of meat



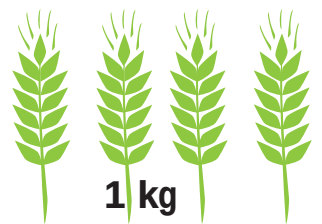
5,000-20,000 L



287 L



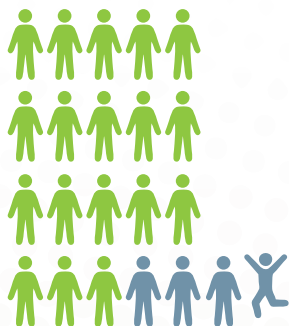
822 L



500-4,000 L



3 cal



land: 50 % of the available suitable land is already appropriated. One hectare of land can produce rice or potatoes for 19–22 people or lamb or beef for 1–2 people per annum.



35 cal

energy: 7–10 calories of input in the production = one calorie of food – depending on crop – from 3 calories for plant crops to 35 calories in the production of beef

ABOUT FOOD WASTE

What is food waste?

Food is defined as any substance — whether processed, semi-processed, or raw — that is intended for human consumption including any substances that have been used in the manufacture, preparation, or treatment of food excluding drinks.

Inedible parts = unavoidable food waste refers to components associated with a food that in a particular food supply chain are not intended to be consumed by humans. This is food thrown away that has not been edible under normal circumstances for most of the inhabitants. Examples could include bones, rinds, or pits/stones. Contrary Avoidable food waste is coming from originally edible parts.

Food waste(including food loss) refers to food as well as associated inedible parts removed from the food supply chain. That means they are not used for normal human consumption.

Inedible parts (Bones, skins...)	Non-avoidable
Preparation residues (skins, ...)	Non-avoidable
Consumption residues	Avoidable
Partially consumed food	Avoidable
Entirely uneaten food (as purchased, whole, unopened)	Avoidable



B. STRATEGIES TO REDUCE AND MANAGE FOOD WASTE



For VEGETABLE & FRUIT FARMERS

FACTS & FIGURES OF FOOD WASTE

Quantifying the exact amount of discarded food originating from primary production is not possible based on current knowledge. Recent assumptions can range from 25 % to 30 % of the total food production (FAO, 2013) or from 10 % to 50 % of the production of one specific food item (Mutter Erde, 2017). A significant part of this waste would have been appropriate for human consumption – this part is categorised as avoidable food waste and important for the further discussion.

The discarded crops have different levels of quality, including class I and class II crops, crops which don't meet marketing standard because of size, shape or colour, and crops affected by pests or diseases. On the farm level the number of discarded crops varies significantly and can range from "hardly any" to almost 100 % of the crop yield. The predominant cause for this variability is the unpredictability of surplus crops, influenced by variables which can be only partially controlled, such as the seasonality of weather, outbreaks of pests and diseases, market constraints, etc.

Consequences and problems

Based on new studies the primary production is responsible for about 10 % of all food waste in the EU 28 (Fusion, 2016). Looking more closely at this sector worldwide, it becomes clear that most of it is cereals, roots & tubers, and fruits & vegetables (FAO, 2011).

Introduction |

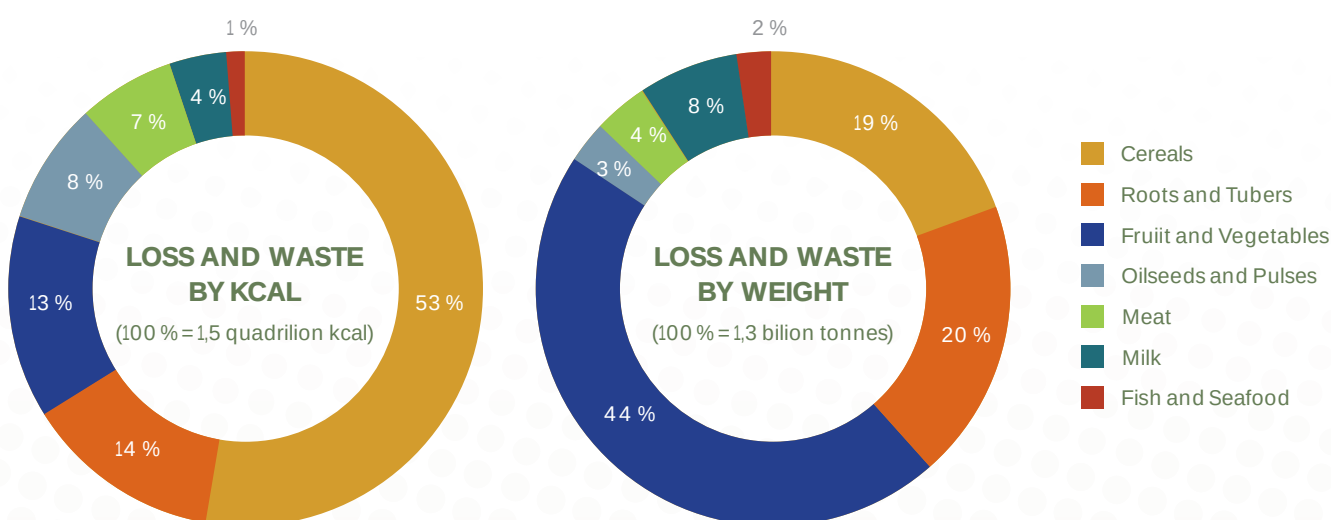


Figure 2: Global food losses and waste (FAQ, 2011)

Up until the turn of the millennium, food waste from primary production was mainly fed to livestock, largely to pigs and poultry. With the enforced feed ban of animal products in 2001, this has been restricted and the import of soya has increased significantly. In the best-case scenario, the discarded vegetable products still can be used as animal feed. If that is not impossible, it should be used for biogas generation or compost. It is only possible to leave a surplus of vegetables on the field and plough them under, as this can cause over-fertilization, create too much biomass in the soil and can lead to rot or large amounts of spores and funguses can enter the soil.



reasons

WHY PARTS OF PRODUCE ON FIELD AND FARM GET NOT USED FOR HUMAN CONSUMPTION



PRODUCE DOESN'T MEET QUALITY CRITERIA OF MARKETING AND HYGIENIC STANDARDS OR CUSTOMER'S REQUESTS



MARKET IS SATURATED BECAUSE OF OVERPRODUCTION OR NEW FOOD TRENDS



PRODUCE IS DAMAGED ON THE FIELD, DURING TRANSPORT, PROCESSING AND STORAGE



PRODUCE DOESN'T GET FULLY HARVESTED DUE TO INEFFICIENT HARVEST OR ECONOMIC REASON

avoiding and managing strategies

HOW TO USE MORE OF ALL PRODUCE FROM FIELD AND FARM

CHECK YOUR PRODUCTION, PROCESSING, HARVESTING AND STORAGE METHODS IN ORDER TO AVOID DAMAGE OR LOSSES AT FIELD AND FARM

ESTABLISH NEW MARKETING CHANNELS TO SELL YOUR PRODUCE

DEVELOP NEW PRODUCTS BY PROCESSING YOUR UN-SELLABLE PRODUCE
either on your farm or in cooperation (farmers' association)

ESTABLISH A FARMER-PLATFORM AS DISTRIBUTION COOPERATION AND/OR EXPERIENCE EXCHANGE

ADAPT YOUR RANGE OF PRODUCTS, RESPOND WITH CUSTOMER DEMAND

MAKE PRODUCE AVAILABLE AT YOUR OWN FACILITY FOR CONSUMPTION OR DISTRIBUTION TO EMPLOYEES

DONATE YOUR UNUSED PRODUCE TO LOCAL FOODBANKS OR SOCIAL INITIATIVES

LET PEOPLE GLEAN YOUR NOT-HARVESTED PRODUCE

RAISE AWARENESS ABOUT THE TOPIC BY COMMUNICATING THE VALUE OF FOOD TO YOUR CONSUMERS AND/OR EXPERIENCE EXCHANGE

HOW TO USE FOOD THAT CAN'T BE AVOIDED FROM BEING WASTE:

UTILIZE UNUSED PRODUCE AS ANIMAL FEED

e.g. by getting in cooperation with other farmers that use unused produce as animal feed

PREPARE AND USE COMPOST

at your farm or in cooperation with other farmers to produce high value fertilizer

USE FOOD WASTE AS SUBSTRATE FOR BIOGAS PRODUCTION AT BIOGAS PLANTS

in order to produce fertilizer, power, heat and/or fuel

TRAINING PROGRAMME

Quantifying the exact amount of discarded food originating from primary production is not possible based on current knowledge. Recent assumptions can range from 25 % to 30 % of the total food production (FAO, 2013) or from 10 % to 50 % of the production of one specific food item (Mutter Erde, 2017). A significant part of this waste would have been appropriate for human consumption – this part is categorised as avoidable food waste and is important for the further discussion.

The discarded crops have different levels of quality, including class I and class II crops, crops which don't meet marketing standard because of size, shape or colour, and crops affected by pests or diseases. On the farm level the amount of discarded crops varies significantly and can range from "hardly any" to almost 100 % of the crop yield. Predominant cause for this variability is the unpredictability of the surplus crops, influenced by variables which can be only partially controlled, such as the seasonality of weather, outbreaks of pests and diseases, market constraints, etc.

Objective

- Understand food waste / unused food: kind, origin, reasons, quantities and associated consequences – considered across the entire value chain
- Reflection of own farm, collection and recording of own situation: potential problem areas and possible suggestions for improvement
- Introduction to various approaches to tackle food waste

Target group

- active and future fruit and vegetable farmers

Proven Training materials

Description and further materials on the proven training programme and educational lesson are available on: <http://www.reducefoodwaste.eu/training-primary-production.html>



IMPROVE YOUR DAILY BUSINESS AND

reducefoodwaste

For
RETAIL

FACTS & FIGURES OF FOODWASTE

Due to globalization of the market and changing lifestyles as well as consumer's behaviour, the demand for butcher's meat, fruits, vegetables and other rapidly perishable products is increasing. Therefore, the food chain has gradually become more complex over the past decades.

Despite the inconsistent data situation, food waste is present in all areas of the food supply chain with visible impacts. It is estimated that one third of the food produced globally for human consumption gets lost or wasted every year (FAO, 2011). The retail sector is responsible for approximately 5 % of the total food waste generated in Europe. However, the responsibility of the retail sector is bigger than their food waste rate shows since retailers can indirectly affect the increase or decrease of food waste amounts in other sectors as well.

The interest of all retailers has to be waste prevention – which refers not only to food waste. This should be a priority throughout all departments in the retail food chain. Retail can contribute to food waste prevention already in the purchasing department e.g. by not focusing too much on perfect produce in terms of size or form – this avoids food waste in the agricultural sector. An increase in donation capture rates could be accomplished with establishing active donation programs.





The last possibility is proper waste management and food utilization. This depends on specific conditions; nonetheless many methods of food processing are available: recycling, composting, biogas utilisations, etc. Food waste generates considerable costs for all actors of the food supply chain. It is necessary to look for the best opportunities that both increase profits and reduce the amount of food waste at the same time. Food waste is a tangible, highly visible problem gaining public attention. It affects retailers' reputation with customers, employees, and investors, and can impact retailers' brands (Rethink food waste (ReFED), 2018). Therefore, consumer education campaigns should be given special emphasis by retailers.

In the retail sector, the highest amount of food waste results from unpackaged food. These foods – mainly vegetables, fruits and bakery products – are more influenced by physical, chemical, microbiological contamination and varying temperatures along the distribution, storage and sale chain. However, the option to sell the unpacked fruits and vegetables to further actors of the market may lead to food waste reduction in the retail sector because of different handling of the products and storage requirements (e.g. shelves containing food are not exposed to light and warmth).

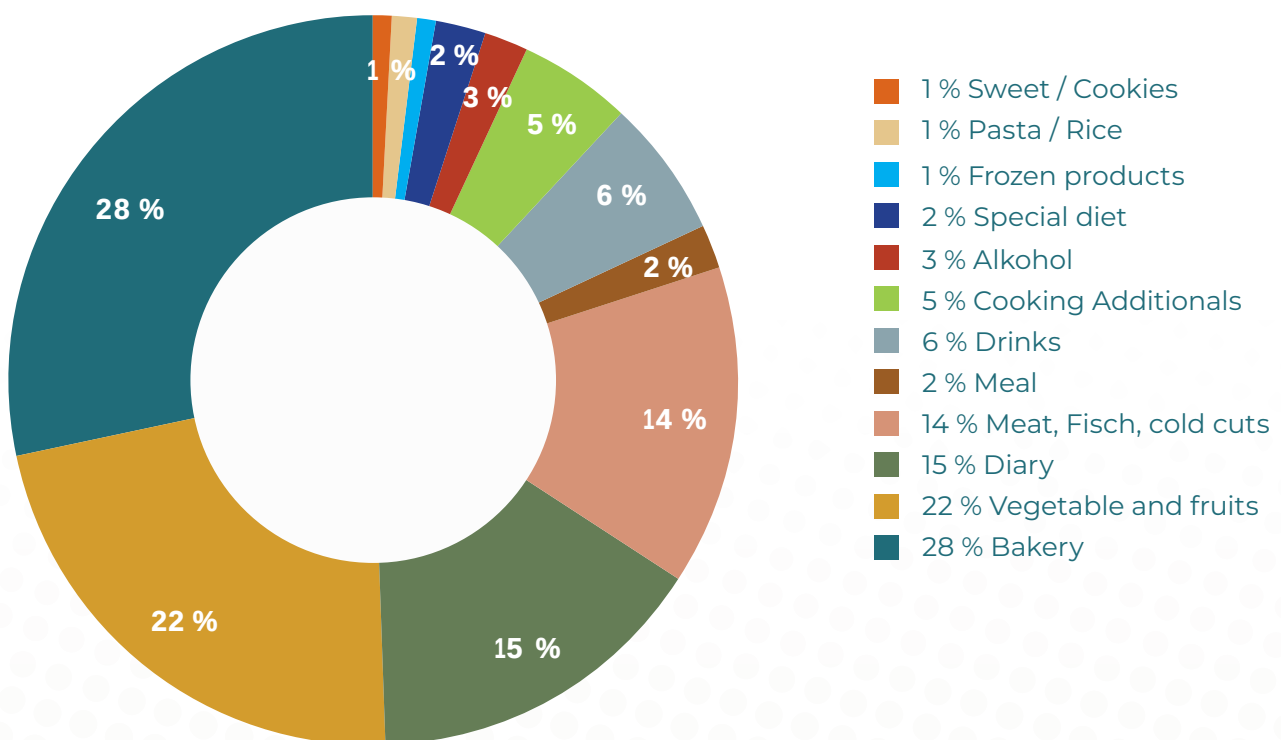


Figure 3: The composition of the food waste at retailers (source: TESCO)

reasons

WHY FOOD IS WASTED FROM RETAIL SECTOR INSTEAD OF BEING SOLD



HIGH QUALITY CRITERIA PASSED ON TO SUPPLIERS



MARKETING REASONS AS PRODUCTS HAVE TO BE AVAILABLE



PROBLEMS WITHIN LOGISTICS, COOLING CHAIN AND STORAGE



REJECTION DUE TO BAD PACKAGING, IMPROPER LABELLING, PRODUCT LINE CHANGE



INEFFICIENT INVENTORY MANAGEMENT SYSTEM



LACK OF AWARENESS OF THE SUSTAINABLE USE OF UNSOLD FOOD/ DONATIONS

avoiding and managing strategies

HOW TO REDUCE FOOD WASTE IN RETAIL

TRANSPORTATION - Choose the best possibilities of routing and donation

DO A GOOD PLANNING

UPGRADE THE IT SYSTEM AND KEEP TRACK ON THE EXPIRATION DATES

MEASURE IT! - Enhance demand forecasting

REDUCE HANDLING OF GOODS

SET UP AN ONLINE SUPERMARKET to reduce handling of goods

COLD CHAIN MANAGEMENT - Organize and optimize storing perishable products

FURTHER PROCESSING OF FRUITS AND VEGETABLES AT THE POS
(e.g. fruit salad, sliced vegetables)

APPLY THE "FIRST IN-FIRST OUT PRINCIPLE" (FIFO)

DO SPECIAL OFFERS FOR PRODUCTS NEAR THE BEST BEFORE DATE

EDUCATE YOUR EMPLOYEES AND YOUR CONSUMERS

HOW TO REDUCE FOOD WASTE IN COOPERATION WITH OTHER SECTORS

DONATE FOOD
(e.g. to food banks)

COOPERATE WITH SMALL BUSINESSES IN ORDER TO MAKE NEW PRODUCTS
(e.g. cooking a dish/day, making smoothies, juices, jams, etc.)

SUPPORT EMPLOYEES
Offer unsold food to employees to eat in place and/or take it home

TRAINING PROGRAMME

It is estimated that global food production loss ranges between 20–30 % and the retail sector is responsible for approx. 5 % of the total amount of wasted food (FAO, 2013). Since the retail sector has an opportunity to indirectly affect food waste amounts in other sectors as well, the responsibility of the retail sector is higher than its rate. An important thing to understand is that in this case not only food is being wasted. Consequently, food waste has a huge environmental impact on CO² emissions, resource's use, energy consumption etc. Finally, direct and indirect economic costs caused by discarded food should be considered.

The main purpose of this training is to decrease the amount of food waste in the hypermarket for a long period of time.

Objectives

- Help shop workers to understand food waste and food loss: kind and origin, reasons that cause wastage of food, quantities, associated consequences and benefits of food waste reduction
- Provide knowledge on the “hot spots” – what food group is wasted in the highest amounts, where and why food waste is generated, what are the main logistic steps where food waste can be generated
- Introduce various solutions to tackle food waste
- Food tasting – understanding of the issue by food tasting
- Raise awareness & reduce food waste in stores

Target group

- Employees of hypermarkets: head of department, sellers, warehouse workers, shop assistants, etc.

Proven Training materials

Description and further materials on the proven training programme and educational lesson are available on: <http://www.reducefoodwaste.eu/training-retail.html>

IMPROVE YOUR LOSS RATIO AND #reducefoodwaste

For FOOD SERVICE

FACTS & FIGURES OF FOODWASTE

The food service sector turned out to be one of the largest producers of food waste after households. An Austrian study investigated the amount of food waste created in different types of food service outlets, including restaurants, hotels, workplace canteens and healthcare centres. The ratio between the amount of avoidable food waste and the food consumed (level of efficiency) ranged between 3 % to 46 % in all companies. Healthcare centres showed significantly higher loss ratios (median 27 %) compared to hotels (median 18 %), restaurants (median 13 %) and workplace canteens (median 13 %). Highest loss ratios have been detected in the catering industry with 36 %.

It also turned out that there are differences concerning the composition of food waste between different sectors. The observed preparation loss was substantially low in healthcare centres which might be due to increased use of convenience food. On the other hand, the share of leftovers on the plate showed the highest level (59 %). In the case of hotels, a rather high share of leftovers from the buffet table and preparation loss could be recognised. Restaurants also revealed low levels of food loss caused by unserved meals (10 %). However, the share of food loss during kitchen preparation (48 %) showed the highest level. In workplace canteens, the main causes of food waste were kitchen leftovers resulting from overproduction (34 %) and plate waste (30 %). Also, differences we detected in the composition of product groups found in waste. E.g. in healthcare centres avoidable food loss consisted to a large extent of soup, in workplace canteens a high proportion of starch side dishes could be recognised.

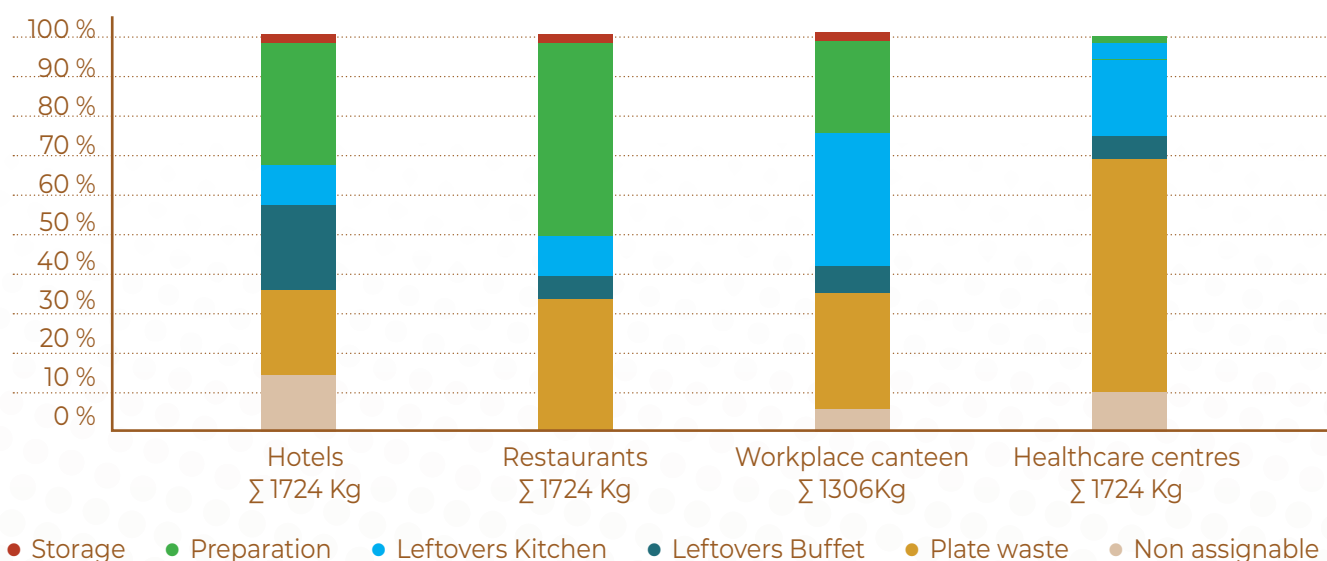


Figure 4: Food loss sorted by the area of origin across business types

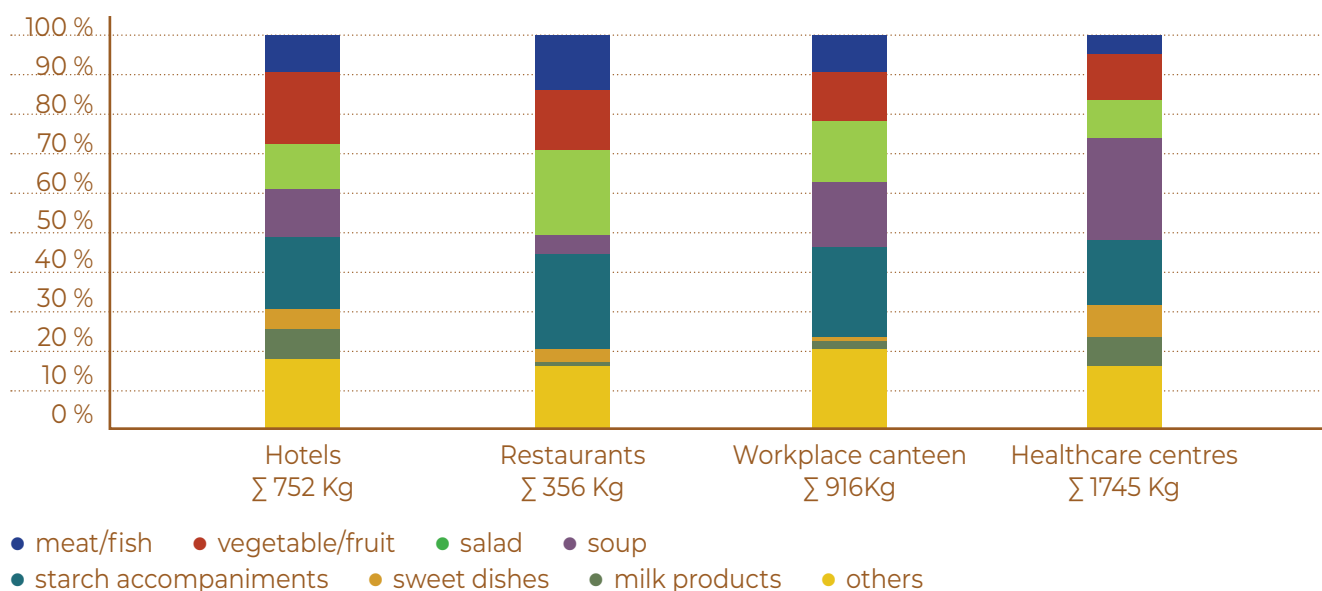


Figure 5: Composition of avoidable food waste across business types

Figure, 4 and 5 show the composition of avoidable food waste (without unavoidable preparation loss) across various business types. Residues of fruit and vegetable waste as well as food loss from starch side dishes are a particularly important issue in hotels (in each case 18 %). When compared to the other food service sub-sectors, restaurants and workplace canteens showed large quantities of food waste originating from starch side dishes (25 % and 23 %), meat and fish (16 % and 12 %) and salad (21 % and 16 %). In healthcare centres avoidable food loss consisted to a great extent of soup, while meat and fish had the lowest share.



reasons

WHY FOOD IS WASTED IN THE SERVICE SECTOR INSTEAD OF BEING EATEN



PURCHASE PLANNING AND STORAGE

- Not keeping track of stock
- Too big menus
- Handling of expiration dates



KITCHEN

- Too much is produced (in advance)
- High standards concerning appearance of certain products
- Lack of information between management and kitchen



LEFTOVERS BUFFET

- Hygienic regulations
- Too large containers
- Edible decoration



PLATE WASTE

- Insufficient communication between kitchen, service and guests
- Edible decoration
- Too big standard portions (especially sides)

avoiding and managing strategies

HOW TO REDUCE FOOD WASTE IN MY FOOD SERVICE BUSINESS

PURCHASE PLANNING AND STORAGE

- Work with first in first out principle
- Keep records of your purchases
- Be aware of the correct interpretation of “Best before” and “Use by” dates
- Freeze and preserve food in time
- Optimize your storage temperature

KITCHEN

- Pre-cook less
- Create new dishes
- Offer surplus food to employees
- Use innovative cooking techniques
- Improve your peeling and cutting techniques
- Offer flexible menus of the day
- Downsize your menu
- Introduce pre-ordered dishes
- Use surplus food for appetizers

BUFFET

- Adjust container size
- Renounce edible decoration

GUESTS

- Offer selectable portion sizes
- Offer a second helping for free
- Variable choice of supplements
- Improve communication between kitchen, service and guests
- Offer a Doggy Bag
- Educate your guests e.g. with information boards next to the buffet or within the menu

HOW TO USE FOOD THAT CAN'T BE AVOIDED FROM BEING WASTE

COOPERATE WITH LOCAL MARKETS AND FARMERS TO USE REJECTED OR OVERPRODUCED PRODUCE

DONATE FOOD

OFFER YOUR FOOD AT CHEAPER PRICES BEFORE CLOSING (late night offers)

TRAINING PROGRAMME

The training course aims to raise awareness among restaurateurs about the extent of food waste and the importance of preventing it: when caterers start to take concrete actions to reduce food waste the results are significant – from both an economic as well as an environmental perspective.

The training will focus on the prevention of food waste with an overview of the hierarchy of food waste in the food service sector. In particular, the training will start with information about the food waste situation at the European level and current food waste amounts and then move specifically to the case of the food service sector, discussing data on the sources of food waste, divided by different categories.

After an analysis of the causes, solutions will be proposed, starting with the prevention of waste and ending with proposals to reuse all surplus food that can still be served.

Objective

- Raise awareness among those working in the food service sector on the issue of food waste, both in its generic form, but especially in their sector
- Promote prevention of food waste at all stages of food preparation
- Encourage donation of surplus food to people in need, where such waste is inevitable or unforeseen
- Show the importance of proper separate collection of organic waste for the recovery of matter and/or energy (compost, biogas, etc.)

Target group

The training programme is aimed at those working in the food service sector. In particular, the training is aimed both at the owners of the restaurant/hotel/catering for everything related to the management, organization and staff involvement, but it is also aimed at the kitchen staff as regards the actual management of the food cooked and served.

Proven Training materials

Description and further materials on the proven training programme and educational lesson are available on: <http://www.reducefoodwaste.eu/training-food-service.html>



APPRECIATE YOUR FOOD AND #reducefoodwaste

For CONSUMERS

FACTS & FIGURES OF FOODWASTE

According to the project FUSIONS, which provided first data and specific estimates on food waste in the EU-28, the amount of food wasted along the full supply chain equals about 20 % of the total food produced in Europe. Households generate more than half of the occurring food waste. In total, that sums up to about 46,5 million tonnes each year, which equates to 173 kg per person (Stenmark et al, 2016).

Household food waste is especially hard to measure because there are different disposal paths that must be considered. Food waste gets disposed of through residual waste or organic disposal, but will also be home-composted, fed to animals or just be disposed of through the sewer system. It is estimated that about 75 % of household food waste in the EU- 28 member states ends up in municipal waste streams while 25 % will be disposed via other paths (Stenmark et al, 2016).

There are no existing reliable figures for all European countries. An analysis conducted in Austria for example shows that up to 25 % of the residual waste is organic waste. In Austria, the most frequently wasted product groups are bread and pastry, fruits and vegetables and dairy products. Further existing studies concur, showing that the composition of food waste in other European countries is similar (Jörissen et al, 2015).

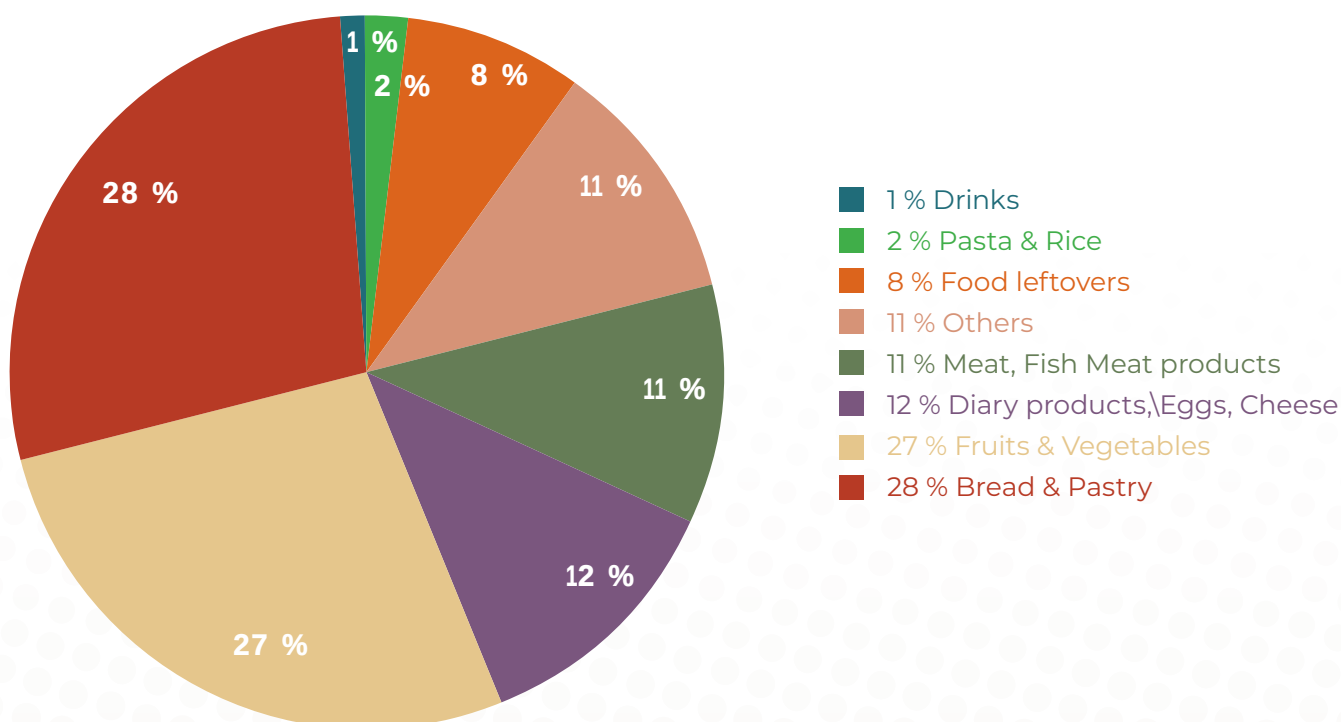


Figure 6: Composition of avoidable food waste in Austria (Schneider et al, 2012)

reasons

WHY FOOD IS WASTED IN HOUSEHOLDS INSTEAD OF BEING EATEN



NOT KEEPING TRACK OF STOCK AT HOME



SHOPPING BEHAVIOUR (BUYING TOO MUCH, NOT STICKING TO A SHOPPING LIST)



TOO MUCH PREPARED, COOKED OR SERVED



NO IDEAS FOR COOKING (ESPECIALLY WHEN DEALING WITH LEFTOVERS)



WRONG STORAGE / TREATMENT OF FOOD E.G. IN FRIDGE



INCORRECT INTERPRETATION OF SELL-BY / BEST BEFORE DATE



MISSING KNOWLEDGE ABOUT PRESERVING METHODS



LACKING AWARENESS AND KNOWLEDGE ABOUT ENVIRONMENTAL AND SOCIAL IMPACTS OF FOOD WASTE

avoiding and managing strategies

HOW TO REDUCE FOOD WASTE AT HOME

KEEP TRACK OF THE FOOD YOU HAVE AT HOME

SHOP SMART!

- Plan your meals
- Buy less more often
- Use a shopping list
- Don't shop hungry
- Be careful with special offers

COOK SMART!

- Cook the right amount
- Create creative dishes out of your leftovers
- Eat your leftovers

EXTEND YOUR FOOD'S SHELF LIFE

- Store food correctly
- Preserve and freeze it, if necessary

DON'T BE CONFUSED BY EXPIRY DATES - TRUST YOUR SENSES!

SHARE YOUR SURPLUS OF FOOD E.G. BY JOINING/FORMING SHARING INITIATIVES

HOW YOU CAN HELP OTHERS TO AVOID FOOD TO BECOME WASTE

BUY B-MERCHANDISE ITEMS

BUY DISCOUNTED PRODUCTS THAT EXPIRE SOON

TAKE THE INITIATIVE AT BUFFETS OR IN RESTAURANTS

- Ask to take food home, bring your own reusable box
- Ask for a smaller portion or share
- Share your ideas with persons responsible

INITIATE POSITIVE EXAMPLES IN YOUR NEIGHBOURHOOD

FIND LOCAL FARMERS AND GO GLEANING

TRAINING PROGRAMME

More than half of the food waste occurring in the EU-28 is generated by households. In total that makes about 46,5 tonnes or 173 kg per person and year (Stenmark et al., 2016). Teaching, but even more importantly, reaching consumers is probably one of the most difficult food waste challenges.

Nowadays, old knowledge about food handling, cooking and preservation methods is lost and is not handed down anymore to the next generations. Teachers become important role models and schools more often undertake the task to not only teach certain subjects but also common knowledge and values. These will have life-long lasting effects on attitudes, behaviours and decisions.

Furthermore, children are important multipliers and will influence the behaviours of their parents today.

Within the framework of the STREFOWA project, a training programme has been developed that will help teachers to integrate the topic of food waste in their lessons. The aim of the training is to provide teachers and waste consultants with the necessary basic knowledge about food waste. Furthermore, it will give ideas about how to implement this topic in class with an overview of available teaching materials. Moreover, the workshop concept "crime scene: organic waste", which has been developed within this project, will be provided.

Objective

- Understand food waste: kind, origin, reasons, quantities and associated consequences – considered across the entire value chain
- Explore causes and possible solutions for different sectors with a special focus on food waste handling and preservation methods that will be useful in daily life
- Introduce teachers or waste consultants to various approaches and ideas to tackle food waste in school

Target group

- Teachers and waste consultants, who educate children to young adults (8–16 years)

Proven Training materials

Description and further materials on the proven training programme and educational lesson are available on: <http://www.reducefoodwaste.eu/training-consumers.html>



EFFICIENT TREATMENT OF FOOD

reducefoodwaste

For WASTE MANAGEMENT

ORIGIN

As outlined in the previous sections, food waste occurs along the whole food supply chain wherever food is produced, processed, traded or used.

In primary production a variety of factors are accountable for food losses. Recent assumptions range from 25 – 30 % of the total food production (FAO, 2013). The main reasons are that fruits and vegetables are not conform to market standards and are therefore not even harvested, sorted out at the farm or returned from trading partners. Losses occur also because of mechanical, handling and logistic and selection reasons. Food from primary production can even be wasted when the market is saturated and a surplus is available.

The retail sector is responsible for approx. 5 % of the total amount of food waste in the EU (FAO, 2011). The largest shares of the unused food consisted of bakery products (25 %), fruits & vegetables (20 %), dairy products (13 %) and meat-fish-cold cuts (12 %) according to TESCO, Hungary.

According to the European Environment Agency and the National Waste Management Directory, the restaurant and catering sector is responsible for 14 % of the total amount of food waste. Waste in the food service sector mainly results from the surplus of servings or prepared food, food purchased in excess and the inability to consume it before the expiration date, the difficulty of correctly interpreting the indications provided on the labels, and faulty preservation of food. WRAP estimates that each meal (in the service sector, including preparation and consumption phases) generates, on average, about 220 grams of organic waste (WRAP, 2013).

Statistically the largest fraction of municipal waste is bio waste. However, in most countries the collection level is relatively low, lower than the level for dry recyclables. In a number of countries, food waste is most often collected combined with residual or mixed waste. In other countries however, municipalities and their inhabitants are obliged to separately collect bio-waste.

WASTE MANAGEMENT MEASURES

The aim and duty of the waste management sector is to prevent food waste and if food waste can't be avoided to treat it according to state of the art procedures. In order to define measures for food waste prevention the waste management sector can assist and cooperate with all other sectors. Waste prevention measures are defined in single chapters of each individual sector. In case that food waste can't be avoided a proper collection system fosters an optimum treatment performance. Therefore, in next sections of this handbook, state of the art collection and treatment options are explained.

COLLECTION SYSTEMS

Depending on the sector or site of waste generation different collection schemes are available or have been proved to be appropriate. Whereas undefined containers and bins are used in primary production, households, retail, food service and processing use standard waste collection contain-

ers, bins or tanks (see list below). While pre-collection bags or bins and collection bins/containers from 80 – 1,100 litres are quite common in the retail and food service sector, the tank-connected systems are quite new and increasing. There the organic food residues are entered into an input station where the material is shredded and transferred into a storage tank. In contrast to the former bin system, the tank system guarantees high hygienic standards and lower manipulation and pickup intervals of food waste.

The proper separation and collection of food waste (not mixed with packaging or residual waste) is crucial for the further treatment process and product generation. High amounts of impurities can cause problems during the treatment processes (e.g. abrasion of aggregates like pumps...) or affect the quality of the gained products (biogas slurry, composts...). Therefore, high efforts need to be done to raise awareness from households to staff in gastronomy and retail sector.

Regarding the collection system, especially for households a door-to-door system is more preferable than a bring-system in terms of collection rates and amounts. With the bring-system, waste is collected on central sites that demand that citizens pre-collect their food waste in bags or bins and bring transport them to the respective destinations. Due to the composition of organic waste, bring-systems often result therein that it is collected with residual waste, composted at house-gardens or even disposed of in landscape areas. Besides negative effects to environment this means also a loss of an important renewable energy or raw material source.

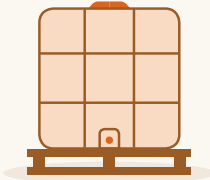
			
BIODEGRADABLE BAG	BIN	CONTAINER AND BIN	TANK
consumer	consumer	at your farm in cooperation with	Processing, Retail, Food service

Figure 7: list of collection systems



TREATMENT

As mentioned above, organic waste is an important resource to generate compost and/or energy. Two processes – aerobic degradation and anaerobic digestion – are applied for the treatment of organic waste. Depending on the process, either compost (aerobic) or biogas (anaerobic) can be produced.

Compost can be used as fertilizer and/or soil conditioner in agriculture, landscaping nurseries, home gardening and other scopes of application (e.g. land reclamation and landfill cover). In order to fulfil the quality requirements a proper composting process as well as suitable raw material is important. A stable composting process during home composting at European climate conditions especially during winter season is sometimes hard to achieve and therefore home composting is controversially discussed. Waste management companies or municipalities in most cases have installed professional composting plants to treat the collected food waste.

In contrast to aerobic degradation the anaerobic digestion process is used to produce biogas from food waste. Biogas can be then used for heat and electricity production or even be further processed to bio-methane. Bio-methane can be injected to the gas grid where it can be used again as energy or fuel source. In the meantime, the process of anaerobic digestion takes place at specific biogas plants or even in the fermenters of wastewater treatment plants (WWTP). Depending on the production site, further important side products can be gained from anaerobic digestion. In the case of biogas plants, slurry from organic/food waste can be used as fertilizer at agricultural fields. Application of sewage sludge from WWTP although co-digested with food waste is in some areas forbidden by law to bring it on agricultural land. In this sense the European Commission is preparing a new directive that P-recycling needs to be done from sewage sludge through and after incineration. Again, food waste can contribute to P-fertilizer generation.

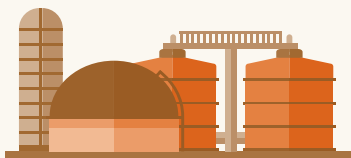
		
COMPOST PLANT	BIOGAS PLANT	WASTEWATER TREATMENT PLANT
Products: compost (→fertilizer)	Products: biogas (→heat, electricity, fuel), biogas slurry (→fertilizer)	Products: biogas (→heat, electricity, fuel), sewage sludge (→P-fertilizer)

Figure 8: list of treatment options

C. NETWORK

#REDUCEFOODWASTE COMPETENCE NETWORK FOR FOOD WASTE PREVENTION AND MANAGEMENT

Food losses along the entire value chain are estimated at 88 million tonnes in the EU (European Commission). The amount will increase if no suitable measures are taken. The exchange between countries and the development of new strategies are indispensable for the implementation of functioning and practicable structures.

Objectives

#reducefoodwaste as a competence network with the focus on food waste prevention and management offers on the one hand an active platform for networking and exchange of all interested stakeholders and persons, on the other hand, the expertise of the private, public as well as the scientific sector is bundled. The umbrella organization is not only an international multi-stakeholder platform, but at the same time sees itself as a think tank, project incubator and a hub for innovative initiatives.

Activities

#reducefoodwaste offers a discussion platform on current food waste prevention and management developments. The platform elaborates regional, national and international food waste prevention opportunities in order to present it as a starting point for joint projects and strategies for participating organizations and individuals. Decision-makers throughout the region receive valuable input for their work.

Including experts along the entire value chain has a special significance in the context of the work of specific working groups. Under the direction of a group leader who is particularly experienced in the respective field, the individual working groups develop tailor-made solutions and ensure the promotion and visualization of best practice examples. Thus the #reducefoodwaste competence network effectively contributes to the reduction of food waste.

More about the current activities of the individual working groups can be found here:

- Working Group Production
- Working Group Processing
- Working Group Retail and Wholesale
- Working Group Consumer
- Working Group Waste Management
- Working Group Logistics

Services and Benefits

The annual conference "#reducefoodwaste Conference on Food Waste Prevention and Management" will enable and encourage direct exchange on current topics and developments between universities, non-university research institutions, active actors along the entire value chain, stakeholders and policy makers. Regular exchanges among the participating institutions is ensured by regular meetings and workshops, which take place either within the working group or across groups. Within regularly recurring awards the entire society is effectively involved.

Participation

#reducefoodwaste is open to all interested institutions and individuals who wish to contribute to food waste prevention and management activities.

<http://www.reducefoodwaste.eu/beitrittserklaerung.html> DECLARATION OF ACCESSION

<http://www.reducefoodwaste.eu/statuten.html> STATUTES

D. BENEFITS

FAO estimates that globally one third of food produced for human consumption is lost or wasted throughout the entire supply chain (FAO, 2011). Recent investigations for the European Union came to the conclusion that 88 million tonnes of food waste is produced along the supply chain, which is equivalent to $173 \text{ kg} \pm 27 \text{ kg}$ per capita and year (Stenmarck et al., 2016). According to this study, the amount of food wasted along the full value chain equals about 20 % of the total food produced in Europe. This food waste amount is associated with costs of 143 billion euros (FUSIONS, 2016).

The production of food in agriculture and following processing steps require the use of several resources including land, water, fuels, energy and raw materials. Consequently, the extraction, processing and production of each of these resources come to waste along with the food product itself across the whole supply chain. Significant environmental impacts are associated. It is estimated that 20–30 % of greenhouse gas emissions related with consumption can be allocated to food waste (Tukker et al., 2006).

Scherhauser et al. (2017) evaluated the environmental impacts deriving from food waste throughout the food supply chain including food waste management. They concluded that food waste accounts for 186 million tonnes of CO²-equivalents in the European Union. This is equivalent to 4 % of the European global warming impact or the national greenhouse gas emissions of the Netherlands. 1.7 million tonnes of SO²-equivalents resulting from food waste contribute to the European acidification potential and 0.7 million tonnes of PO⁴-equivalents deriving from food waste contribute to the European eutrophication potential.

The later in the food supply chain a product is wasted, the higher are its environmental impacts since all emissions coming from up-stream steps of the supply chain (e.g. production, processing, transport etc.) are included in the overall impact of the wasted material. The environmental impact of food production and consumption is further exacerbated when food is wasted rather than consumed. One can also interpret that preventing food from being wasted can lead to lower production thus less environmental costs.





ENVIRONMENTAL BENEFITS OF FOOD WASTE PREVENTION AND MANAGEMENT

To calculate the environmental benefits of saving food waste one has to consider that production of new food (including all related environmental impacts) is substituted by the (re)-use of second choice or ugly products, leftovers etc. Secondly, the existing waste management system is replaced. That might have positive or negative impacts depending on the existing waste management system. Highly influential, for example, would be to replace landfills with composting or biogasification, which serve as environmentally friendly solutions.

The environmental benefits of food waste prevention can be shown with the following examples along the whole supply chain:

- **Agriculture/Gleaning:** 0.13 kg CO²-equivalents could be saved by each kg of potatoes that are eaten instead of staying on the field because of their unsuitable size for supermarkets. Hence 3.3 million tonnes of CO²-equivalents could be saved if all potato fields would be gleaned in Austria.

- **Retail/Donation:** By donating 1 kg of food, the STREFOWA project calculated that the Federation of Polish Food Banks managed to save 5.86 kg of CO²-equivalents. In his master thesis, Lehtonen (2019) proved that on average each of the five examined European foodbanks saved 27 kg of CO²-equivalents for each kg their establishment processed.
- **Food Service Sector:** Obersteiner et al. (2019) calculated that between 1 and 3.5 kg of CO²-equivalents can be saved per kg of food waste prevented, depending on the specific measure and the existing waste management system. Saxe et al. (2013) quantified an impact of 2.1 kg CO²-equivalents per kg of food for an average Danish diet. Stucki et al. go more into detail. According to them, by avoiding wasting a meat or fish menu, 3.6 kg CO²-equivalents could be saved per portion. Whereas 1.7 kg can be saved by not throwing away a vegetarian menu.
- **Food Waste Management:** if food waste is not avoidable, it is important that proper food waste management (Composting or gasification) is performed. By saving 1 kg of food waste from landfills by composting, another 1.1 kg of CO²-equivalents can be saved per kg of waste.

Beside these environmental benefits in terms of saved greenhouse gas emissions additional benefits concerning other environmental impacts like acidification or eutrophication can be considered. A 2013 FAO report estimated that 1.4 billion hectares of land, which is 28 % of the total global agricultural area, as well as 250 km³ of surface and groundwater resources, are used to produce food that is then wasted. Sustainable approaches to food production can decrease these impacts.

It can be concluded that reducing food waste could reduce the amount of food production and its associated impacts overall. The UN Sustainable Development Goal 12.3 which targets a 50 % reduction in food waste at the retail and consumer levels, in addition to reducing food losses along production and supply chains by 2030 can, therefore, serve as a significant step towards a reduction of environmental impacts due to food waste.

FINANCIAL BENEFITS

Reducing food loss and waste has not only environmental but of course also financial benefits for businesses. More and more start-ups identify the prevention or utilisation of food waste as part of their business models. Saving food waste also leads to saved money for farmers, companies and households. After all, according to the UN, food waste adds up to a cost of \$940 billion a year, a staggering figure. Just in the UK, the manufacturing and retail sector is estimated to waste 1.9 million tonnes of food a year worth £1.9 billion.

Lehtonen (2018) showed as a mean value for five European foodbanks that for every 1 euro invested a return of investment of 10 euro can be calculated.

FOOD SECURITY BENEFITS

Additionally, to the described environmental and economic benefits of food waste prevention by ensuring the reduction of food waste, we could potentially feed globally everyone suffering from malnutrition. By reducing the tonnes of food going to waste every year, most of it avoidable, we can expect that food security will improve.

At the moment, about 43 million people in the EU cannot afford a quality meal every second day. By offering them high quality fruits and vegetables instead of wasting them, we can save nutritious food for redistribution to those in need, helping to eradicate hunger and malnutrition.

It can be concluded that food loss and waste is a global concern and tackling it will bring a wealth of benefits to the environment, manufacturers and distributors, and people.

E. REFERENCES

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WRAP, 2013: Where food waste arises within the UK hospitality and food service sector: spoilage, preparation and plate waste.

F. ANNEXES

#reducefoodwaste – Tool

Use the #reducefoodwaste – Tool to find out what is going on and help reduce food waste along the food supply chain in your area! This tool will introduce you to a lot of important stakeholders in Europe and besides that you can find tips & tricks to prevent food waste, educational materials or information on start-ups, initiatives and other ideas.

<https://tool.reducefoodwaste.eu/>

Guidelines & Factsheets

Primary Production: <http://www.reducefoodwaste.eu/guideline-primary-production.html>

Retail: <http://www.reducefoodwaste.eu/guideline-retail.html>

Food Service: <http://www.reducefoodwaste.eu/guideline-food-service.html>

Consumer: <http://www.reducefoodwaste.eu/guideline-consumer.html>

Waste Management: <http://www.reducefoodwaste.eu/guideline-waste-management.html>

Training Programmes

Primary Production: <http://www.reducefoodwaste.eu/training-primary-production.html>

Retail: <http://www.reducefoodwaste.eu/training-retail.html>

Food Service: <http://www.reducefoodwaste.eu/training-food-service.html>

Consumer: <http://www.reducefoodwaste.eu/training-consumers.html>



<https://www.interreg-central.eu/STREFOWA>

