waste2worth
creating circular communities

SME FOOD WASTE COMMUNITY

EXPLORATION GUIDE

www.waste2worth.eu

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01

INTRODUCTION

INTRODUCTION

Food waste management is a challenge that affects businesses of all sizes. For Small and Medium-sized Enterprises (SMEs), managing this issue effectively can be rather difficult on the one hand but can lead to substantial benefits on the other hand.

*This guide **aims to provide SMEs with practical strategies to reduce food waste, enhance sustainability**, and improve their bottom line.*

One of the first steps towards effective food waste management is awareness. Understanding the extent of food waste within your organisation and its impact on the environmental and economic impact is fundamental. SMEs can foster a culture of sustainability and responsibility by increasing awareness among employees and stakeholders.

A second important point is the active involvement of all levels of the organisation. Engaging employees actively in strategies which aim at the reduction of food waste and in a more efficient use of resources will promote motivation to commit to the cause. A joined effort can lead to innovative solutions and more efficient practices

This guide will not only give an overview of the impact foot waste has in Europe but will also focus on the management of food waste in Ireland, Spain, Finland and Italy. Furthermore, it will give you some advice and ideas on how to reduce your environmental footprint and on how to achieve cost savings and improve your reputation among eco-conscious consumers. Let's embark in this joined venture towards a more sustainable and profitable future.

02

ROLE OF SMES IN THE FOOD INDUSTRY- ENABLERS & BARRIERS THEY FACE

Food Waste in Europe

In 2021, more than 58 million tonnes of food waste were generated in the European Union [4].

131 kg
PER PERSON

or

€132
BILLION

or

252,000,000
TONS OF CO_2

Households waste the most amount of food across all economic sectors (more than 31 million tons) – almost twice the amount compared to the sectors of primary production and manufacture of food products and beverages

Fig. 1

Food waste in the EU by main economic sectors, 2020 [5]

Fig. 2

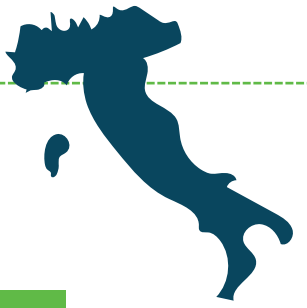
Food waste by Member State, 2021 [5]

The states which produce the most of food waster per inhabitant are: Cyprus, Belgium, and Denmark. Slovenia Croatia, and Sweden produced the least amount of food waste .

Food Waste Management in Ireland, Spain, Finland and Italy

*This section analyses the current **food waste management situation in each of the partner countries**. It gives an information about:*

- Waste created in each partner country
- The role of Sme's in the food waste management
- Initiatives to increase awareness with regards to food waste management
- Education and training opportunities for efficient food waste management
- Innovative technologies to reduce food waste
- Policies, governmental initiatives and strategies and laws to reduce food waste



The Role of SMEs in Food Industry in Italy: Challenges and Barriers

Family-controlled SMEs prevail in the Food Sector in Italy. These companies, recognised for their qualitative excellence in many market segments, remain relatively small, with an average turnover of around EUR 97 million and 178 employees. Nevertheless, they guarantee quality by combining tradition and innovation and represent a competitive constraint at international level. The challenges the food sector needs to face to achieve climate neutrality by 2050 and the transition from a 'linear' to a circular economy can be very difficult for them, since this implies adopting new approaches on the production of raw materials and their processing, consumption and finally waste disposal, to stop the depletion of non-renewable resources. In addition to this they need to face other barriers such as: initial costs related to transition processes, the necessity to apply new technologies. They also need to overcome the resistance to change.

Food Waste in Italy: Scope and Impact

In 2022, more than 4 million tonnes of food were wasted in the Italian food supply chain for a total value of 9,301,215,981 euro.[1]

With these numbers, it exceeded the European average for **food waste** produced, with 139 kilograms of food wasted per inhabitant. Of this, 72%, or 100 kilograms, was generated directly in **Italian homes**, a worrying figure that highlights the central role of **domestic waste** in this country.[2]

Even more concerning is the fact that, according to a report by **Waste Watcher 2024** the rate of food waste in Italy has increased by 45% in the last year: 42% of the total waste is of domestic origin, while that of the catering industry is 14% and that of distribution - i.e. sales - just 5%. The large slice that remains is 39% related to production[3].

Food waste has a direct impact on the purchasing power of Italians: it has a value of EUR 360 per person per year, about 13% of the average food budget. This means that an Italian citizen shops unnecessarily for 47 days a year. This generates another repercussion, which is less obvious but directly related to waste: it concerns the environmental impact generated. With 2.6 meals per week, an individual in Italy wastes as much as 180 kg of CO_2 and 187m² of land and 54,270 litres of water per year which are needed for the production.[4]

Education and Training: Current Status

In Italy, there are not many courses available on the topic of food waste management.

- **ANCI and Ministry of the Environment**

  In 2018 the national Association of Italian Municipalities and the Ministry of the Environment signed the Implementation Agreement aimed at developing actions to support municipalities to encourage, stimulate and facilitate the identification and implementation of measures and initiatives to prevent and reduce food waste. The measures include training, education and guidelines for schools, school catering, commercial catering, SME's, local markets etc.

- **Confconsumatori**

  Confconsumatori (Association of consumers) has developed a free course on food waste dedicated to middle and high school teachers. It contains three agile training modules available online, with materials to use during classroom activities.

- **University Politecnico di Milano**

  Offers an Open course to all citizens with the title "From words to action: surplus food management to tackle food poverty and food waste".

- **Italian Food Academy**

  Offers a postgraduate Course in Circular Cuisine and Food Legislation

- **Consulcesi**

  Consulcesi Club offers a distance learning service for doctors. One course has the title "Taste is Health. Functional and sustainable nutrition"

Raising Consumer Awareness and Education

Reducing waste is one of the essential elements indicated in the National Strategy for Sustainable Development SNSvS, in coherence with the goals of the 2030 Agenda, both as a tool for combating poverty and for sustainable production and consumption patterns.

Therefore, The national Association of Municipalities and the Ministry for the Environment, Land and Sea, have promoted the **'Zero Waste'** awareness campaign, which pays special attention to local administrators. Raising awareness in municipalities to combat waste, in addition to economic and social benefits, contributes to spreading a sense of belonging, solidarity and civic awareness in local communities, which are consolidated through anti-waste administrative actions promoted by local governments.

There is also the magazine **Mi Alimento** which is dedicated to promoting food sustainability, environmental sustainability, circular economy and conscious eating. Through articles and insights, they aim to inform and inspire readers to make more conscious choices about food, thus contributing to a healthier and more sustainable future for all.

Innovative Solutions

Food waste is generated at several stages of the food supply chain, from production and processing to distribution and consumption. In Italy there have been developed Innovative solution for different steps of the supply chain

Artificial Intelligence

*The Start-up **Orobix Life** based in Bergamo, has adapted a Machine Vision Inspection system based **on Artificial Intelligence** created for the **manufacturing** sector to the agricultural supply chain.*

A system that has been tested for optimising the sorting of quality grapes both during the ripening and growing phase and when they are being poured onto conveyor belts, and for defining the storage time of apples (short, medium or long shelf life) once they have been unloaded from agricultural vehicles. Thanks to a Deep Learning model that is 'trained' to recognise different quality classes, it is possible to introduce objectivity and timeliness in the assessment of product quality throughout the process and to maintain or improve its quality even in the face of unpredictable situations, such as the effects of climate change and the emergence of an increasingly competitive and demanding market.

Software platforms such as **Resmart from Maiora Solutions** based on machine learning algorithms can also be used to analyse historical and current data to accurately predict demand, enabling retailers to manage orders and stock more efficiently.

E-Commerce

Another delicate stage concerns the steps involved in in transport, raw material storage and food processing.

These are still subject to a significant component of food waste, often due to **inefficiencies, inadequate facilities and production processes which are not aligned** with consumer demand. In this phase of food waste generation enters the company Bestbefore, an e-commerce dedicated to the sale of imperfect, end-of-stock and soon-to-be-expired products. Thanks to a proprietary algorithm, it is able to produce dedicated discounts for these products, guaranteeing a second life for the food and thus a gain for both the producer and the end consumer.

Blockchain

Blockchain can be used as an e-solution against food waste since it creates a more secure, transparent and efficient food supply chain

Blockchain can be used as an e-solution against food waste since it creates a more secure, transparent and efficient food supply chain, One example is the IBM Food Trust project that offers all stakeholders (producers, suppliers, distributors, retailers) the possibility to access a transparent record of all transactions and interactions in the Food Supply Chain. This improves the traceability of "farm to fork" food products and, increases transparency for consumers and reduces the possibility of food fraud. As well as quickly identifying the source of the problem, speeding up recalls and minimising the impact on public health and consumer confidence.

State policy & Government supports (regulations, initiatives and schemes)

Food Waste Prevention Day (Feb. 5), was established in 2014 by the Ministry of the Environment in collaboration with the Zero Waste campaign of Last Minute Market.

National Waste Prevention Program

The National Waste Prevention Program adopted by the Ministry of Ecological Transaction by Directorial Decree of October 7, 2013, contains a specific section devoted to possible measures to reduce food waste.

The work of the *task force* "Analysis and development of models for food waste reduction" (2013) resulted in the development of a National Food Waste Prevention Plan (PINPAS). **PINPAS** - Italy's first National Food Waste Prevention Plan includes "ten measures" to fight food waste in Italy: from discount sales of food close to expiration to the donation of unsold products, from voluntary agreements with catering/distribution companies to the introduction of rewarding criteria in public procurement of mass catering services for those who distribute surplus for free

In 2016 a law on "**Provisions concerning the donation and distribution of food and pharmaceutical products for purposes of social solidarity and limiting waste"** was established which has as one of its purposes, among others, to help reduce waste production, promote reuse and recycling as well as contribute to the achievement of the overall goals set by the national waste prevention program.

The Role of SMEs in Food Industry in Ireland: Challenges and Barriers

Small and Medium Enterprises (SMEs) in the food industry play a critical role, contributing significantly to local economies and food supply chains. However, they face numerous challenges, such as navigating stringent regulations, managing operational costs, skills shortages, and adapting to evolving consumer preferences for sustainability and waste reduction. These obstacles can be particularly daunting in the context of food waste management, which poses both a challenge and an opportunity for SMEs to innovate and align with global sustainability goals.

Food Waste in Ireland: Scope and Impact

*Ireland's food sector generates a considerable amount of waste, with an estimated 750,000 tonnes produced in 2022, according to the **Environmental Protection Agency (EPA)** study published in June 2024.*

This equates to 146kg of food waste per person, surpassing the EU average of 130kg per capita. The food and beverage manufacturing sector alone contributed around 230,000 tonnes of this waste, making it the largest contributor.

Food waste in Ireland stems from multiple points in the supply chain:

Fig. 3

Irish Food waste measured across five economic sectors of the supply chain Source **EPA**

Food Waste in Ireland: Scope and Impact

***The food and beverage manufacturing and processing sector** in Ireland generated an estimated 230,000 tonnes of food waste (31% of total) in 2022.*

Food waste from this sector includes: foods unsuitable for consumption or processing (e.g. unsafe products or product returns), process wastes (e.g. wastes arising during processing & cleaning) and some animal tissues waste which are disposed as waste.

Households generate 29%, restaurants and food services produce 21%, retail and distribution add 12%, and 7% comes from **primary production**. Of this, horticulture accounted for the largest share. The main cause of food waste at the primary production stage is that products are not saleable as they do not meet quality specifications or due to a lack of customer demand. The consequences of this waste extend far beyond local economies, as it contributes up to 10% of global greenhouse gas emissions. This highlights the urgent need to tackle food waste with significant resources consumed during food production, processing, storage, and transportation.

Food waste has a direct financial impact on households, costing the average Irish household approximately €60 per month, or €700 annually, with a national cost reaching €1.29 billion per year.

Education and Training: Current Status

In response to the pressing need for waste reduction, Ireland has developed several educational and training initiatives.

The **National Food Waste Prevention Roadmap 2023-2025** underscores the importance of awareness and capacity-building across the food sector, in line with Ireland's commitment to halving food waste by 2030, as outlined in the United Nations Sustainable Development Goals.

One key element of this roadmap is the national **Stop Food Waste** campaign, which educates households on how to maximise the use of food through better planning and waste segregation. Such programmes also target businesses and institutions, aiming to embed sustainable practices across all levels of the food supply chain. In Irish secondary level schools, **VOICE** has developed a Food Waste educational resource for the Home Economics junior cycle. This resource has been designed to support the existing curriculum so that food waste awareness and action can be brought into the classroom with ease.

ATU Sligo offers several Surplus food management courses including; Certificate in **Sustainable Food Surplus Practices** that is a one Year, Part-time, QQI Level 6 course. This accredited course, is provided in partnership with Atlantic Technological University (ATU), and FoodCloud

Campus Living Labs Project: A collaboration between the Irish Universities Association (IUA) and the Environmental Protection Agency (EPA), this two-year project used university campuses as 'living labs' to trial effective waste management interventions. The project focuses on reducing food waste and eliminating single-use plastics, aiming to inform campus sustainability programmes and introduce systemic changes in waste prevention and recycling. During **National Food Waste Recycling week** mywaste.ie (the Irish governments official guide to managing waste) aim to encourage everyone to recycle food waste by providing practical advice along with hints and tips on how easy it is to recycle and get everyone involved.

Raising Consumer Awareness and Education

Consumer awareness plays a crucial role in reducing food waste, especially when it comes to understanding food labels. A 2018 survey by the EPA revealed that over 30% of consumers in Ireland discard food based on "best before" dates, confusing them with "use by" dates

Educating consumers about the difference between these labels can help significantly reduce unnecessary waste. To address this the EPA's **STOP Food Waste** platform has a suite of resources available to all.

Non-profit organisations like **FoodCloud** work to bridge the gap between surplus food and food insecurity. Since its inception in 2013, FoodCloud has partnered with leading retailers, restaurants, and other supply chains to redistribute excess food. Their initiatives contribute to a circular economy by ensuring food is used rather than discarded. To further support this, FoodCloud has collaborated with the Food Safety Authority of Ireland to develop guidelines on how long food can be safely consumed after the "best before" date. They also have an online platform **FoodCloud Academy** to empower individuals with knowledge and tools that foster a deeper understanding of food waste and its impact on our world.

Innovative Solutions

Several initiatives have emerged in Ireland to encourage food waste reduction through technology and community engagement.

Several initiatives have emerged in Ireland to encourage food waste reduction through technology and community engagement. The mobile app **Foodie Save** connects consumers with surplus food from restaurants, bakeries, and retailers, allowing users to purchase this food at reduced prices. This not only helps prevent waste but also promotes more sustainable and cost-effective consumer habits.

Crosscare's food poverty support programme addresses both food waste and food insecurity through community cafes, discreet food collection and casework centres. Crosscare collect food surplus and donations from the local community, businesses and run annual appeals to support families and individuals in need.

Savour Food Programme: Operated by the Clean Technology Centre at Munster Technological University, this initiative assists food businesses in identifying and implementing strategies to reduce food waste through audits and tailored solutions.

Conscious Kitchens is an independent business operated by Amy Irwin who offers Food service businesses an array of services, including a food waste analysis and assistance in directing these businesses on less wasteful paths or even zero-to-landfill routes.

The Role of SMEs in Food Industry in Finland: Challenges and Barriers

A sector more significant than its size – Finnish food industry is the fourth largest industry in Finland, employing 40,000 people in 2,600 companies. The industry has a significant indirect impact in employment: one job in the food industry generates three new jobs in Finnish food ecosystem. **(Finnish Food & Drink Industries' Federation)**

Food Waste in Finland: Scope and Impact

*In the Finnish food chain, around **400 million kilos of edible food are wasted every year.** Households account for the largest share of food waste in the food chain, more than a third.*

In Finland, 20–25 kilos of edible food are thrown away per person every year. Within the Finnish food chain, this equates to around 400 million kilograms of edible food being wasted every year. Households account for the largest share of food waste in the food chain, more than a third. This means that more than 155 million kilograms of food waste is generated in homes every year. **(Natural Resources Center Finland)**

The value of food waste in households as a monetary loss is equivalent to approximately 590 million euros annually in Finland, 106 euros per inhabitant. In autumn 2022, the price of a kilo of household food waste was estimated to be around €4-5**. (Natural Resources Center Finland)**

Education and Training: Current Status

In response to the pressing need for waste reduction, Finland has developed several educational and training initiatives. Finland is committed to halving the amount of food waste by 2030 is in line with the United Nations Sustainable Development Goals.

Achieving the goal requires actions at all stages of the food chain and regular monitoring of waste amounts. Natural Resources Institute (Luke) has built a monitoring system for food waste and food waste in Finland. Alongside it, a national waste road map has been established, which aims to cut food waste in half.

In Finland, there has been several organisations producing a lot of education and training materials for different kinds of users in a food chain, such as:

- **Hävikki -battle (Finfood –Finnish Food Information & Motiva)**
  Hävikki-battle introduces students to food waste in a practical way: during the lesson, the young people come up with ideas and implement main dishes and desserts from food waste raw materials donated by supermarkets. The goal is to learn ways to reduce food waste and apply your own cooking skills. The material can be used in teaching throughout the year, even if the Zero waste-battle competition is not underway.
- **Avoid food waste (Finfood – Finnish Food Information)**
  Tips for preventing food waste and storing leftover food.
- **Ruukku's Food Waste learning environment (Uukku)**
  In the learning environment, food waste, its economic significance and the climate perspective are thoroughly reviewed. In addition, in the learning environment, we consider what we could do to reduce food waste.
- **Tasty School (Pot)**
  In many schools, plate waste in school meals is monitored in the spirit of sustainable development. It is also worth practicing with the students how to take an appropriate portion size and taking into account their own hunger. When you know how to take food appropriately, plate waste is reduced.
- **Digital lesson on food waste (Paulig)**
  A material package on how everyone can concretely reduce their own waste and use the food waste calculator as a help.
- **RuokaTutkaTube's Hävikkivelkky (Pot)**
  How could you reduce waste with your own small actions - i.e. not putting food in the trash? Dabi and the flashy Pinkku Pinsku think together, watch the video!
- **Food waste and food waste monitoring project (LUKE)**
  The food waste and food waste monitoring project develops a national food waste and food waste monitoring system for the entire food chain.
- **Retail operations - responsibility (Finland Retailers' Association)**
  Information e.g. climate effects of trade and food waste, age limit control, product safety and security of supply.

Raising Consumer Awareness and Education

Consumer awareness plays a crucial role in reducing food waste, especially when it comes to understanding food labels.

The Consumer's Union of Finland produces a lot of useful and concrete information about how to avoid food waste: **https://www.kuluttajaliitto.fi/materiaalit/ruokahavikki/**

- **Food waste (Consumers' Association)**
  The consumer association's material package on waste. Background information and material suitable for teaching.
- **Food waste forum (Consumer Association)**
  The national Waste Forum (2020–2023) coordinated by the Consumers' Association aims to be Finland's largest food waste project by bringing together all interested actors in the food industry, companies, organisations, local grassroots actors and other parties to make effective cooperation and communication in order to halve household food waste.
- **Information about food waste (Waste week)**
  This year's Food waste week's material.

Innovative Solutions

Several initiatives have emerged in Finland to encourage food waste reduction through technology and community engagement.

Examples include services created for forwarding food waste from restaurants, restaurants that utilise store waste, services developed to measure and reduce food waste in restaurants, and various waste-based foods. The innovations were grouped into services that prevent food waste, selling or reselling expired food before it ends up as waste, utilising waste as new products and packaging solutions that reduce waste or waste.

There are several actively running projects, and pilots in different parts of Finland, such as a **Food waste ecosystem** project that implements concrete innovations by creating a new and community engagement method for the metropolitan region, reducing food waste and making it possible to use it more efficiently.

Fiksuruoka buys wasted food from manufacturers and sells it cheaply to consumers via the online store. The company has already reduced food waste by millions of kilos. The company also exports waste food online to the world.

Then what comes to digital innovations there is a mobile app **ResqClub** connecting consumers with surplus food from restaurants, bakeries, and retailers, allowing users to purchase this food at reduced prices. This not only helps prevent waste but also promotes more sustainable and cost-effective consumer habits.

Innovative Solutions

Several initiatives have emerged in Finland to encourage food waste reduction through ***technology and community engagement****.*

Another community-based digital solution, **Kamupak** digital reuse platform provides frictionless tools and data to optimise circular economy processes for better environmental impact. **The digital reuse platform** focuses on providing superior reuse experience for consumers utilising AI to reduce friction from B2C and B2C reuse processes by adding educational and gamification elements for reuse. Kamupak innovation provides accurate and real-time impact data to all stakeholders and ESG (*Environmental, Social & Governance*) reporting, for instance, to optimise reuse processes and minimise negative environmental impact caused by logistics and washing. Also, it provides API (*Application Programming Interface*) for reuse ecosystem partners to integrate and interoperate eg, food delivery platforms, reverse vending machines, washing and logistics providers, and POS systems.

The Finnish waste food innovation, **the Biovaaka service system**, is spreading rapidly for use by professional kitchens. The smart device measures how many grams of food the customer has thrown into the bio-waste container. At the same time, important information is obtained for food service planning. Using the device significantly reduces food waste.

Lumilma Eco Fresh can revolutionise the way fresh food is transported and stored. The benefits of the patented method are a significant reduction in food waste, and fuel and cost savings. For reasons related to food preservation and hygiene, there are still many empty or half-empty trucks on EU highways at the moment. By controlling the air quality, logistics operators are also able to drive mixed loads, such as tomatoes and apples in the same transport. Lumilma Eco Fresh naturally brings cost savings to food chains in that the filling rate of trucks can be improved, i.e. transports can be planned even more optimally. A version that works with solar panels is also being developed, which can be used especially in developing countries.

State policy & Government supports

(regulations, initiatives and schemes)

Circular Economy Finland (KiSu) *is a hub for circular economy know-how knowledge launched by the national circular economy programme of Finland.*

The programme is coordinated by the Ministry of the Environment and the Ministry of Economic Affairs and Employment. KiSu brings together those with knowledge and skills linked with circular economy, disseminates information and good operating models, and improves readiness to promote circular economy. The network brings information, tools, and support mechanisms linked with circular economy to one place. KiSu is turning into a centre of circular economy information.

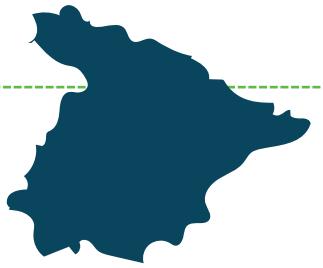
We want to make circular economy a new foundation for the economy, and we want Finland to be a forerunner in it. We need to shift gears to encourage those operating in the regions, municipalities, businesses, research, and the public sector to work closer together.

Fig. 9

Here you can find the link for a Strategic programme to promote a circular economy (Ministry of the Environment)

The vision of the food industry low-carbon roadmap for 2035 is that low-carbon solutions will have been widely adopted in the sector, and that climatic effects will be well-managed in the food industry value chain. The Finnish Food and Drink Industries' Federation is aiming for carbon neutrality in cooperation with companies in the industry. The 2035 target of the industry is to reduce the sector's greenhouse gas emissions by 75 per cent relative to net sales. The food industry is firmly committed to advancing the entire food supply chain's efforts to reach carbon neutrality. **(Finnish Food and Drink Industries' Federation)**

A SPOTLIGHT ON SPAIN



FOOD WASTE IN SPAIN

In Spain, the food sector generates a significant amount of waste. According to recent data, it is estimated that around 7.7 million tonnes of food is lost or wasted annually across the country. This figure includes waste generated in production, distribution and consumption.
The food sector produces significant amounts of waste, with households alone discarding more than 1.3 billion kilograms of food in 2020, which equates to around 31 kilograms per person annually. This waste results in a financial loss of approximately **€250 per person.** The Spanish government has taken steps to address this issue with new legislation that came into effect in January 2023, requiring businesses to reduce food waste through measures like **lowering prices for near-expiry items**, **donating unsold products**, and **encouraging food reuse** through processing into jams or juices.

The **environmental impact of food waste is substantial on the environment and on people.**

1. Environmental Impact

- **Greenhouse Gas Emissions**: Methane, a potent greenhouse gas is about 25 times more impactful on climate change than carbon dioxide. This is especially concerning in Spain, where nearly **2.9 million tonnes** of food are discarded each year.
- **Resource Depletion**: In Spain, food production requires significant water, especially in agriculture. Wasting food equates to wasting the resources which puts added pressure on Spain's limited water resources, particularly in regions affected by drought.
- **Loss of Biodiversity**: Food waste contributes indirectly to biodiversity loss, as land cleared for agriculture disrupts natural habitats. Reducing food waste could lessen the demand for agricultural expansion, thereby conserving ecosystems.

2. Social and Economic Impact on People

- **Economic Costs**: For Spanish households, food waste represents a financial burden, estimated at around **€250 per person per year**.
- **Food Insecurity**: Despite substantial food waste, food insecurity persists in Spain. Many people lack access to sufficient, nutritious food, and food waste exacerbates this issue by diverting resources that could otherwise alleviate hunger.
- **Health Impacts**: Decomposing food waste in landfills can contaminate local air and water sources, impacting public health. Methane emissions contribute to air pollution, which affects respiratory health, particularly in urban areas with high population densities

WHAT IS THE CURRENT STATUS OF EDUCATION AND TRAINING AROUND THIS

There are various initiatives underway to tackle this problem. Awareness-raising campaigns and food recycling and donation programmes are being carried out

- *"Educar en Consumo Responsable"* **(Educate in Responsible Consumption)** program in Spain is an educational initiative designed to foster responsible consumer habits, with an emphasis on sustainability, environmental consciousness, and reducing food waste with the direct involvement of the below organisations which also provide training:
  - ✓ National Institute of Consumer Affairs (INC) / Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN)
  - ✓ Ministry of Consumer Affairs
  - ✓ Spanish Confederation of Consumer and User Cooperatives (HISPACOOP)
  - ✓ Municipal Governments and Local Consumer Information Offices (OMIC)
  - ✓ Non-Governmental Organisations (NGOs) and environmental groups.
  - ✓ Organisation of Consumers and Users (OCU).
  - ✓ Food banks and local food redistribution initiatives.
  - ✓ Universities and research institutes
  - ✓ Private companies and supermarkets

- *"Más alimento, menos desperdicio"* **(More Food, Less Waste)** campaign run by Spain's Ministry of Agriculture, Fisheries, and Food includes public workshops, awareness materials, and events focused on reducing food waste across different sectors, including households and the food industry.

- **"Too Good To Go"** and *"Comida Basura"* **(Food Waste)** organisations engage in awareness activities and workshops to teach people about food waste issues and solutions. They both host workshops, talks, and events to educate participants on the causes and impacts of food waste, as well as practical solutions for reducing it; collaborate with local communities, schools, and other organisations to spread awareness, sharing tools and techniques to help individuals and families minimise food waste in their daily lives; they also use social media and public events to highlight the importance of food waste reduction, aiming to shift mindsets towards more sustainable consumption habits.

AWARENESS CREATING AN EDUCATION FOR CONSUMERS

(eg. Use by date and best before date in connection to food waste... food waste avoidance)

Raising awareness of **the correct interpretation** of **best-before and use-by dates** plays a crucial role in reducing food waste.

#ClearLabelling, an educational campaign, has been launched and informative videos have been published to help consumers better understand these terms and avoid throwing away food unnecessarily.

In addition, it has been highlighted that product such as yoghurts, preserves and cereals can be consumed beyond the best-before date, as long as they do not show signs of spoilage.

Euskadi Directo and **#EtiquetadoClaro** are the two main educational campaigns in the Basque Country helping consumers to better understand these dates. One in four Basques still does not clearly distinguish between the two, which contributes to good food being discarded unnecessarily.
Look, Smell, Taste initiative spearheaded by Too Good To Go organisation intends to clarify confusion around "best before" and "use by" dates.

ROLE AS INNOVATORS AND BECOMING CHANGEMAKERS

Due to flexible or agility- using food avoidance Apps / food banks- donations / local causes etc)

In Spain, the role of innovators and change agents in reducing food waste has grown considerably thanks to the use of technologies such as mobile apps, food banks and digital donations.

- **Too Good To Go** is one of the most popular food-saving apps in Spain. It connects consumers with local restaurants, bakeries, and supermarkets that have surplus food at the end of the day. Users can purchase “magic bags” filled with unsold food at a discounted price, typically at one-third of the original price.
- Too Good To Go has been instrumental in raising awareness about food waste in Spain and has a large user base across major cities.

- **Nadie Sin Su Ración Diaria** (No one without his daily portion), whose main objective is to guarantee access to food for people in vulnerable situations, has developed technological solutions that facilitate digital food donation. Through these apps, donors can contribute from anywhere and at any time, and donations are managed quickly and efficiently by food banks.

- **Phenix** is similar to Too Good To Go and helps businesses sell their excess food to consumers at a lower price. The app works with a range of food providers, from supermarkets to restaurants.

- **Encantado de Comerte** whose name means “Pleased to Eat You,” focuses on helping local businesses reduce their food waste. It offers consumers a way to buy surplus food from shops, bakeries, and restaurants at reduced prices.

ROLE AS INNOVATORS AND BECOMING CHANGEMAKERS

Due to flexible or agility- using food avoidance Apps / food banks- donations / local causes etc)

- **Karma,** originally from Sweden, is an app that offers consumers discounted surplus food from restaurants, cafes, and grocery stores. Users can browse available surplus items, reserve them, and pick them up at the designated times.
- **OLIO** is a global app with a focus on sharing food locally, including food that people don't plan to consume before it expires. Users can list and share unwanted or surplus food items, making them available for free pickup by other people nearby. OLIO also includes non-food items for sharing.
- **Yo No Desperdicio** ("I Don't Waste") is an app and platform where users can share surplus food items they don't need with others nearby. The platform is based on donation rather than sale.
- **SomosOrekak** is a Basque mobile app designed to reduce food waste and promote responsible consumption. Developed in the context of sustainability and respect for the environment. SomosOrekak connects consumers with local shops and establishments that have surplus food or products that might otherwise be thrown away.

STATE POLICY & GOVERNMENT SUPPORTS

In Spain, state policy and government support has been instrumental in tackling food waste and promoting more sustainable management in the agri-food sector.

The Prevention of Food Loss and Waste Act law passed in 2023, is pioneering in Spain and seeks to establish a regulatory framework to reduce waste along the entire food chain. It is based on principles such as: **Priority of human consumption**: It encourages the donation of food that is still fit for consumption, obliging establishments of more than 1,300 m² to collaborate with food banks; **Waste prevention plan**: All businesses must implement a plan to identify and minimise their food losses.

In line with the Sustainable Development Goals (SDGs), this strategy includes an action plan to reduce food waste by **50%** at consumer level and **20%** in the production chain by 2030. It also promotes the reuse and recycling of resources in food production. The government has launched campaigns to educate the population about the importance of reducing waste, such as the **'More food, less waste'** campaign, which aims to change consumption habits and encourage food donation.
Food donations are regulated, allowing food that is still safe for consumption to be donated, even if it is close to its expiry date. This is done through agreements with non-profit organisations and food banks. For more information on the law go to: https://www.lamoncloa.gob.es/lang/en/gobierno/councilministers/paginas/2024/20240109_council.aspx

In the **Basque Country**, the Basque Government has developed the **Basque Strategy against Food Waste**, which is based on the principles of **reduce, reuse and recycle**. This strategy is implemented in collaboration with the **Elika Foundation** and seeks to involve all actors in the food chain, from production to consumption. It aims to halve food waste by 2030. https://zerodespilfarro.elika.eus/es/estrategia-vasca/

03

HOW IS FOOD WASTE AFFECTING CLIMATE CHANGE

1. Impact of Food waste at Europa level

*In the EU, **over 59 million tonnes** of food waste (132 kg/inhabitant) are generated annually (Eurostat, 2024), with an associated market value estimated at **132 billion euros** (SWD (2023)421). At the same time, **over 42 million people** cannot afford a quality meal every second day (Eurostat, 2023).*

When looking at the numbers in detail it can be seen that households generate more than half of the total food waste (54%) in the EU (accounting for 72 kg per inhabitant) (Eurostat, 2024). The remaining 46% was waste generated by: 19% by the manufacture of food products and beverages (25 kg per inhabitant), 11% by restaurants and food services (15 kg per inhabitant), 8% in the retail and other distribution of food (11 kg per inhabitant), and 8% in the primary production (10 kg per inhabitant). (Eurostat, 2024).

When food waste is generated, all resources used in producing, processing, transporting, preparing, and storing discarded food are also wasted. Food loss and waste also has a huge impact on the climate change crisis due to its significant greenhouse gas (GHG) footprint. Production processes, transportation, and handling and distribution of food generate significant amounts Carbon Dioxide (CO_2).

Wasting food does not only have an impact on CO_2 emissions but also has an ethical and economic impact and moreover, it depletes the environment of limited natural resources.
The following chapters will give some information about the different types of impact food waste can have.

2. Greenhouse Gas Emissions from Decomposition

Food waste is very often disposed of in landfills where it cannot compose properly: inside these landfills' food breaks down slowly by releasing methane, a greenhouse gas which is 87 times worse than carbon dioxide and in the recent years this methane concentrations in the atmosphere have been growing rapidly (over a 20 year period)[1]. This contributes to global warming and has a direct impact on the temperatures of the Earth and Ocean. Sea surface temperatures have increased by more than 0.85°C (1.5°F) since the start of the 20th century.

According to the **ClimateWorks Foundation**, the food sector accounts for about 60 per cent of global methane emissions and food loss and waste related emissions account for 20 per cent of that. Even though this percentage is less than emissions created by other parts of the food supply chain, reducing food loss and waste can be a strategy to fight climate change that can be acted upon immediately by creating a substantial impact. **WWF** highlights that about 6%-8% of all human-caused greenhouse gas emissions could be reduced if we stop wasting food.

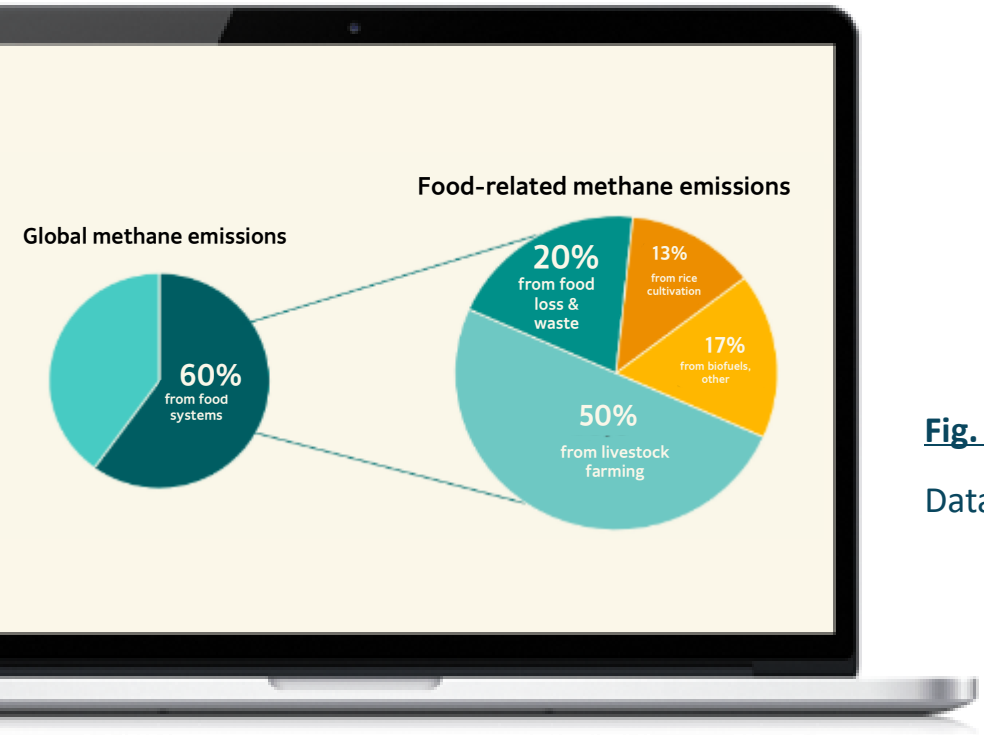


Fig. 4

Data from ClimateWorks

1 https://farmingfirst.org/2023/12/at-cop28-reducing-methane-emissions-from-food-waste-is essential/#:~:text=Inside%20landfills%2C%20food%20slowly%20breaks%20down%20and%20releases,period%29—meaning%20that%20methane%20makes%20the%20climate%20warm%20faster.

3. Waste and Loss of Resources in Food Production

Consumers often are not aware of the connection between the origin of their food and the resources required to produce it. This leads to a lack of responsibility for the environmental impact of their food choices.

There are also other factors which lead to an increase of waste and loss of Resources during the food production: the "throwaway" culture, the prioritisation of convenience over sustainability, the normalisation of high food production and consumption levels; Therefore it can be highlighted that social and cultural factors play significant roles in influencing energy, water consumption and waste generation within the food industry.

Energy and Water loss during Food production

Think about a slice of Pizza: you need the dough the tomato sauce and the mozzarella cheese to create it. Now consider where these items come from and who much water and energy goes into the creation of these items:

Dough:
you need water to grow the wheat; you need energy to harvest and to transport the wheat that is milled into flower; you need energy for the packaging of the wheat and again energy to transport it to the retail store. Then you need to add yeast and water to make the dough

Mozzarella:
you need water for the cows, you need energy for the milking process and energy for the transportation of the milk to the cheese factory; you need water to produce the mozzarella; you need energy for the packaging and for the transportation to the retail store; you need energy for the refrigeration

Tomato Sauce:
you need water to grow the tomatoes and energy to create the sauce, which needs to be packaged and transported to a retail store where you can buy it.

Baked Pizza:
you need energy to bake the pizza

As you can see, there are a lot of steps included, during which water and energy are being used. If we are wasting one slice of pizza, we will also waste all the energy and water that has gone into the production of it.

Energy Consumption

The food sector is one of the largest energy consumers worldwide, accounting for approximately 30 % of the total energy consumption[2].

Some reports highlight that around 200 EJ per year are being consumed, of which about 45 % corresponds to food processing and distribution activities in developed countries, 30 % to cooking, preparation, and retail, and 25 % to production stages.[3]

The following graph shows the energy employment in various food sectors categorised per source within European Union. It can be highlighted that for all the activities, most of the energy comes from fossil fuels, with about 90 % for agriculture and logistics and about 80 % for packaging and food use.

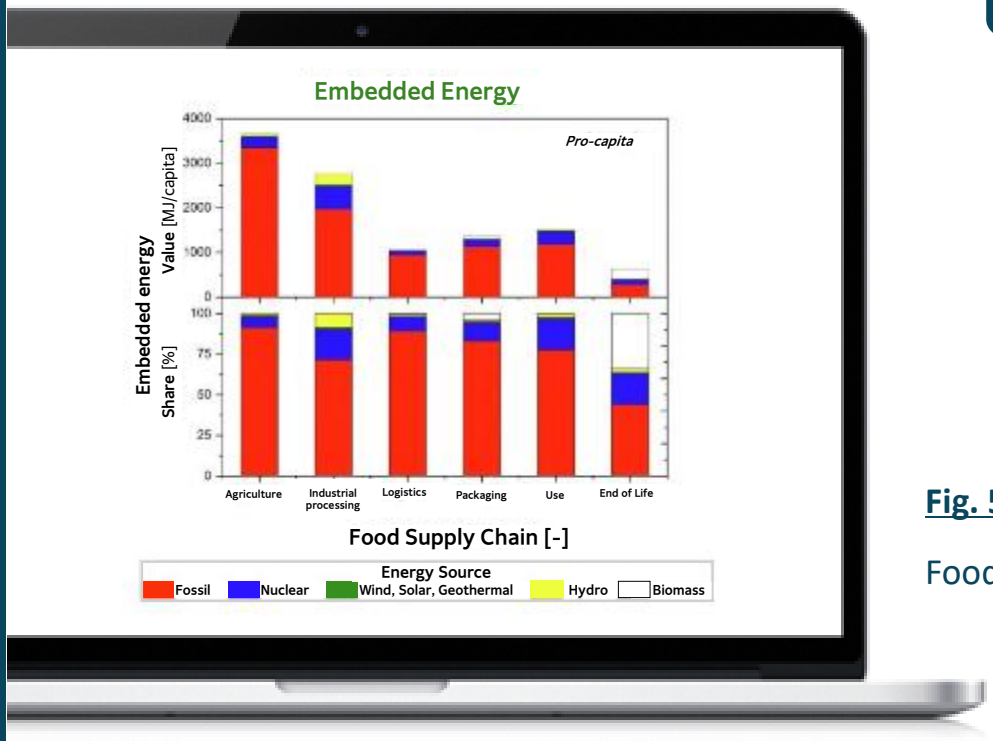


Fig. 5

Food Supply Chain

2 https://www.sciencedirect.com/science/article/pii/S2590174524001399
3 https://www.sciencedirect.com/science/article/pii/S2590174524001399

Water Consumption

***Fresh water** is a vital, irreplaceable resource for the food processing industry. Animal products like meat, dairy and eggs have the highest water footprint of all foods.*

Some examples:

Meat water footprint:
it doesn't just result from the water that the animal drink but from growing the crops that livestock eat.

Beer water footprint:
you might just think about the water in the bottle; but there is more to it: water is needed to grow the barley and the hops. it's not just the water in the bottle that counts, but also all the water needed to cultivate the barley and hops necessary to brew the drink in the first place. Fruit and vegetable processing is also a heavy user of water largely because it requires water to grow the crops and an exponential amount of water to wash the end produce

It is estimated, that around 60% of all water consumption in the EU is expended by the food and agriculture industry [4]

Fresh water is not only used as ingredient of food but also for different **food processing operations, for example for sanitation operations, for cooling and heating operations**. Generally only 20–30% of the used water becomes part of the product while more more than 70% of the total water used is discharged as effluent which has high levels of biological and chemical oxygen demand), as well as fats, oils, and grease (FOG) which creates a negative impact on the environment and the climate.

4 https://greco.services/is-water-scarcity-dangerous-for-the-european-food industry/#:~:text=63%2C625%2C200%2C000%20litres%20to%20be%20precise!&text=With%20statistics%20like%20these%20it,the%20food%20and%20agriculture%20industry.

4. Food Waste in Supply Chains

Food is being wasted or lost along the whole supply chain. Before going into detail, it might be interesting to look at the 2 terms ***food loss and food waste*** *which are both used to describe food that does not reach its final stage: human consumption.*

The European commission refers only to Food Waste for all stage of the supply chain. However, the Food and Agriculture Organisation distinguishes between food loss and food waste: food loss is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, foodservice providers and consumers" (FAO 2022a); food waste is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, including retailers, foodservice providers and consumers (FAO 2022b).

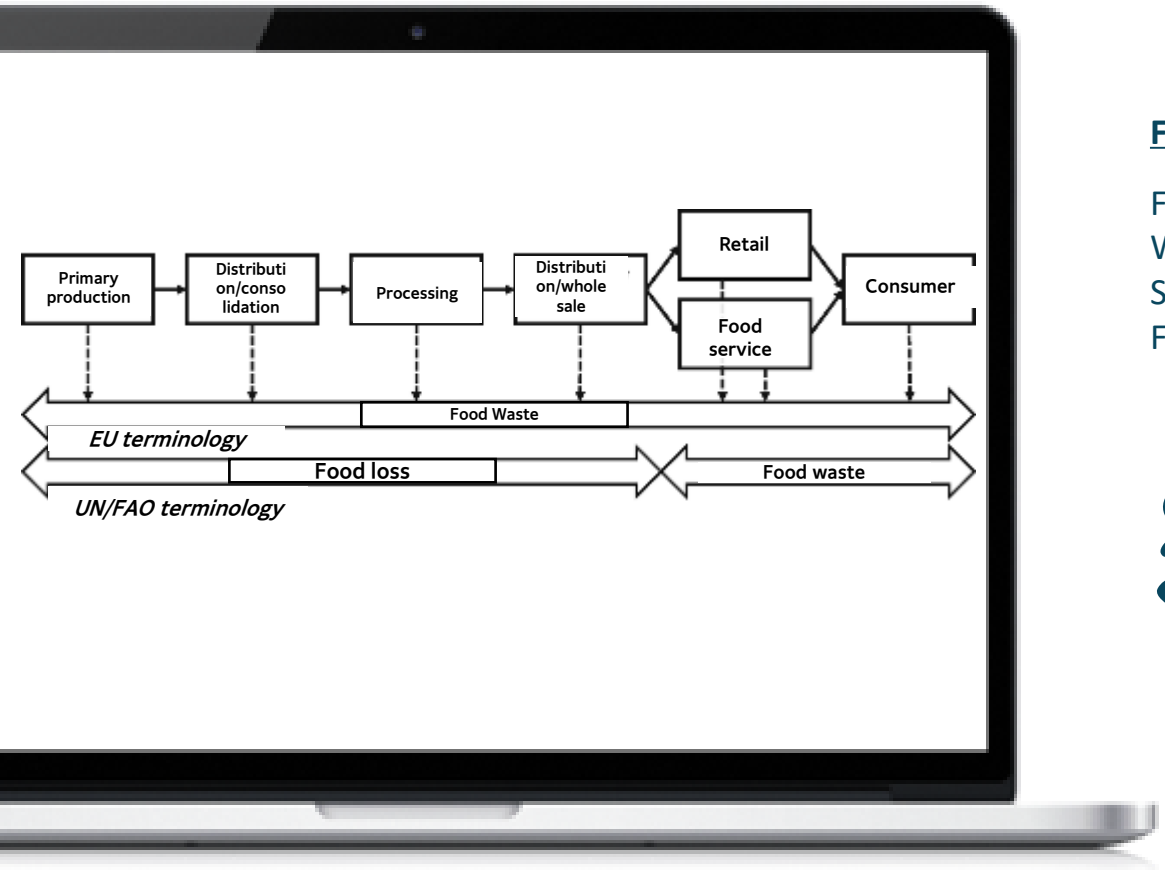


Fig. 6

Food Loss, Food Waste, and Sustainability in Food Supply Chains

When we look at the Food Waste along the food supply chain, it is actually worrying that a lot of the food which is produced does not actually get consumed. This means a lot of resources have been wasted while at the same time, food insecurity is a critical problem in many parts of the world.

The following table shows the causes **of food loss/food waste along the supply chain.**

Production

Definition
Food losses during harvesting

Example
Edible commodities not harvested or spilt during harvesting; food losses occurred due to mechanical damage

Storage

Definition
Food losses occurring during transport and storage

Example
Presence of pathogens and pests, poor transport infra- structure

Process & Packaging

Definition
Losses in product evaluation, processing and packaging

Example
Contamination; inadequate packaging technologies

Distribution

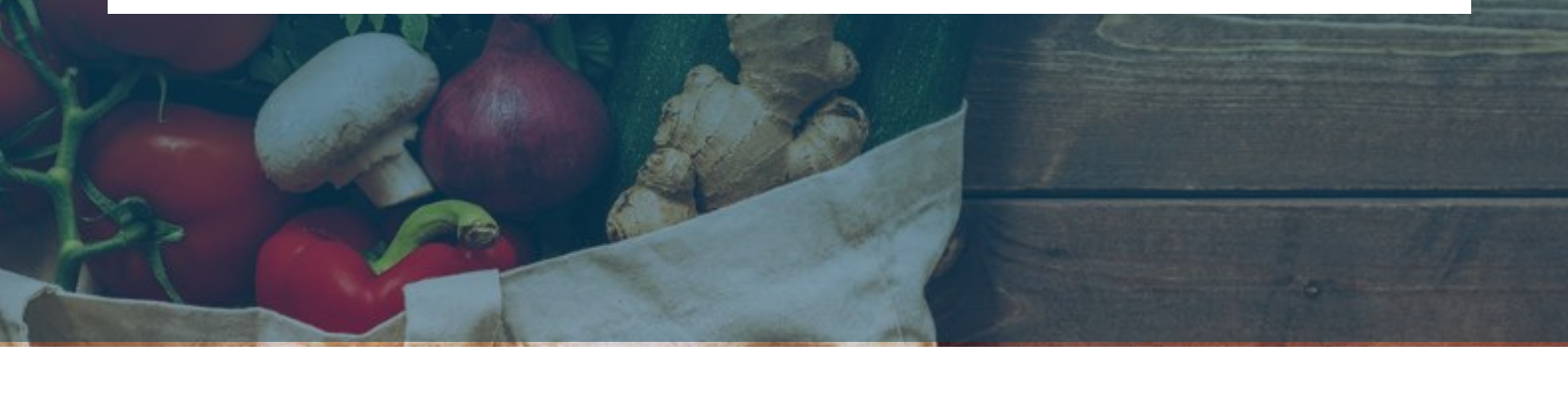
Definition
Food losses at distribution level, in wholesale and retail markets

Example
Poor storage infrastructure in transportation, overproduction due to error in demand forecast; product returns for damaged products; poor handling in markets

Consumption

Definition
Food losses occurring down-stream, at the household level

Example
Over-purchasing; spoilage during storage; exceeding best by/before date



The Food Waste created along the supply chain contributes to the creation of CO_2 and other greenhouse gases. The graph below shows that the further we move along the supply chain, the more food loss occurs and the more carbon intensive the loss and waste. This is because, with each phase, more resources are being used.

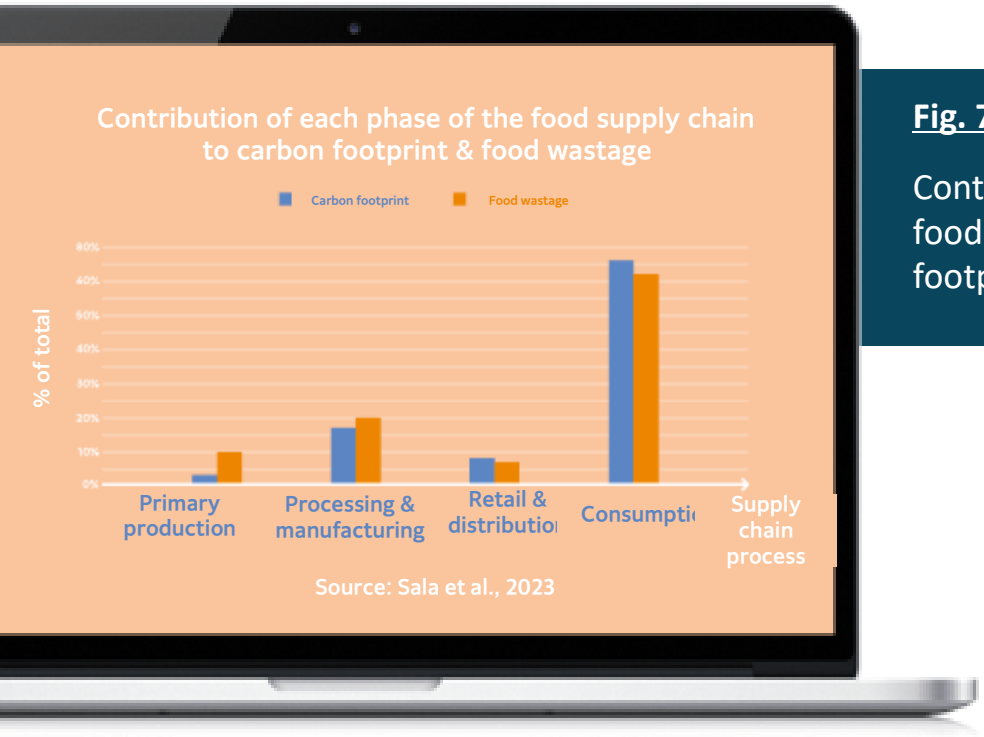


Fig. 7

Contribution of each phase of the food supply chain to carbon footprint and food wastage.

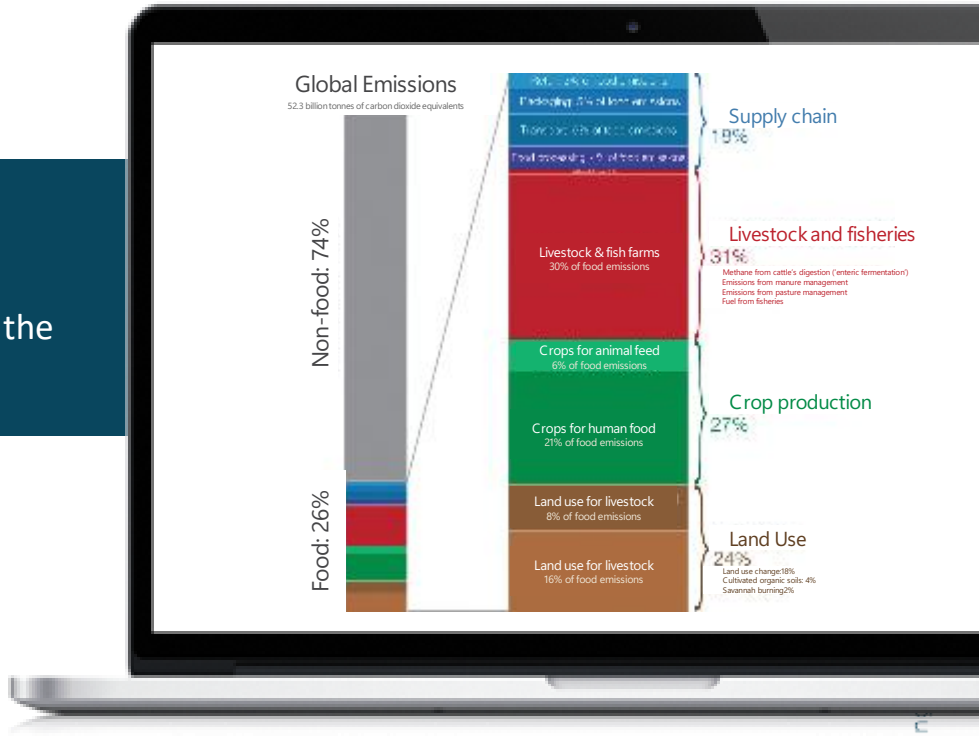


Fig. 8

This graph shows the different causes of creation of CO_2 along the Food Supply Chain.

5. Cold chain logistics and its impact

Cold chain distribution is an essential component of the agrifood sector and is used for different steps of the supply chain such as storage and food processing, transport, retail, and household consumption of temperature-sensitive goods, such as food, medications, and chemicals.

Cold chain logistics relies on various equipment, technologies, and procedures to maintain the item's required temperature, which means constant temperature control that leads to high energy use. Also the refrigerated warehouses and transportation units need constant power, deriving very often from fossil fuels. Due to the fact that temperature sensitive products are in high demand worldwide, the sector is under pressure to lessen its environmental impact since the greenhouse gases generated during the cold chain logistics and distribution process are a significant challenge with regards to combating the climate change. Therefore, developing sustainable food cold chains with minimal GHG emissions impact is crucial.

Reduce the GHG Emission

There are a few strategies that could be used in order to reduce the GHG emission caused by the cold chain logistics

1. Using renewable energy sources through solar or wind power systems.
2. Using biomass energy
3. Equipment that uses less energy
4. Using Led lighting and modern refrigeration systems
5. Enhancing the insulation

6. Loss of Carbon Sequestration Potential

The loss of carbon sequestration potential in Europe is a significant environmental concern. Carbon sequestration refers to the process in which carbon is removed from the atmosphere and stored in various carbon pools, such as forests, soils, and oceans. This process is crucial for mitigating climate change by reducing the amount of CO_2 in the atmosphere.

In Europe, several factors contribute to the **loss of carbon** sequestration potential:

Urbanisation and Soil Sealing:

The expansion of urban areas and the covering of soil with impermeable materials like concrete reduce the land available for natural carbon sequestration. Between 2012 and 2018, significant losses in carbon sequestration potential were observed in Functional Urban Areas (FUAs) across the EU-27 and the UK [5]

Changes in the use of Land :

Conversion of forests and wetlands to agricultural or urban land decreases the carbon storage capacity of these ecosystems. Among terrestrial ecosystems and their habitats, forests have the highest carbon sequestration rates, reaching up to three times that of wetlands and agroecosystems [6]

Agricultural Practices:

Intensive farming practices can decrease the carbon sequestration potentials.

Climate Change:

Climate changes can affect the growth and therefore the carbon storage capacity of forests and other ecosystems. For example, droughts can reduce forest growth and increase the risk of wildfires, which release stored carbon back into the atmosphere. These phenomena have happened in the last few years in the southern states of Europe such as Greece and Italy.

5 https://www.eea.europa.eu/en/analysis/maps-and-charts/estimated-loss-of-carbon-sequestration-figures
6 https://www.eea.europa.eu/publications/carbon-stocks-and-sequestration-rates

In order to rise the carbon sequestration across Europe it is fundamental to restore degraded ecosystems and to implement policies and strategies that increase the carbon sequestration.

The European Green Deal aims to enhance carbon sequestration through nature restoration and sustainable land use practices which is also called carbon farming.[7]

Examples of **Carbon Farming** are:[8]

1. **forestation and reforestation** conducive to biodiversity and sustainable forest management, including forest adaptation practices to climate change;
2. **agroforestry** and other forms of **mixed farming** that combine woody vegetation (trees or shrubs) with crop and/or livestock production systems on the same land;
3. use of **cover crops** and **minimum tillage** or no-tillage techniques as protection against soil erosion and increasing organic carbon content in degraded arable soils
4. **targeted conversion** of fallow land to permanent grassland;
5. **restoration of peatlands** and wetlands that reduce the loss of existing carbon stock and increase sequestration potential.

According to the latest studies, grassland soils (which cover one third of Europe's agricultural areas) already absorb 41 million tons of CO_2 per year, but their sequestration potential would be much higher: with proper agroforestry management, up to 250 million tonnes of CO_2 per year could be absorbed. Importantly, all these activities would bring not only results in terms of carbon sequestration, and thus mitigation of the climate crisis, but also many other benefits related to increased biodiversity and conservation of ecosystems.[9]

7 https://climate.ec.europa.eu/document/download/26c00a03-41b0-4d35-b670-fca56d0e5fd2_en?filename=com_2021_800_en_0.pdf
8 https://www.esg360.it/normative-e-compliance/carbon-farming-cose-e-perche-e-importante-per-lesg/
9 https://www.esg360.it/normative-e-compliance/carbon-farming-cose-e-perche-e-importante-per-lesg

7. Impact of Food Waste on Marine Ecosystems

The environmental impact of food waste isn't limited to land. Food waste has also an impact on the Marine System.

There are different negative impacts which food waste generates on Marine ecosystems:

Global warming through food waste:

As explained above, food waste generates global warming and therefor also changes in the sea surface temperature: the slightest fluctuation in sea surface temperature causes a negative impact on the marine ecosystems in multiple ways. It affects migration and breeding patterns, impacts sensitive ecosystems such as coral, and changes the nutrient supply in the ocean.

Pesticides from agriculture and food waste:

Agricultural runoffs such as fertilisers and pesticides enter water bodies, which eventually make their way into oceans, where they cause dead zones. These dead zones are areas so depleted of oxygen that marine life cannot survive. Dead zones have become an increasing concern worldwide. Furthermore, food waste is often dumped into oceans. One example is the offshore food waste that is not used by consumers when traveling in rivers or high seas. It includes food that is spoiled, expired, or over-prepared or food that has been discarded by restaurants on board of ships or oil rigs, as part of food production. Offshore disposal of waste is prohibited in many countries. It needs to be transferred to shore for disposal. However, there is a loophole: marine food waste disposal often occurs in the high seas, i.e. in international waters where no single country has a jurisdiction. Due to the fact that this food is often treated with pesticides, insecticides, hormones, antibiotics, and preservatives it can damage the marine ecosystem. When human food waste is dumped in the ocean, it is consumed by marine life. As these chemical elements move up the food chain they accumulate and cause elevated levels of toxicity for both fish and humans who rely on fish as a food source.

Plastic Pollution:

Food waste dumped in the ocean also contains very often accidental plastic. Plastic breaks down into microplastics that take thousands of years to decompose. The microplastics are typically consumed by plankton and other tiny organisms. In multiple studies, microplastics have been shown to negatively impact feeding, growth, and reproduction of smaller organisms. This affects phytoplankton populations which are the backbone of the marine food chain

8. Contribution of Food Waste to Global Food Insecurity

Food insecurity is the limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways. [10]

As already explained in the previous chapters Food Waste is a significant issue in Europe, contributing not only to environmental degradation but also to global food insecurity. The previously described impacts of food waste can be summarised as follows:

Food waste = all resources used to produce it such as water, energy and labour are also wasted. This results in a negative impact on climate change and economic cost, which includes loss of potential incomes for farmers and the cost of waste management. Food waste worsens food insecurity by reducing the amount of food available for consumption and increasing food prices.

Food waste which means climate change and food insecurity has an **impact on agriculture**:

Economic Challenges:
economic pressures, including fluctuating market prices, high production costs (such as seeds, fertilisers, and equipment), and limited access to credit

Climate Change:
threat to agriculture. Extreme weather events, such as droughts, floods, and heatwaves, can reduce crop yields and livestock productivity. These events are unpredictable and create huge challenges for farmers.

Supply Chain Disruptions:
Events like the COVID-19 pandemic and geopolitical conflicts (e.g., the Ukraine invasion) have disrupted global supply chains. This lead to shortages of essential products and therefore to higher prices. For example: the prices of sunflower oil rose with the Ukrainian and Russian War.

Resource Depletion:
Overuse of natural resources, such as water and soil, can have a negative impact on the environment and reduce agricultural productivity.

10 https://www.worldhunger.org/united-states-hunger-facts-and-statistics/food-insecurity-infographic-fix-1-1/

9. Impact of food packaging

Food packaging, although necessary for protecting and preserving food has a huge negative impact on the environment. Plastic food packaging which is a significant fraction of food packaging materials, is a primary source of pollution and consequently human health risks.

The impact of the different food packaging types:

Plastic:
For the production of plastic natural resources are necessary such as crude oil, natural gas, and coal. This has a negative effects on the environment since it involves deforestation and resource depletion. Furthermore, the plastic production utilises 4% of the world's total fossil fuel supply which contributes to the greenhouse gas emission [11]

Paper:
Even though paper packaging is often perceived as a more eco-friendly alternative, it has its fair share of environmental consequences. Around 90% of paper pulp is made up of wood. Paper production is responsible for around 35% of all trees cut down: every year 3 billion trees are cut down around the world to produce paper-based packaging. The capacity of Swedish forests to capture CO_2 has been reduced by 5 million tonnes due to overexploitation. [12] The choice between recycled and non-recycled paper packaging carries significant environmental implications. Recycled paper packaging demonstrates clear advantages in terms of energy consumption, water usage, and carbon dioxide emissions. Therefore, recycled paper packaging should be chosen to reduce carbon emissions and to contribute to resource conservation.

Glass:
seems to be the best packaging material because it is recyclable and reusable. But analysing it in detail also shows that glass has a negative impact on climate change. First of all, there is the colour: green glass can incorporate up to 95% recycled material, while clear glass is limited to around 60% due to stringent quality requirements.[13] The melting process of glass requires huge amounts of energy, which result in a higher environmental footprint than aluminium or plastic. In addition, glass is heavier and bulkier and, therefore, results in higher transport costs.

Aluminium:
Also, the production of Aluminium has its negative impact due to the fact that it releases Greenhouse gases, Sulphur dioxide, Dust and Wastewater

11 https://www.limepack.eu/blog/takeaway-packaging-eu/assessing-the-food-packaging-environmental-impact
12 https://www.itp.company/en/will-paper-packaging-really-save-the-world/#:~:text=The%20negative%20environmental%20impact%20of%20paper%20packaging&text=Around%2090%25%20of%20paper%20pulp,to%20produce%20paper%2Dbased%20packaging.
13 https://www.limepack.eu/blog/takeaway-packaging-eu/assessing-the-food-packaging-environmental-impact

04

THE IMPORTANCE OF CIRCULAR COMMUNITIES

THE IMPORTANCE OF CIRCULAR COMMUNITIES

The circular economy plays a key role in avoiding food waste: products, materials, and nutrients are continuously reused, recycled, or upcycled (different from the traditional linear economic models where resources are used once and discarded).

This approach is particularly crucial in the food sector where waste means simultaneously a loss of resources and a significant contribution to environmental degradation. The following paragraphs show how circular economies help in avoiding food waste.

Here's how circular economies help in avoiding food waste:

01

Maximising Resource Efficiency

- **Full Utilisation of Food:**
  Circular economies foster the use of the whole food product, by-products included (e.g. pulp, peels, seeds). In fact, the latter can be upcycled into new products ensuring that nothing goes to waste. For instance: fruit scraps can be turned into pectin, animal feed, or even biofuels.
- **Extending Shelf Life:**
  In order to reduce food spoiling and waste, innovative packaging, preservation techniques, and storage solutions are crucial to help to extend the shelf life of food products. .

02

Creating Value from Food Waste

- **Upcycling Waste into New Products:**
  Another goal is turning scraps into valuable products to reduce/prevent waste. This process may also lead to new revenue streams for businesses. Examples: converting spent grain from brewing into snacks or using vegetable trimmings to produce stock or sauces.
- **Composting and Soil Health:**
  Preferring composting over discarding food waste because the former returns valuable nutrients to the soil, enhances its fertility and reduces the need for synthetic fertilisers (whereas these require resources and contribute to greenhouse gas emissions).

Here's how circular economies help in avoiding food waste:

03

Reducing Environmental Impact

- **Minimising Greenhouse Gas Emissions:**
  By keeping food and organic waste out of landfills, circular economies reduce methane emissions - a major greenhouse gas - thereby mitigating climate change impacts.
- **Reducing Pressure on Natural Resources:**
  This action involves reducing the need for agricultural production through the better use of existing resources. This results in benefits for the environment because of the reduction of the burden from farming, such as deforestation, water use, and soil degradation.

04

Enhancing Food Security

- **Redistribution of Surplus Food:**
  Circular approaches facilitate the redistribution of surplus food by using food-sharing platforms or donation networks; these guarantee food security while minimising waste.
- **Localised Food Systems**
  Circular economies often emphasise local sourcing, which means fostering local sourcing and consumption. Such choice reduces food loss during transportation while simultaneously supporting the community-based solutions to food waste.

05

Encouraging Innovation and New Business Models

- **Innovative Business Practices:**
  Circular economies inspire the creation of new and innovative business models, i.e. services for "imperfect" products, companies that focus on food rescue and redistribution, etc. These businesses influence market demand towards products that might otherwise be wasted. Among these business practices, there are two examples that the W2W Consortium has identified as highly relevant:
  - **OLIO** is a global app with a focus on sharing food locally, including food that people don't plan to consume before it expires. Users can list and share unwanted or surplus food items, making them available for free pickup by other people nearby. OLIO also includes non-food items for sharing.
  - **Too Good To Go** is one of the most popular food-saving apps in Europe. It connects consumers with local restaurants, bakeries, and supermarkets that have surplus food at the end of the day. Users can purchase "magic bags" filled with unsold food at a discounted price, typically at one-third of the original price. Too Good To Go has been instrumental in raising awareness about food waste and has a large user base across major European cities
- **Technology Integration**:
  Technologies like blockchain for supply chain transparency, AI for demand forecasting, and smart packaging that monitors freshness all play roles in reducing waste through precise management and informed decision-making.

Here's how circular economies help in avoiding food waste:

06

Changing Consumer Behaviour

- **Education and Awareness:**
  Education and Awareness: A significant amount of food waste happens at the household level; therefore, circular economies' goal is also encouraging consumers to value food differently and promoting responsible behaviours (e.g. creative use of leftovers, meal planning, proper storage) to minimise the impact.
- **Product Design and Recycling:**
  recyclable or biodegradable food packaging safeguards the environmental footprint.

07

Closing the Loop on Food Production

- **Industrial Symbiosis:**
  Building collaboration between companies so that the scrap from one process turns into a raw material for the other, therefore creating a closed-loop system that benefits not always the companies involved but also the entire food chain.

05

HOW SMES CREATE FOOD WASTE NETWORKS

HOW SMES CREATE FOOD WASTE NETWORKS

SME's can create or become members of food waste networks in different ways.

In this chapter of the guide, you can find some examples

01

Collaborations and Partnerships

- **Partnering with Food Banks and Charities:**
  Collaboration with local organisations and companies (food banks, charities, and community organisations) facilitates the distribution of surplus food to those in need while avoiding food waste.
- **Supply Chain Collaborations:**
  SMEs and other businesses in the food supply chain (farms, restaurants, pastries) can cooperate to share resources. Working together allows them to create an efficient and effective system to manage excess food and prevent waste. For example: restaurants/bakeries might partner with farms to upcycle leftover bread as animal feed.

02

Establishing working relationships with Food Waste Platforms

- **Digital Marketplaces (e-platforms) for Surplus Food:**
  SMEs can create or join digital platforms that link surplus food suppliers to potential buyers. These platforms facilitate the excess food sale (they allow producers to discover new markets for products that might otherwise be wasted) and foster the donation of food to people in need.
- **Food Waste Apps:**
  Too Good To Go and Olio are just two examples of Apps that allow SMEs, such as restaurants, bakeries, pastries, and grocery stores, to find customers ready to buy surplus food at a discounted price. The waste is minimised thanks to the direct connection with the consumers.

03

Building Local Food Hubs

- **Community-Based Food Hubs:**
  Since the hubs have the possibility to collect excess food from various businesses and to relocate it to areas in need (schools, community kitchens, charities), SMEs can establish or join local food hubs.
- **Shared Processing Facilities:**
  They process and upcycle surplus food into new products. SMEs have therefore the chance to co-invest and/or develop shared facilities as well.

In this chapter of the guide, you can find some examples

04

Circular Networks and Industrial Symbiosis

- **Connecting with other Industries:**
  SMEs can go beyond the food sector by joining networks or collaborating with industries like bioenergy, cosmetics, packaging, etc. For instance: fruit and vegetable by-products can become a useful product for companies of the cosmetic of biofuel sector
- **Industrial Symbiosis**:
  The waste from one business turns into the raw material for another developing a closed-loop system within the network.

05

Networking for Waste Valorisation Projects

- **Joint R&D Initiatives:**
  SMEs can take part in research and development projects aiming at waste valorisation to develop innovative uses for food waste
- **Shared Investment in Technology:**
  SMEs can find a way to manage food waste more effectively and effectively by investing in innovative shared technologies (i.e. anaerobic digesters, dehydration equipment, or composting systems), which also lower the cost of the process.

06

Engaging in Policy and Advocacy Networks

- **Participating in Food Waste Forums:**
  Such spaces are crucial to share best practices, influence policies, and foster collaboration on projects with other businesses, entities or private/public bodies.
- **Advocacy and Awarenes:**
  These are important networks that SMEs can join to have an impact on public policies regarding food waste reduction, e.g. incentives for food donations or regulations that promote sustainable packaging.

In this chapter of the guide, you can find some examples

07

Leveraging Data and Technology

- **Data Sharing Networks:**
  They foster better decision-making and resource optimisation by helping SMEs to identify where the waste happens along the supply chain and how to minimise it.
- **Blockchain and Traceability:**
  SMEs can use the blockchain technology to track food waste and surplus food management in a transparent and traceable way.
- **AI:**
  AI can come to hand to analyse consumption patterns to adjust the relevant distribution or can help with weather forecasts to manage the production accordingly. This use of AI increase efficiency, promote a responsible approach, increase the awareness towards the environment and reduce food waste.

08

Educational and Training Networks

- **Workshops and Training Programs:**
  SMEs can be an added value to workshops and training programs about food waste reduction techniques for employees, suppliers, community members.
- **Knowledge Sharing:**
  Sharing best practices and innovations in food waste management is a great contribution to a wider cultural shift towards sustainability.

SMEs can definitively foster a collaborative approach to food waste awareness, exploiting their local connections, knowledge, and innovative spirit to create solutions that influence others and benefit the community, economy, and environment at large.

06

HOW CAN SMES EXPLORE WASTE STREAMS IN THEIR COMMUNITIES

How can SMEs explore waste streams in their communities

Through the creation of an interactive map, we aim to highlight networks and associations in each country that support ***existing and potential food waste valorisation actions.*** *Simply click on the links of the networks.*

We also created some sample maps – demonstrating the opportunities that can lie within food chains. Click on this LINK to see the potential for extending the life cycle of these common products and how valuable '*food waste*' is…

Apple Waste Streams

Olive Waste Streams

Potato Waste Streams

Oat Waste Streams

Dairy Waste Streams

Regional Community Maps of Waste Streams - Waste2Worth

waste2worth

creating circular communities

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