Save Food. Waste less.
Τέρμα στη σπατάλη τροφίμων!

Project:

Awareness – raising campaign to prevent and manage food waste among consumers, the food and hospitality industries.

PSC Parpounas Sustainability Consultants

November 2020

PROJECT BASELINE REPORT

LIFE19 GIE/CY/001166

FOODprint project is co-funded by the LIFE Programme of the European Union

List of Abbreviation

AD – Anaerobic Digestion

CEP – Circular Economy Package

DDG – Sustainable Development Goal

ECN – European Compost Network

EU28 – 28 EU Member States

FAO – Food and Agricultural Organization

FWL – Food Losses and Food Waste

GHG – Green House Gasses

MBT – Mechanical Biological Treatment

MSW – Municipal Solid Waste

NGO – Non-Governmental Organisation

SDG Sustainable Development Goal

WFD – Waste Framework Directive

WRAP – Waste & Resources Action Programme

WRI – World Resources Institute

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Executive Summary

According to various sources of information globally, roughly a third of all food produced for human consumption is lost or wasted - approximately 1.3 billion tonnes. Food losses and waste amounts to roughly US$ 680 billion in industrialised countries and US$ 310 billion in developing countries.[1]

About 60% of bio-waste is food waste. Therefore, the reduction of the demand for increased amounts of food achieved when we prevent food waste, can contribute to the decrease for the environmental impacts of the whole food supply chain (production, distribution, consumption). The benefits from the prevention of food waste, measured in any form, are much higher than any environmental benefits from recycling food waste.[2] Wasting food, does not only result in losing valuable resources, but it also has significant contribution to climate change, as the biodegradation of food waste is associated with high emissions of greenhouse gases. According to the UN's Food and Agricultural Organization (FAO), food waste has a global carbon footprint of about 8% of all global greenhouse gas emissions caused by humans.[3]

The losses in the food supply chain differ between industrial and developing countries because of the differences in the nature of production, distribution and consumption of food. Therefore, finding solutions to minimise food waste in each region, will depend on these characteristics of each region since in developing countries, over 40% of food losses happen after harvest and during processing, while in industrialised countries, over 40% occurs at retail and consumer level.[4]

However, tackling the food waste problem is hindered among other things by the lack of awareness of the scale of the problem and the potential solutions and benefits resulting from reducing food waste. International research reveals that the food waste problem is underestimated. Globally, people perceive that the food waste problem is smaller than it actually is. This is an area which can be targeted through the primary research incorporated in the actions of the Foodprint project, since there are no data available on the perception of Cypriot citizens about the scale of the food waste problem.

Bio-waste is a significant fraction of European municipal waste generation. In 2017, the EU-28 (28 EU Member States) generated 249 million tonnes of municipal solid waste, of which about 34%, or 86 million tonnes, was bio-waste.[5] Because of the bio-waste considerable volume, the EU's

[1] "Food Waste Facts". 2020. Stop Wasting Food. https://stopwastingfoodmovement.org/food-waste/food-waste-facts/
[2] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe
[3] "Food Wastage footprint & Climate Change". FAO. https://www.fao.org/3/bb144e/bb144e.pdf
[4] Gustavsson, Jenny et al, 2011. "Global Food Losses And Food Waste - Extent, Causes And Prevention". Rome: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS.
https://www.fao.org/fileadmin/user_upload/suistainability/pdf/Global_Food_Losses_and_Food_Waste.pdf
[5] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe

LIFE19 GIE/CY/001166
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common objectives for waste management cannot be met without addressing the bio-waste stream. As explained previously, one of the impacts of biowaste, is its contribution to the climate crisis because of significant GHG emissions. The emissions created by food waste corresponds to about 3% of total EU greenhouse gas emissions. The ambition of the EU to deal with the impacts of municipal bio-waste is reflected in the new targets defined in the 2018 revised Waste Framework Directive. The Directive introduces, specifically for food waste, new targets regarding recycling and preparation for reuse of Municipal Solid Waste: by weight, at least 55 % by 2025, 60 % by 2030, and 65 % by 2035.[6]

EU legislative action regarding food waste has intensified in the last few years. There has been a significant shift towards addressing the management of food waste especially after the introduction of the Circular Economy Package in 2018. While older versions of the EU waste legislation concentrated on the management of other waste streams like packaging, batteries, waste electrical and electronic equipment, other hazardous waste etc., the latest revisions of the legislation depict a clear shift to dealing with biodegradable waste and food waste. We now have clear statements of the need to collect food waste separately and divert it away from landfills. The emphasis on food waste is evident in the revision of the Waste Framework Directive (2008/98/EC) in 2018, as a result of the provisions of the Circular Economy Package. While the original Directive had little reference to food waste, (food waste is mostly dealt with as part of the biodegradable waste that needs to be diverted from landfilling as per the Landfill Directive (1999/31/EC), the revision of the WFD highlights the issue of food waste by setting higher recycling targets, enforcing the separate collection of bio-waste and promoting the prevention of food waste.

The Sustainable Development Goal 12.3 which is halving food waste by 2030, has contributed to promoting the prevention of food waste and placing it high on the policy agenda, in most European countries. The Commission is now committed to halving per capita food waste at retail and consumer levels by 2030.

Food waste can be divided into avoidable (edible) and non-avoidable (inedible) food waste. Preventing avoidable food waste, besides the obvious benefits of avoiding waste, is also perceived as an ethical responsibility, because it is associated with the careless spend of economic resources and their resulting negative environmental externalities. For this reason, the recent focus of the European Commission's bio economy strategy has shifted to food systems and the potential to prevent food waste. Generally, in most European countries, food waste stands out as a priority in waste prevention policies. The most common policy actions aimed to address this issue are preventive educational actions like awareness-raising and information campaigns, other common and practical measures like food redistribution platforms and the sale of retailers' second-class

[6] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, pp. 3-30).

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food at lower prices.[7] Most recently, a forthcoming EU 'Farm to fork' strategy was announced as part of the EU Green Deal, which is intended to address all stages of the food chain, including food waste.

In many countries, food waste prevention measures have been given a priority as it is recognised that in order to reduce the environmental impacts of the whole food supply chain the most effective way is to reduce the demand for food and hence its waste. Food waste is by fact an important part of MSW by weight, hence every effort to prevent waste in practice needs to target food waste too. Countries are implementing policy measures ranging from Eco labelling, through awareness campaigns and increasing the responsibilities of producers and distributors.[8] The new reporting requirements and methodology for measuring food waste generation introduced under the WFD, will for the first time enable tracking of the progress of such policies across Europe in a harmonised way.

In the EU, around 88 million tonnes of food waste (equivalent to 173 kilograms per person), are generated annually (an estimated 20% of the total food produced each year is lost or wasted), with associated costs estimated at 143 billion euros.[9] At the same time, latest Eurostat data (2018) indicate that 43 million people cannot afford a quality meal (including meat, chicken, fish, or vegetarian equivalent) every second day. Not only is this a waste of resources and a moral issue when so many people are in need even in developed societies, it also contributes to climate change. It is estimated that greenhouse gas emissions related to food losses and waste in the EU-28 are responsible for 15-22% of the total life-cycle emissions of the food consumed. [10]

Due to the fact that food waste has rather recently been prioritised on the waste agenda, the data found on quantities of food waste are rather limited compared to other waste streams. The fact that in most countries' food waste is not collected separately but as part of Municipal Solid Waste, limits the access to quantitative data on food waste. What is apparent from Eurostat data however, roughly in half of the EU countries, Municipal Solid Waste production per capita has decreased between 2005 and 2018, while in the rest, it has increased. In the majority of the countries though, the differences during this period are rather small.[11] It is not clear due to lack of separate measures of food waste (as part of the MSW) during the same years, however it is possible that the production of food waste followed a similar pattern in most of the countries. So, we can potentially assume that in half of the EU countries the food waste has been decreasing and, while in the rest, it has been increasing. Regarding the treatment of waste, the results reveal that during those years

[7] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe
[8] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe
[9] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.
[10] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe
[11] 77. Ec.europa.eu. 2021. File: Municipal waste landfilled, incinerated, recycled and composted, EU, 1995-2020.png - Statistics Explained. [online] Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Municipal_waste_landfilled,_incinerated,_recycled_and_composted,_EU,_1995-2020.pngb

LIFE19 GIE/CY/001166
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a significant shift away from landfill was achieved as the amount of waste landfilled has been steadily decreasing over time, while more waste has been diverted to material recycling, incineration, and composting. There are of course significant differences in the practices and progress achieved between the EU countries.

The lack of data and analysis of food waste in the EU can be mainly attributed to the fact that there was no specific obligation to collect such data separately. Data on food waste generation have usually been derived so far from ad hoc studies. The database will improve with the recent obligations by the revised Waste Framework Directive, for all EU Member States to measure and report food waste generation annually, starting in 2020.

The common practice of landfilling bio-waste, results in high negative environmental impacts since biodegradable waste decomposes producing mainly methane, a powerful greenhouse gas.[12] Landfilling of separately collected bio-waste, or of bio-waste within residual municipal waste without pre-treatment, is prohibited in the EU according to the WFD and the Landfill Directive. The two main treatment options for the treatments of separately collected bio-waste currently are composting and anaerobic digestion with biogas production. The level of separate bio-waste collection differs considerably across EU Member States.[13] Many countries are indeed very far from capturing bio-waste's full potential, and that includes Cyprus too, as the food waste is not sorted at source or collected separately, despite the significant installed capacity of anaerobic digesters with energy recovery for the farming waste.

Food has an environmental footprint not only when it biodegrades in landfills but throughout the whole food supply chain. In fact, the greatest environmental impact of food occurs at the stage of food production. Therefore, the prevention of food waste becomes significant at all stages of the food value chain. Decreasing the demand for food, will result in lower environmental impacts in the production, processing, and transportation of food. The most important areas to target for food waste prevention to achieve the greatest environmental impact, are the households and the hospitality sector[14].

The WFD requires all EU Member States to develop specific food waste prevention programmes. In many Member States the development of such programmes is still under way. However, the analysis of 32 national and regional waste prevention programmes, demonstrate that measures on food waste are already included in the prevention programmes of 28 countries and regions. Such measures include, for example, awareness-raising and information campaigns and

[12] "Green Paper On The Management Of Bio-Waste In The European Union {SEC(2008) 2936}". 2008. https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52008DC0811.
[13] "European Bio-Waste Management – Overview Of Bio-Waste Collection, Treatment & Markets Across Europe". 2019. ECN. https://www.compostnetwork.info/policy/biowaste-in-europe/.
[14] "Scherhaufer, Silvia et al. 2018. "Environmental Impacts Of Food Waste In Europe" 77: 98-113. doi: https://doi.org/10.1016/j.wasman.2018.04.038.

LIFE19 GIE/CY/001166
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programmes to reduce food waste, economic and financial measures, regulatory measures, voluntary agreements, targets, and food redistribution platforms. These measures can target both the consumers and industry.[15] Examples of nation-wide measures include "Pay as you throw" schemes in several EU countries, government support for the promotion of food donation such as the development of technological and logistical solutions in Ireland (redistribution "hubs" managed by FoodCloud) to facilitate food donation at national level, voluntary agreements for businesses (Austria's Agreement 2017-2030) and country regulations over and above the EU waste regulation such as the French Law 2016-138 which obliges all supermarkets and retailers with a surface larger than 400 square meters to donate their surplus food.

The availability of local statistics on biodegradable waste in general and more specifically on food waste in Cyprus, is low. Using different data sources and proxies, the project team estimated food waste in 2017 to be about 155,000 tonnes in Cyprus, representing 28.2% of total municipal solid waste generated for the same year. Consequently, it can be derived that almost one third of the cost for infrastructure and the operational cost for waste management in Cyprus, is expensed to manage food waste. At the same time, little work has been done to tackle food waste. Most of the initiatives found are fragmented and isolated and depend mostly on individuals in the catering business who are aware of the food waste problem and have managed to utilise local networks to share cooked food that remains unsold in their stores every day.

According to hotspot analyses prepared so far, there are international and EU data on the types and quantities of food produced and lost at various stages of the life - cycle of food, from production to consumption. There are also good indicators of the damage caused both socially and economically by food waste. To a certain extent, some of the root causes of food waste that are related to public behaviours, are also known. However, we know very little about the public opinion and habits of people in Cyprus regarding food waste. To design an effective communication campaign, it is imperative to have a better baseline of the existing opinions and behaviours of people. At the same time, this baseline will serve as a base for the measurement of the effectiveness of the campaign to be deployed during the project duration.

It is necessary to understand the extent of the food waste problem in Cyprus, the reasons causing it, the rates at which food waste is produced and where this happens most intensely. Understanding and recording any negative habits and mentalities of the public, as well as any possible disincentives for the proper management of food waste, are all important and will be utilised for the design of an effective communication campaign with the aim to positively influence the public opinion and habits to facilitate the prevention and treatment of food waste.

[15] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe

LIFE19 GIE/CY/001166

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To facilitate the design of the Life Footprint project baseline, two quantitative surveys were conducted during October and early November 2020. The main survey was based on structured questionnaires (Annex A) and a stratified sample of 554 people over the age of 18 who were responsible for the food in the household, run in the period 21 – 23 October 2020. The second, was a shorter online questionnaire (Annex C) via the Dias group websites with a larger but random sample (total 1828 participants, out of which 1104 provided complete answers to all the questions) and participation from other countries too (Greece, UK, other).

As can be seen from the surveys, the vast majority of Cypriot consumers buy more than the necessary quantities of food on a regular basis. This is done mainly for two reasons, to satisfy the different preferences of family members, and to maintain a sense of security and adequacy. Even more, the percentage that indicates that during every meal, there are leftovers, is high. In most cases they are consumed in the next few days, or given to pets, but there are many cases in which the leftover food is simply thrown away. This is the second challenge beyond the excessive food purchases. The poor management of food stocks results in about one in four cases, to surplus food simply ending up in the trash.

The main reason for which consumers waste food according to the survey, is that they do not manage to consume it before the expiration date, which means poor planning of stocks. This, coupled with the excessive purchase of food, also demonstrates limited knowledge of food storage and preservation techniques and poor refrigeration and food management practices. Another point that deserves attention is that the greatest contributors to food waste are the youngest people, the upper social classes, the people who shop more often and the people who more often order ready-made food.

It is also apparent that consumers do not consider the wasting of food as a serious environmental problem. Instead, they feel guilty when they waste food (possibly because they throw food away while others do not have the necessary food) and also that they waste their money. So financial concerns and charity feelings prevail when food is wasted, while environmental concerns from wasting food are lower in priority. This is one of the issues that can be targeted by our communication campaign, as the appreciation of the environmental impacts of wasting food is underrated, which is possibly a result of the lack of knowledge of the greenhouse gas emissions contribution of food waste. This is not something that has been communicated sufficiently in Cyprus and it is very possible that people consider the organic waste the most “innocent waste” because it is organic.

The most important conclusions from the two research surveys, will be used to design a campaign for the prevention of food waste targeted at the public. The main conclusions are:

- People are wasting almost a third of the food they buy

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- People buy more than needed and they throw much of that away (they do not properly manage their food stocks)
- Younger people waste more than older people
- More effluent consumers waste more
- Consumers buy more, mostly for security reasons (to feel safe)
- They do not consume at the same rate they buy (over-consumption)
- Consumers are having difficulties to properly manage their food (freezing, storing etc.) and consequently they throw more food that becomes waste away
- More than 70% of people throw their food waste in the waste bin, and less than 10% compost it
- There is a fallacy that people plan their purchases and manage their food properly, but real behaviours do not support that
- There are good intentions to managing the food, but little action to do so
- Consumers do not consider food waste a serious environmental problem
- Consumers feel guilty when they waste food (possibly because they throw food away while others need food) and also that they waste their money (financial and charity feelings prevail)
- There is poor utilisation of food expiration labelling
- There is poor knowledge or limited attention to methods to prevent food waste
- Consumers are not used to sharing their food leftovers, and instead they throw them in the waste.

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Introduction

This report is an integral part of the work for the project FOODprint – "Awareness – raising campaign to prevent and manage food waste among consumers, the food and hospitality industries", co-funded by the Life Programme of the European Union (LIFE19 GIE/CY/001166). The report is intended to serve as the baseline for the project and provide material and findings that will be used to properly design the awareness raising campaign to prevent and manage food waste among consumers, the food and hospitality industry, which is the main scope of this project.

In this context, the collection and analysis of data had been deployed at the following levels:

- International food waste data and initiatives
- EU food waste data and initiatives
- Cyprus food waste data and initiatives
- Primary research in Cyprus to identify existing public opinions and public habits with regard to food and food waste.

The combination of this information will be used to develop the campaign of the project, while some of the data collected from the EU and the international markets, can serve as benchmarks to gauge the success of the project initiatives. To measure the impact of the project interventions, two additional primary research surveys will be performed, one in the middle of the project duration and one towards the end of the project. These two future surveys will be designed partially to investigate further issues relating to food waste, but also to follow up on issues identified in the first survey to examine the impact of the project intervention on these parameters. To enable the measurement of the impacts of the project interventions (primarily project communication campaign), the second survey will follow a few months after initiation of the campaign and the third will be performed towards the end of the project. The second survey, expected to provide results of the impact of the campaign during the first months of the campaign, can be used to fine tune and better target the campaign messages and or tools. The end survey will serve as an overall evaluation of the impacts of the campaigns on the knowledge and beliefs of people. The intention is to structure the sample of these two surveys similarly to the first survey to facilitate the comparability of the data.

During the whole duration of the project, additional web-surveys will be performed on a quarterly basis via the websites of Dias Group. These web-surveys will also serve two purposes. One is to further investigate issues that cannot be investigated in the main surveys due to the limitation of the number of questions (to have a survey of a proper size). The web-surveys will also give us the chance to investigate potential lack of knowledge for parameters that are related to food waste. For this purpose, the questions for the first 5-6 surveys have been structured to do that. The second purpose of these web-surveys will be to see the impacts of the project interventions over time.

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Therefore, the questionnaires for the web-surveys following the first 5-6 surveys, will be more structured to evaluate progress over time in the knowledge and beliefs of people.

LIFE19 GIE/CY/001166

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Contents

LIFE19 GIE/CY/001166
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Table of Figures

LIFE19 GIE/CY/001166
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List of Tables

LIFE19 GIE/CY/001166
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1. Global Perspective

Bio-waste comprises mainly of food and garden waste and it is a valuable resource with great potential in circular economy solutions such as the use of bio-waste for the production of fertiliser and for the production of renewable energy (biogas)[16].

About 60% of bio-waste is food waste[17] therefore, any reduction in the demand for food can contribute to the decrease of the environmental impacts of food waste throughout the entire supply chain (production, distribution, consumption). The prevention of food waste will bring better environmental results than the recycling of food waste[18].

According to the UN's Food and Agricultural Organization (FAO) in 2011 it was estimated that globally, about a third of all food produced for human consumption is lost or wasted every year[19].That is approximately 1.3 billion tonnes[20]. Food losses and waste amounts to roughly US$ 680 billion in industrialized countries and US$ 310 billion in developing countries[21].

Other than the loss of valuable resources used in the production of food (energy, soil, water), food waste is also contributing to climate change[22]. Based on a UN's FAO 2013 study[23] the global carbon footprint of food loss and waste, excluding emissions from land use change, is 3.3 gigatonnes of carbon dioxide (CO_2) equivalent, corresponding to about 7% of total GHG emissions.

Wastage of food presents an ethical issue too. According to FAO, about 793 million people in the world are malnourished. According to Eurostat, 55 million people (9.6% of the EU's population), were unable to afford a quality meal every second day in 2014[24].

Food loss and waste in industrialised countries has a different distribution than in developing countries[25]:

[16] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[17] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[18] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[19] "SOFA 2019 - The State Of Food And Agriculture In The World". 2019. *Www.Fao.Org*. https://www.fao.org/state-of-food-agriculture/2019/en/.
[20] "Food Waste: The Problem In The EU In Numbers [Infographic]". 2017. *Europarl.Europa.Eu*. https://www.europarl.europa.eu/news/en/headlines/society/20170505STO73528/food-waste-the-problem-in-the-eu-in-numbers-infographic.
[21] "Food Waste Facts". 2020. *Stop Wasting Food*. https://stopwastingfoodmovement.org/food-waste/food-waste-facts/.
[22] "Food Waste: The Problem In The EU In Numbers [Infographic]". 2017. *Europarl.Europa.Eu*. https://www.europarl.europa.eu/news/en/headlines/society/20170505STO73528/food-waste-the-problem-in-the-eu-in-numbers-infographic.
[23] "Food Wastage Footprint - Impacts On Natural Resources". 2013. *Fao.Org*. https://www.fao.org/3/i3347e/i3347e.pdf.
[24] "Food Waste: The Problem In The EU In Numbers [Infographic]". 2017. *Europarl.Europa.Eu*. https://www.europarl.europa.eu/news/en/headlines/society/20170505STO73528/food-waste-the-problem-in-the-eu-in-numbers-infographic.
[25] Gustavsson, Jenny et al, 2011. "Global Food Losses And Food Waste - Extent, Causes And Prevention". Rome: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. https://www.fao.org/fileadmin/user_upload/suistainability/pdf/Global_Food_Losses_and_Food_Waste.pdf.

LIFE19 GIE/CY/001166
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- In developing countries, more than 40% of the food losses occur at post-harvest and processing levels;
- In industrialised countries, more than 40% of the food losses occur at retail and consumer levels.

Food loss is also higher in industrialized countries (affluent) compared to developing countries.

Figure 1 is indicative of the increased food waste production in affluent countries.

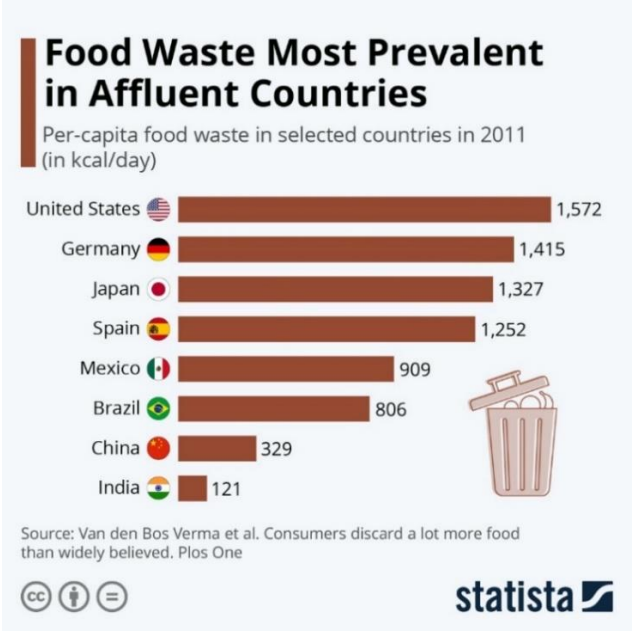

Figure 1: Food Waste Most Prevalent in Affluent Countries (2011)

Source: Statista.com

About 14 percent of the world's food is lost before it even reaches retail. This is the conclusion of a report released recently by the UN Food and Agriculture Organization[26]. Figure2, presents the breakdown of losses by food type.

[26] "The State Of Food And Agriculture 2020. Overcoming Water Challenges In Agriculture". 2020. Rome: FAO. https://www.fao.org/documents/card/en/c/cb1447en/.

LIFE19 GIE/CY/001166
FOODprint project is co-funded by the LIFE Programme of the European Union

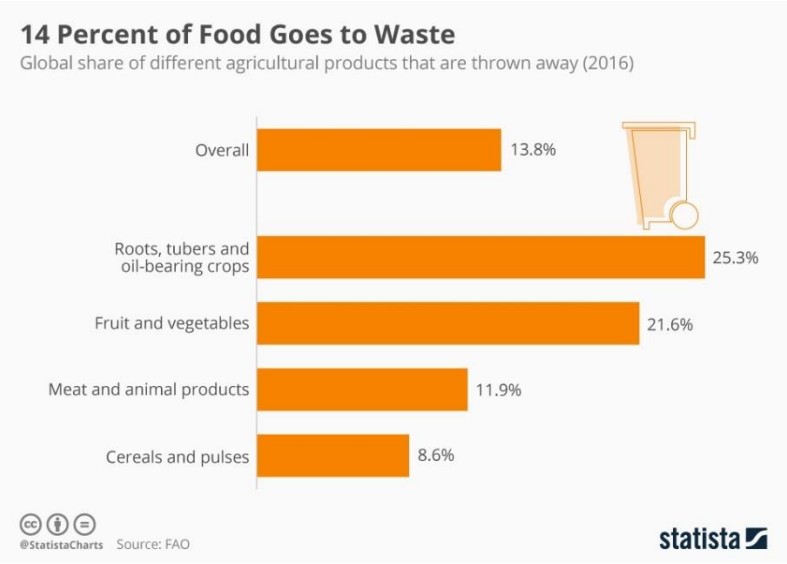

Figure 2: Percent of Food Goes to Waste

Source: Statista.com

According to the report, the losses occur due to incorrect harvesting times, climatic conditions, incorrect harvesting techniques, poor storage, and improper transport. Countries in Central and South Asia are particularly affected by food losses (20.7%). However, North America and Europe also lose food at a rate that is above the world average (13.8%). Regions more careful with food waste are Australia and New Zealand (5.8%), the rest of Oceania (8.9%) as well as Eastern and Southeast Asia (7.8%)[27].

Food losses, or food wasting, happens along the full food supply chain. There are losses on the farm, in processing and manufacturing, in shops, in restaurants and canteens and in the household. The most important losses however happen at the household level. The reasons for food waste vary depending also on the specific sector.

1.1. Factors contributing to food waste

There are many factors that contribute to the food waste issue, some of which are[28]:

- Insufficient meal planning and shopping
- Marketing techniques to increase sales (e.g. promotions like "buy one, get one free" that may lead to impulse buying and buying more than needed)

[27] "The State Of Food And Agriculture 2020. Overcoming Water Challenges In Agriculture". 2020. Rome: *FAO*. https://www.fao.org/documents/card/en/c/cb1447en/.

[28] Gustavsson, Jenny et al, 2011. "Global Food Losses And Food Waste - Extent, Causes And Prevention". Rome: *FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS.* https://www.fao.org/fileadmin/user_upload/suistainability/pdf/Global_Food_Losses_and_Food_Waste.pdf.

LIFE19 GIE/CY/001166

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- Not being aware of the meaning of "best before" and "use by" date labels resulting in throwing away edible foods
- Insufficient food management skills (e.g. meal preparation, use of food/food ingredients in-stock, use of leftovers)
- Inadequate storage/transport at all stages of the food chain including households (e.g. refrigerator temperatures)
- Packaging difficult to empty or too large
- Aesthetic considerations (bruised or ugly fruit and vegetables etc.)
- Standardised and too big portion sizes in restaurants and canteens
- With regards to catering and restaurants, the difficulty in anticipating the number of customers
- Stock management issues for manufacturers and retailers
- High quality standards (e.g. for produce sold at retail)
- Incorrect estimation of future demand for products resulting in overproduction or over ordering of products in manufacturing and retail operations
- Production errors, products and/or labelling not meeting specifications
- Product and packaging damage (farmers and food manufacturing)
- Lack of knowledge and/or misinformation on the environmental, social and financial impacts of food waste
- Low perceived value of food
- Busy lifestyle and conflicting priorities

Underneath these obvious problems, there are underlying facts that contribute to the losses, like the gross underestimation of the scale of the problem, the limited awareness of the solutions and the potential benefits from food waste reduction. Following is an analysis of the challenges and opportunities at different levels.

Consumers

Every individual can play a role in reducing food waste and often this can be achieved with minimal effort by the individual. So, underestimating the size of the problem and considering that the solution may be difficult, prevent actions that can limit food waste, save money, and help to protect the environment. There are many examples of easy ways and means to minimise food waste at the household level and this is critical due to the high contribution of the households to the creation of the problem. The most recent estimates of European food waste levels, reveal that 72% of EU food waste arises in the household (estimated 47 million tonnes) and the food processing sector (estimated 17 million tonnes). The remaining 28% is attributed to the food service sector (estimated 11 million tonnes), the production sector (estimated 9 million tonnes) and the wholesale and retail sectors (5 million tonnes)[29].

[29] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.

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There are various steps that consumers can take to limit food waste, among which are the following[30]:

- Compile shopping lists
- Check the expiration dates and be aware of the meaning of date labelling
- Store food in accordance with the instructions on the packaging
- Put new food at the back of the fridge and the cupboards
- Use up leftovers to produce other foods
- Consume leftovers in the next days
- Freeze food to preserve.

Industry

Companies can also utilise various ways to limit food waste and find better ways to manage food, with resulting benefits at different levels. It is estimated that returns on investment spent for food loss and waste reduction are quite high. Research by the World Resources Institute (WRI) and the Waste & Resources Action Programme (WRAP) has shown that for every $1 invested in food loss and waste reduction, the company saved $14 in return. The companies for which the returns were highest were restaurants. Food retailers, hotels and food service companies had lower returns on investment. The research evaluated cost and benefit data of about 1,200 businesses in 17 countries and across different sectors (retail, hospitality, food service)[31].

Governments

The governments' role is very important in tackling food waste issues because they control and supervise the legal framework and the resulting obligations. They are expected to create enabling policy environments that promote food waste prevention and reduction, including economic incentives for application of the waste hierarchy (e.g. frameworks for food donation and incentives to people and companies to limit the production of waste etc.). Food waste is a cross-cutting issue affecting different policy areas; therefore, relevant public services should coordinate efforts and develop integrated action plans to tackle food waste effectively**.** Strengthening collaboration between all actors of the food supply chain is crucial and governments can facilitate such synergies in view of achieving more sustainable food systems[32].

1.2 The food waste problem is underestimated

International research reveals that the food waste problem is underestimated in many countries. Globally, people perceive that the food waste problem is smaller than it actually is, with only few

[30] "Food Waste: The Problem In The EU In Numbers [Infographic]". 2017. *Europarl.Europa.Eu*. https://www.europarl.europa.eu/news/en/headlines/society/20170505STO73528/food-waste-the-problem-in-the-eu-in-numbers-infographic.
[31] Hanson, Craig, and Peter Mitchell. 2017. "THE BUSINESS CASE FOR REDUCING FOOD LOSS AND WASTE". *Champions 12.3.* https://champions123.org/sites/default/files/2020-08/business-case-for-reducing-food-loss-and-waste.pdf.
[32] "Food Waste". 2022. *European Commission*. https://food.ec.europa.eu/safety/food-waste_en.

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exceptions. Ignoring or underestimating a problem, limits the incentive to strive to find solutions and the motivation to implement them. Figure 3 is indicative of this fallacy at the level of the households in different countries.

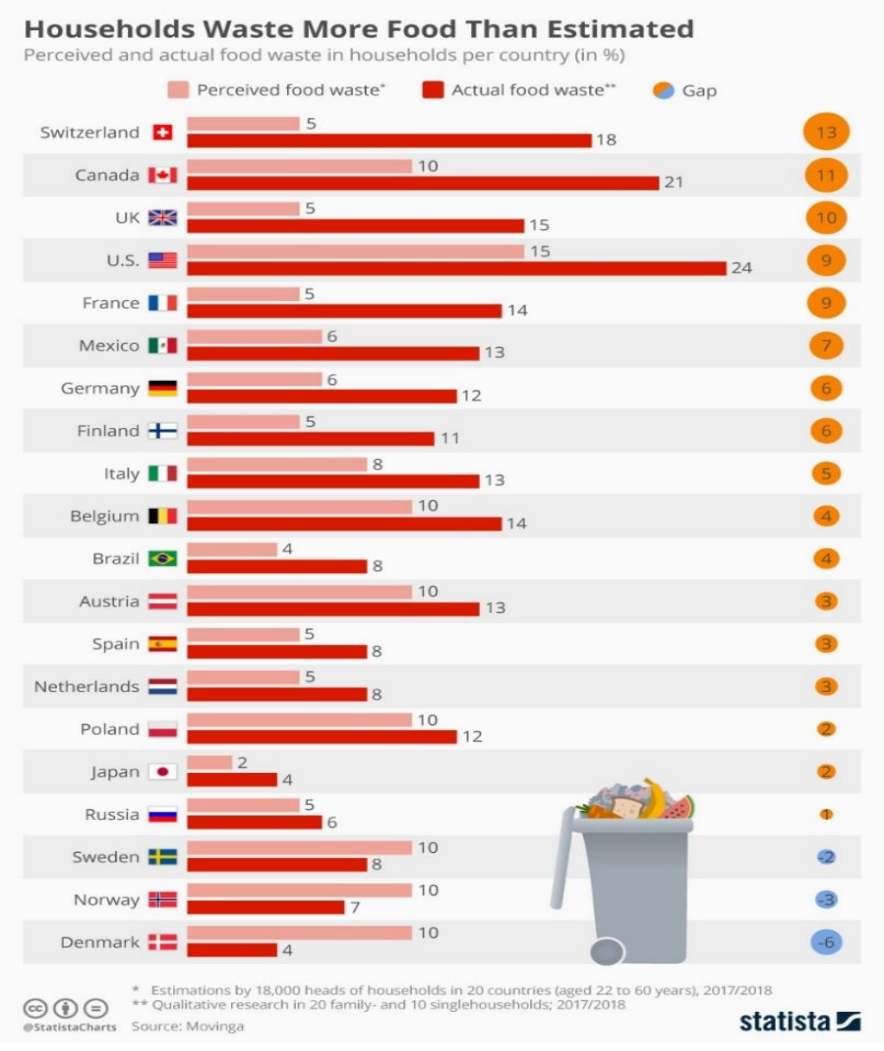

Figure 3: Households Waste More Food Than Estimated (2017/2018)

Source: Statista.com

Consumers are also often unaware of the reasons behind food waste and its main causes. For instance, according to a Eurobarometer survey, date markings on food products is poorly understood, even though nearly six out of 10 Europeans say they always check “best before” and

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"use by" labels[33]. With lack of understanding of the labelling, the fact that the labels may be checked by people, does not guarantee better management of food and food stocks. Especially when the best before and the use by labels are misunderstood, there is a real risk of food ending up in waste although the food is still good for consumption.

[33] "Food Waste: The Problem In The EU In Numbers [Infographic]". 2017. *European Parliament.* https://www.europarl.europa.eu/sides/getDoc.do?type=IM-PRESS&reference=20170505STO73528&format=XML&language=EN.

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2. EU perspective

Bio-waste in the European union is a significant fraction of the total municipal waste. In 2017 it was estimated that out of a total of 249 million tonnes of municipal waste, 86 million tonnes were bio-waste, that is 34% of the total municipal waste. This estimate includes separately collected bio-waste and bio waste in mixed waste but excludes bio waste composted at home[34].

The bio-waste definition in the EU Waste Framework Directive is that bio-waste comprises "biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food-processing plants"[35]. Food waste includes edible food (e.g. food purchased but not eaten, meal leftovers) which is what is targeted by food waste prevention initiatives and non-edible food (e.g., egg shells and fruit peel). Other types of bio-waste are wood, natural fibres in clothing and paper and cardboard, but these are not included in the bio-waste definition[36].

Given the large volume of bio-waste in Europe, to achieve the recycling goals set in the WFD, means that the bio-waste stream must addressed. The 2018 revised WFD has set ambitious goals for municipal waste recycling: at least 55% of municipal waste by weight will have to be recycled by 2025, 60% by 2030 and 65% by 2035[37]. If not addressed, the bio-waste stream poses an important environmental threat and a significant contributor to GHG emissions. In 2018 it was estimated that about 3% of total EU GHG emissions are attributed to the waste sector (including all waste treatment methods such as biological treatment, incineration, landfilling, etc.)[38].

In addition to the 2018 revised WFD, the UN Sustainable Development Goals' target of halving food waste by 2030 has contributed to promoting the prevention of food waste and placing it high on the policy agenda, in most European countries. As already mentioned, bio-waste amounts to 34% of the municipal solid waste and addressing this waste stream is essential to reach the 65% municipal waste recycling target by 2035. Even though 17% of municipal waste was composted and digested in 2018, there is still a high percentage of bio-waste ending up in mixed municipal waste which is incinerated or landfilled even in countries with well-established collection systems. Therefore, if bio-waste is to be recycled to produce high value material such as fertilizer and soil improver it will have to be collected separately at source and to maintain a very high purity level[39].

[34] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[35] EU, 2018b, Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (OJ L 150, 14.6.2018, pp. 109-140).
[36] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[37] Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (OJ L 150, 14.6.2018, pp. 109-140).
[38] "Annual European Union Approximated greenhouse Gas Inventory For The Year 2018EEA Report No 16/20191994-2019". 2019. Luxembourg : European Environnent Agency. https://www.eea.europa.eu/publications/approximated-eu-ghg-inventory-proxy-2018.
[39] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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2.1 Food waste in the EU

The European Union has recently been very active in dealing with food and food waste. Food waste is an increasing concern in Europe. The production, distribution and storage of food use natural resources and generate environmental impacts. Discarding food that is still edible increases these impacts and causes financial loss for consumers and the economy[40].

Prevention of food waste has also an ethical component and may help reduce the existing inequities in the food system. Preventing food waste, according to Philippides et al.,2019[41], "represent a legitimate part solution to lessening the misappropriation of economic resources". At the same time the EU wastes 88 million tonnes of food (2012 estimate[42]), in 2017 it was estimated that 22% of the EU population (112 million people) were living at risk of poverty or social exclusion and 7.4% of the EU population (5.8 million people) were living in severely deprived circumstances, in other words with limited access to suitable food and a healthy diet[43][44].

Since food waste is a big share of the total bio-waste in the EU, many initiatives, policies and legislation are focused on the prevention of food waste. The food waste in municipal bio-waste in EU-28 is estimated to be about 60%, the remaining 35% is garden waste and 5% other bio-waste. In 2017, it was estimated that about 43% of the municipal bio-waste was collected separately and 57% in mixed municipal waste. A high percentage of a valuable resource is lost and not available for recycling because it is not collected separately[45].

Most policy actions and initiatives regarding the reduction of food waste in the EU are information and awareness raising campaigns, food redistribution platforms and promotion of sale of second-class food in retail institutions. Other measures implemented in many EU countries are Eco labelling and increasing the responsibilities of producers and distributors. Given the difficulties in measuring the effectiveness of these initiatives the revised WFD new reporting requirement will enable better measurement, tracking and progress of such initiatives across the EU[46].

[40] Wynn Owen, Phil et al. 2016. "Combating Food Waste : An Opportunity For The EU To Improve The Resource-Efficiency Of The Food Supply Chain". Luxembourg: EUROPEAN COURT OF AUDITORS. https://www.eca.europa.eu/Lists/ECADocuments/SR16_34/SR_FOOD_WASTE_EN.pdf.
[41] Philippidis, G., et al., 2019, *'Waste not, want not: a bio-economic impact assessment of household food waste reductions in the EU'*, Resources, Conservation and Recycling 146, pp. 514-522 (DOI: 10.1016/j. resconrec.2019.04.016).
[42] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.
[43] "Archive: People At Risk Of Poverty Or Social Exclusion - Statistics Explained". 2017. *Ec.Europa.Eu.* https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:People_at_risk_of_poverty_or_social_exclusion.
[44] Reynolds, Dr Christian. 2020. "HALVING FOOD LOSS AND WASTE IN THE EU BY 2030: THE MAJOR STEPS NEEDED TO ACCELERATE PROGRESS". Berlin: WWF Deutschland. https://wrap.org.uk/sites/default/files/2020-10/WWF%26WRAP_HalvingFoodLossAndWasteInTheEU_June2020.pdf.
[45] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[46] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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2.2 The Challenge at EU level

In the EU, around 88 million tonnes of food waste (equivalent to 173 kilos per person) are generated annually (an estimated 20% of the total food produced each year is lost or wasted) with associated costs estimated at 143 billion euros[47].

Using 2012 data, it was estimated that GHGs emitted from production and disposal of food in the EU were equal to 170 million tonnes of CO_2 [48]. A similar estimate came from a study by Scherhaufer et al. (2018), which estimated that food waste in the EU has a global warming potential of 186 million tonnes of carbon dioxide equivalent (Mt CO2e) or on average about 2.1 tonnes of CO_{2e} per tonne of food waste. This is equivalent to 15 - 16% of the total impact of the entire food supply chain[49].

In terms of the quantities of food wasted along the supply chain it was estimated that 53% occurs in households, 19% in food processing, 12% in food service/catering, 11% in primary production and 5% in retail/wholesale of food[50]. However, the picture along the supply chain is different when viewed based on GHG emissions. Even though most of the food waste occurs in the households, the highest environmental impact comes from the primary production of food according to a study by Scherhaufer et al. (2018). The study estimated that 73% of GHG emissions related to food waste are derived from food production, 6% from food processing activities, 7% from retail and distribution, 8% food consumption and 6% from food disposal. Animal containing food such as meat and dairy food have the highest environmental impacts of food waste in terms of global warming potential, acidification potential and eutrophication potential[51].

Figure 4 summarises some of the basic parameters of the food waste problem in the EU.

[47] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.
[48] "Food Waste: The Problem In The EU In Numbers [Infographic]". 2017. *Europarl.Europa.Eu.* https://www.europarl.europa.eu/news/en/headlines/society/20170505STO73528/food-waste-the-problem-in-the-eu-in-numbers-infographic.
[49] "Scherhaufer, Silvia et al. 2018. "Environmental Impacts Of Food Waste In Europe" 77: 98-113. doi: https://doi.org/10.1016/j.wasman.2018.04.038.
[50] "Food Waste: The Problem In The EU In Numbers [Infographic]". 2017. *Europarl.Europa.Eu.* https://www.europarl.europa.eu/news/en/headlines/society/20170505STO73528/food-waste-the-problem-in-the-eu-in-numbers-infographic.
[51] "Scherhaufer, Silvia et al. 2018. "Environmental Impacts Of Food Waste In Europe" 77: 98-113. doi: https://doi.org/10.1016/j.wasman.2018.04.038.

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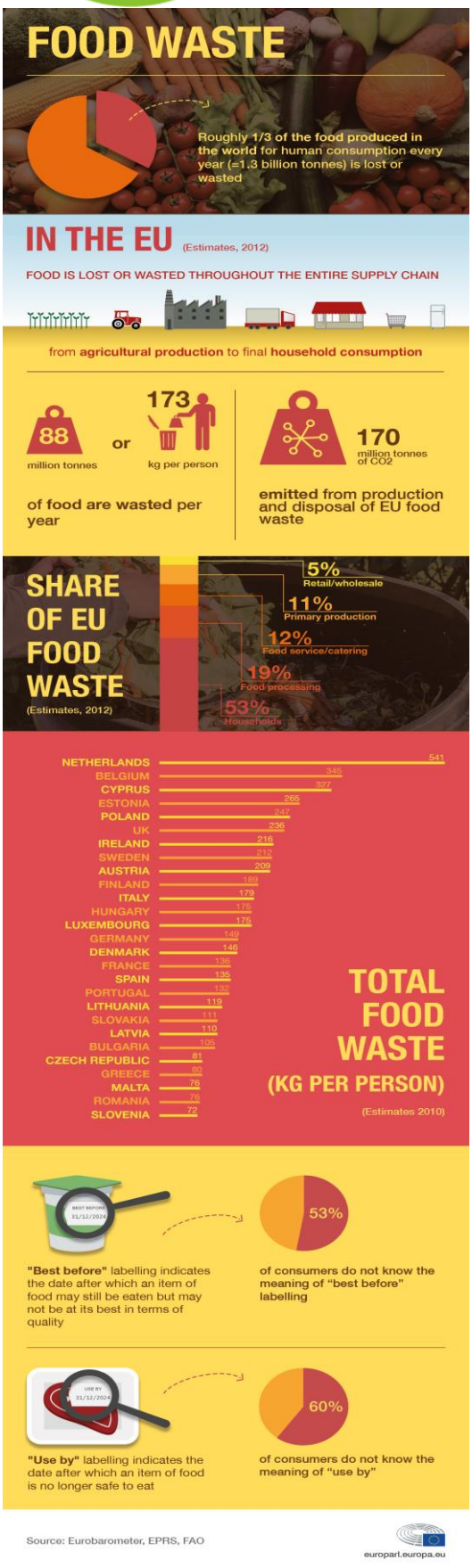

What is obvious from the infographic among other things, is that the per capita production of food waste widely differs between member states. Cyprus is among the top food waste producers in the EU. To a certain extent, this is attributed to the touristic nature of the country. Cyprus used to accept (prior to the pandemic), close to 4 million tourists per year, a very high number compared to the 850,000 of the local population. Tourism has a definite impact on the total food waste production; hence the calculation of the per capita production is inflated.

The EU and its Member States are committed to meeting Sustainable Development Goal (SDG) 12.3 to decrease per capita food waste by 50% at the retail and consumer level by 2030 and to reduce food losses along the food production and supply chains.

As was described in previous paragraphs wasting food poses an ethical, economic and environmental issue. Reducing food waste will contribute to several SDGs such as:

- Support the fight against climate change (food waste alone generates about 8% of Global Greenhouse Gas Emissions)
- Save nutritious food for redistribution to those in need, helping to eradicate hunger and malnutrition.
- Save money for farmers, companies, and households.

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Figure 4: Per Capita Production – EU
Source : Europarl.europa.eu. 2020

The aim of the EU food safety policy is to protect both human and animal health. Therefore, in co-operation with all EU states and stakeholders, the EU is striving to reduce food waste and strengthen the sustainability of the food system[52].

2.3 EU Legislative Action on Food and Food Waste

EU legislative action with regard to food waste has been consistent but has intensified in the last few years. There has been a significant shift towards addressing the management of food waste especially after the introduction of the Circular Economy Package in 2018. While older versions of the EU waste legislation concentrated on the management of other waste streams like packaging, batteries, waste electrical and electronic equipment, end of life vehicles, waste oils, other hazardous waste etc., the latest revisions of the legislation depict a clear shift to dealing with biodegradable waste and food waste. We now have clear statements of the need to collect food waste separately and divert it away from landfills. This shift becomes very obvious in the revision of the Waste Framework Directive (2008/98/EC) in 2018, as a result of the provisions of the Circular Economy Package. While the original Directive had little reference to food waste, (food waste is mostly dealt with as part of the biodegradable waste that needs to be diverted from landfilling as per the Landfill Directive (1999/31/EC)), the revision of the WFD highlights the issue of food waste (not any more in integration of food waste with other biodegradables in the municipal solid waste stream) and focuses clearly on the prevention of food waste. References to both the original Directives (WFD and Landfill Directive) and the 2018 revisions, are found below.

2.4 Directives

2.4.1 Landfill Directive - 1999/31/EC of 16 July 1999

According to the original Landfill Directive:

1. Member states shall set-up a national strategy for the implementation of the reduction of biodegradable waste going to landfills, not later than two years after the date laid down in Article 18(1) (hence by 16/7/2003) and notify the commission of this strategy. This strategy should include measures to achieve the targets set out in paragraph 2 by means of in particular, recycling, composting, biogas production of materials/energy recovery.

[52] "Food Waste". 2022. *European Commission*. https://food.ec.europa.eu/safety/food-waste_en.

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Within 30 months from the date laid down in Article 18(1) the Commission shall provide the European Parliament and the Council with a report drawing together the national strategies.

2. This strategy shall ensure that:

a) not later than five years after the date laid down in Article 18(1), biodegradable municipal waste going to landfills must be reduced to 75 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available

b) not later than eight years after the date laid down in Article 18(1), biodegradable municipal waste going to landfills must be reduced to 50 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available;

c) not later than 15 years after the date laid down in Article 18(1), biodegradable municipal waste going to landfills must be reduced to 35 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available.

Two years before the date referred to in paragraph (c) the Council shall re-examine the above target, on the basis of a report from the Commission on the practical experience gained by Member States in the pursuance of the targets laid down in paragraphs (a) and (b) accompanied, if appropriate, by a proposal with a view to confirming or amending this target in order to ensure a high level of environmental protection.

2.4.2 Waste Framework Directive 2008/98/EC of 19 November 2008

According to the original Waste Framework Directive:

'bio-waste' means biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants;

Waste management plans shall conform to the waste planning requirements laid down in Article 14 of Directive 94/62/EC and the strategy for the implementation of the reduction of biodegradable waste going to landfills, referred to in Article 5 of Directive 1999/31/EC.

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2.4.3 Directive (EU) 2018/850 of 30 May 2018, amending Directive 1999/31/EC on the landfill of waste

According to the revised Landfill Directive[53]:

"Biodegradable municipal waste accounts for a large proportion of municipal waste. Landfilling of untreated biodegradable waste poses significant negative environmental effects in terms of greenhouse gas emissions and pollution of surface water, groundwater, soil, and air. Although Directive 1999/31/EC already sets landfill diversion targets for biodegradable waste, it is appropriate to put in place further restrictions on the landfilling of biodegradable waste by prohibiting the landfilling of biodegradable waste that has been separately collected for recycling in accordance with Directive 2008/98/EC."

2.4.4 Directive (EU) 2018/851 of 30 May 2018, amending Directive 2008/98/EC on waste

According to the revised Waste Framework Directive:

The revision of the WFD (2008/98/EC)[54], as a result of the introduction of the CEP, proposes new measures to promote prevention, including measures for food waste, and its re-use. Member states should:

- Aim to reduce food waste along the food supply chain in line with the 2030 Agenda for Sustainable Development of the United Nations, and most importantly the target to reduce global food waste by half at consumers and retail levels and to reduce food losses along production and supply chains, including post-harvest losses, by 2030. These measures should aim to reduce food waste along the supply chain, in primary production, processing, retail, food services and in households.
- Introduce incremental targets towards achieving the 2030 goals. Aim to reduce food waste by 30% by 2025 and 50% by 2030.
- Establish food waste prevention measures such as food waste prevention awareness campaigns.
- In order to measure the progress of such measures in the EU, each member state should ensure that the common methodology of measuring food waste is followed. Waste levels shall me measured and reported annually.
- Provide incentives so that unsold food at any stage of the supply chain, is collected and redistributed safely.

[53] Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste (Text with EEA relevance)
[54] Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (Text with EEA relevance)

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- Implement measures to improve awareness about the meaning of 'use-by' and 'best-before' dates.

For the achievement of these objectives Member States should use economic instruments and other measures to promote the application of the Waste Hierarchy (including among other things, landfill and incineration charges, pay-as-you-throw schemes, extended producer responsibility schemes, facilitation of food donation, and incentives for local authorities).

According to Article 9 of the Directive (EU) 2018/851 of 30 May 2018, amending Directive 2008/98/EC on waste on the prevention of food waste:

1. Member states should take measures to prevent waste generation. These measures should:
    i. Reduce the generation of food waste in primary production, in processing and manufacturing, in retail and other distribution of food, in restaurants and food services as well as in households.
    ii. Encourage food donation and other redistribution for human consumption, prioritizing human use over animal feed and the reprocessing into non-food products.

2. Member states should monitor and assess the implementation of food waste prevention measures by measuring the levels of food waste on the basis of the methodology established by the delegated act referred to in paragraph 8, as from the first full calendar year after the adoption of that delegated act.

3. All EU Member States should collect bio-waste separately or ensure recycling at source from the end of 2023 onwards;

4. Data collected on food waste will be examined by the Commission by 31 December 2023, to establish whether a union-wide food waste reduction target should be established for 2030. The Commission will submit a report to the European Parliament and to the Council, accompanies, if appropriate, by a legislative proposal.

5. By 31 March 2019, the Commission shall adopt, on the basis of the outcome of the work of the EU Platform on Food Losses and Food Waste, a delegated act in accordance with Article 38a to supplement this Directive by establishing a common methodology and minimum quality requirements for the uniform measurement of levels of food waste.

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The Directive also provides that plant-based substances from the agri-food industry and food of non-animal origin no longer intended for human consumption which are destined for oral animal feeding should, in order to avoid duplication of rules, be excluded from the scope of Directive 2008/98/EC if in full compliance with Union feed legislation.

2.5 EU – Policy Initiatives

In addition to Directives and Regulations, the European Union has been working hard to promote a sustainable agenda at the policy level. The two most important recent policy initiatives towards that direction, have been:

- The Circular Economy Package in 2018, with an aim to boost competitiveness, create jobs and generate sustainable growth
- The EU Green Deal in 2019, a green and inclusive transition to help improve people's well-being and secure a healthy planet for generations to come

The two policy documents are analysed here with a focus on their provisions for addressing the food waste challenge.

2.5.1 Circular Economy Package

The Commission has adopted an ambitious Circular Economy Package (CEP) with the aim to help EU businesses and consumers make the transition to a stronger and more circular economy where resources are used in a more sustainable way. The actions proposed in the CEP will contribute to "closing the loop" of product lifecycles through greater recycling and re-use of resources and achieve benefits for both the environment and the economy. The prevailing philosophy behind this initiative, is the need to ensure better resource efficiency and derive maximum value from the resources we utilise through repeated cycle lives[55].

The CEP, aims to drive the EU economy from a linear model (Figure 5):

Figure 5: Linear Economy Package – EU

Source: (First circular economy action plan, 2020)

To a circular model (Figure 6):

[55] "Closing The Loop: Commission Adopts Ambitious New Circular Economy Package To Boost Competitiveness, Create Jobs And Generate Sustainable Growth". 2015. https://ec.europa.eu/commission/presscorner/detail/en/IP_15_6203.

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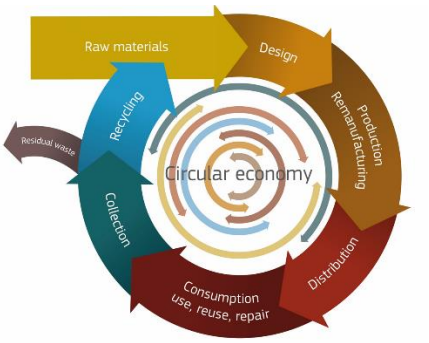

Figure 6: Circular Economy Package – EU

Source: First circular economy action plan, 2020

The circular model promotes initiatives along the entire life - cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible[56]. The CEP considers the protection of the environment and the sustenance of the EU competitiveness as integrated targets that need to be pursuit concurrently (Figure 7).

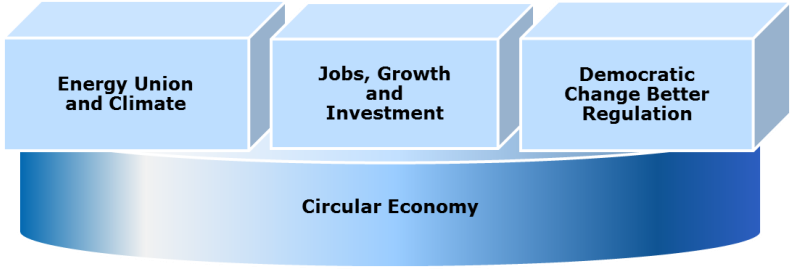

Figure 7: Circular Economy Targets - EU

Source: (First circular economy action plan, 2020)

[56] "Overview - Circular Economy - Eurostat". 2022. *Ec.Europa.Eu*. https://ec.europa.eu/eurostat/web/circular-economy.

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The CEP comprises of six strategic pillars (Figure 8):

Figure 8: CEP Strategic Pillars – EU

Source: First circular economy action plan,

What has become famous in the discussion for the circularity in the economies is Figure 9 below from the *Ellen* MacArthur Foundation. In the Figure, we can see the existing mostly linear routes of biodegradable (green) and non-biodegradable (blue) resources, and the alternative circular practices to maximise the lifecycles of the resources. Clearly, the CEP gives similar attention to the sustainable use of both organic and non-organic resources.

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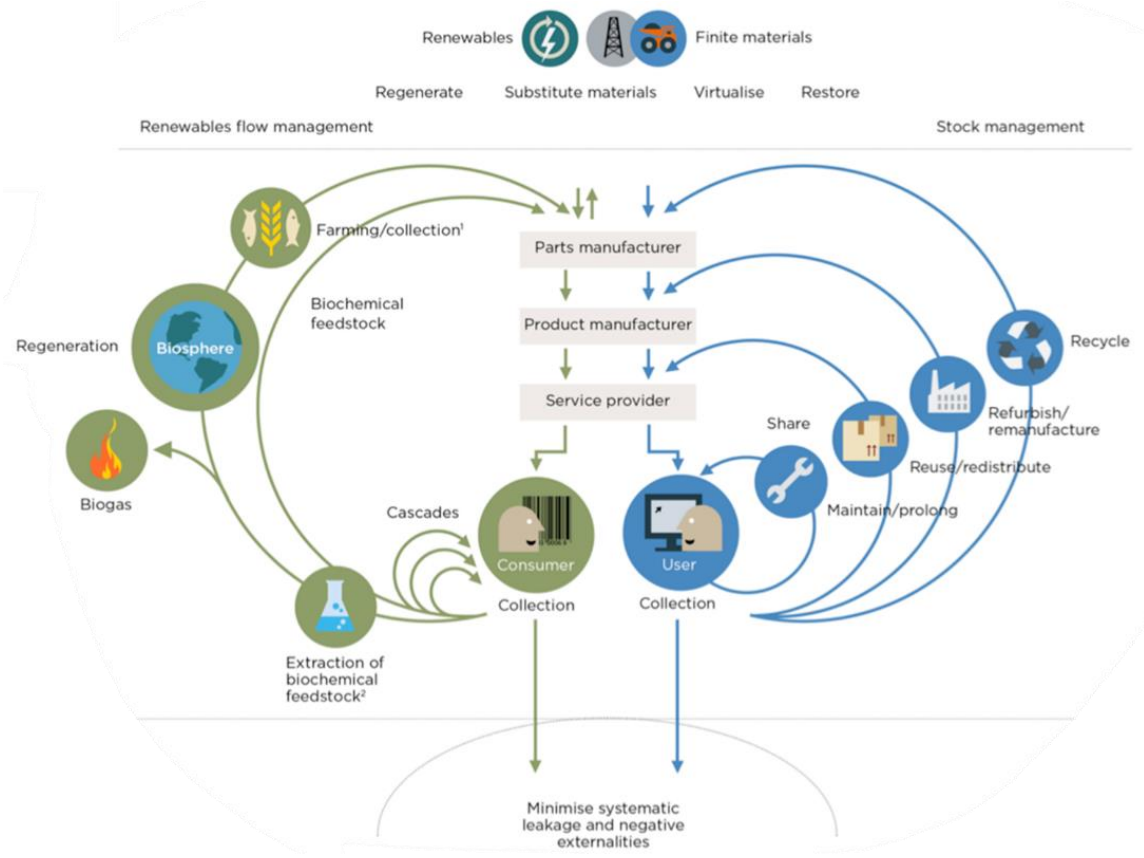

Figure 9: Biodegradable and Non – Biodegradable Resources

Source: Ellenmacarthurfoundation.org.

2.5.1.1 Food Specific Provisions

There are two specific provisions related to food production and food waste in the Circular Economy Package:

- Actions to reduce food waste including a common measurement methodology, improved date marking, and tools to meet the global Sustainable Development Goal to halve food waste by 2030;
- A revised Regulation on fertilizers, to facilitate the recognition of organic and waste-based fertilizers in the single market and support the role of bio-nutrients;

According to the initiative, food waste is an increasing concern in Europe. The production, distribution and storage of food, use natural resources and generate environmental impacts. Discarding food that is still edible increases these impacts and causes financial loss for consumers and the economy.

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In order to support the achievement of the Sustainable Development Goal target on food waste and to maximize the contribution of actors in the food supply chain, the Commission will:

- Develop a common EU methodology to measure food waste and define relevant indicators. It will create a platform involving Member States and stakeholders in order to support the achievement of the SDG targets on food waste, through the sharing of best practice and the evaluation of progress made over time.
- Awareness campaigns are needed to change behavior. The Commission supports awareness raising at national, regional, and local levels and the dissemination of good practices in food waste prevention.
- Take measures to clarify EU legislation relating to waste, food and feed and facilitate food donation and the use of former foodstuff and by-products from the food chain in feed production without compromising food and feed safety; and
- Examine ways to improve the use of date marking by actors in the food chain and its understanding by consumers, in particular the "best before" label.

The Commission will propose a revised EU regulation on fertilizers, so as to facilitate recognition of organic and waste-based fertilizers in the single market and thus support the role of bio-nutrients in the circular economy.

The CEP initiative fosters innovation and promotes a major initiative to fund innovative projects under the umbrella of the EU's Horizon 2020 research program and targeted action in various areas of interest, including food waste.

The CEP action plan sets out a concrete and ambitious EU mandate to support the transition towards a circular economy. A continued, broader commitment from all levels of government, in Member States, regions and cities and all stakeholders concerned will also be necessary[57].

2.5.2 The European Green Deal

The EU Green Deal, released by the Commission in December 2019, resets the Commission's commitment to tackling climate and environmental-related challenges that is this generation's defining task. The atmosphere is warming, and the climate is changing with each passing year. One million of the eight million species on the planet are at risk of being lost. Forests and oceans are being polluted and destroyed[58].

[57] "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - The European Green Deal". 2019. Brussels : European Commission. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

[58] "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - The European Green Deal". 2019. Brussels : European Commission. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

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The European Green Deal is a response to these challenges. It is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use[59].

It also aims to protect, conserve, and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts.

To deliver the European Green Deal, there is a need to rethink policies for clean energy supply across the economy, industry, production and consumption, large-scale infrastructure, transport, food, and agriculture and other. For food and agriculture, the Green Deal proposes the strategy from 'Farm to Fork'. Figure 10 presents the priorities of the strategy[60].

Figure 10: Farm to Fork- EU

Source: *Farm to Fork Strategy*

[59] "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - The European Green Deal". 2019. Brussels : European Commission. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

[60] "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - The European Green Deal". 2019. Brussels : European Commission. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

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2.5.2.1 Farm to fork strategy

The Farm to Fork Strategy is at the heart of the European Green Deal aiming to make food systems fair, healthy, and environmentally friendly[61].

EU needs to redesign its food systems which today account for nearly one-third of global GHG emissions, consume large amounts of natural resources, result in biodiversity loss and negative health impacts (due to both under- and over-nutrition) and do not allow fair economic returns and livelihoods for all actors, in particular for primary producers[62].

Putting EU food systems on a sustainable path also brings new opportunities for operators in the food value chain. New technologies and scientific discoveries, combined with increasing public awareness and demand for sustainable food, will benefit all stakeholders[63].

The Farm to Fork Strategy aims to accelerate EU transition to a sustainable food system that should:

- have a neutral or positive environmental impact
- help to mitigate climate change and adapt to its impacts
- reverse the loss of biodiversity
- ensure food security, nutrition, and public health, making sure that everyone has access to sufficient, safe, nutritious, sustainable food
- preserve affordability of food while generating fairer economic returns, fostering competitiveness of the EU supply sector, and promoting fair trade[64].

European food is well known and appreciated for being safe, nutritious and of high quality. The aim now is to also make it the global standard for sustainability. Despite the steps towards sustainability, the challenge to feed a fast-growing world population with the current production systems is significant. Food production still results in air, water, and soil pollution, contributes to the loss of biodiversity and climate change, and consumes excessive amounts of natural resources, while an important part of food is wasted. At the same time, low quality diets contribute to the deprivation of the health of those suffering and an increase of the problems of obesity, cancer, diabetes and other diseases.

[61] "Farm To Fork Strategy For A Fair, Healthy And Environmentally-Friendly Food System". 2020. https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.
[62] "Farm To Fork Strategy For A Fair, Healthy And Environmentally-Friendly Food System". 2020. https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.
[63] "Farm To Fork Strategy For A Fair, Healthy And Environmentally-Friendly Food System". 2020. https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.
[64] "Farm To Fork Strategy For A Fair, Healthy And Environmentally-Friendly Food System". 2020. https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.

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The EU's goals are to reduce the environmental and climate footprint of the EU food system and strengthen its resilience, ensure food security in the face of climate change and biodiversity loss and lead a global transition towards competitive sustainability from farm to fork and tapping into new opportunities[65]. This means:

- ensuring that the food chain, covering food production, transport, distribution, marketing, and consumption, has a neutral or positive environmental impact, preserving and restoring the
- land, freshwater, and sea-based resources on which the food system depends; helping to mitigate climate change and adapting to its impacts; protecting land, soil, water, air, plant and animal health and welfare; and reversing the loss of biodiversity;
- ensuring food security, nutrition, and public health – making sure that everyone has access to sufficient, nutritious, sustainable food that upholds high standards of safety and quality, plant health, and animal health and welfare, while meeting dietary needs and food preferences; and
- preserving the affordability of food, while generating fairer economic returns in the supply chain, so that ultimately the most sustainable food also becomes the most affordable, fostering the competitiveness of the EU supply sector, promoting fair trade, creating new business opportunities, while ensuring integrity of the single market and occupational health and safety[66].

There are new opportunities for all operators in the food value chain. New technologies and scientific discoveries, combined with increasing public awareness and demand for sustainable food, will benefit all stakeholders. Figure 11 presents the proposed food value chain in the strategy.

Figure 11: Food Value Chain – EU

Source: Farm to Fork Strategy,

Among the pillars of the Farm to Fork Strategy is lastly, to strive to stimulate sustainable food consumption and promote affordable healthy food for all. Imported food that does not comply

[65] "Farm To Fork Strategy For A Fair, Healthy And Environmentally-Friendly Food System". 2020. *European Commission.* https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.
[66] "Farm To Fork Strategy For A Fair, Healthy And Environmentally-Friendly Food System". 2020. *European Commission.* https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en.

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with relevant EU environmental standards is not allowed on EU markets. The Commission will propose actions to help consumers choose healthy and sustainable diets and reduce food waste. The Commission will explore new ways to give consumers better information, including by digital means, on details such as where the food comes from, its nutritional value, and its environmental footprint. The Farm to Fork strategy will also contain proposals to improve the position of farmers in the value chain.

2.5.3 Reducing food loss and waste

Tackling food loss and waste is key to achieving sustainability. Reducing food waste brings savings for consumers and operators, and the recovery and redistribution of surplus food that would otherwise be wasted, has an important social dimension. The Commission is committed to halving per capita food waste at retail and consumer levels by 2030 (SDG Target 12.3). Using the new methodology for measuring food waste and the data expected from Member States in 2022 as per the revised directives, it will set a baseline and propose legally binding targets to reduce food waste across the EU. The Commission aims to integrate food loss and waste prevention in other EU policies. For example, it aims to revise EU rules of the date marking on food products ('use by' and 'best before' dates) by the end of 2022 to minimise food waste. In addition to quantifying food waste levels, the Commission will investigate food losses at the production stage, which are significant, and explore ways of minimising them. Action taken at EU level will incentivise action at national level. Furthermore, the recommendations of the EU Platform on Food Losses and Food Waste, will help show the way forward for all actors[67].

2.5.4 Research and innovation (R&I)

Research and innovation are key drivers in accelerating the transition to sustainable, healthy, and inclusive food systems from primary production to consumption. For this reason, the EU devotes funds for research and innovation in specific areas to attain its targets. Under the Horizon 2020 programme, the Commission is preparing an additional call for proposals of around EUR 1 billion for Green Deal priorities in 2020. Under Horizon Europe, it proposes to spend EUR 10 billion on R&I on food, bio economy, natural resources, agriculture, fisheries, aquaculture, and the environment as well as the use of digital technologies and nature-based solutions for agri-food.

A new Horizon Europe partnership for "Safe and sustainable food systems for people, planet and climate" will put in place an R&I governance mechanism engaging Member States and food

[67] "Frequently Asked Questions: Reducing Food Waste In The EU". 2021. https://food.ec.europa.eu/system/files/2021-09/fw_lib_reduce-food-waste-eu_faqs.pdf.

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systems actors from farm-to-fork to research and innovative on solutions providing co-benefits for nutrition, climate, quality of food, communities and circularity[68].

[68] "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - The European Green Deal". 2019. Brussels : European Commission. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

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3. Food Waste – in Numbers

Due to the fact that food waste has only rather recently attracted more attention in the waste management policies (even within the EU), the statistics found on quantities of food waste are rather limited. The fact that in most countries' food waste is not collected separately, but as part of Municipal Solid Waste, limits the access to quantitative data on food waste. In addition, in the absence of specific obligations to take measures to tackle the food waste problem and the absence of quantitative targets to prevent or better manage food waste, the incentive to measure and quantify the problem or the potential solutions, has been limited.

3.1 Waste data in the EU

According to Eurostat, the evolution in the production of Municipal waste in the EU countries is analysed as follows in Table 1 for the period 1995-2018:

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Municipal waste generated, in selected years, 1995-2018

(kg per capita)

	1995	2000	2005	2012	2018	Change 2018/1995 (%)
EU-27	*467*	*513*	*506*	*488*	*492*	*5.4*
Belgium	455	471	482	445	411	-9.7
Bulgaria	694	612	588	460	407	-41.4
Czechia	302	335	289	308	351	16.2
Denmark	*521*	664	736	806	814	*56.2*
Germany	*623*	*642*	565	619	*615*	*-1.3*
Estonia	371	453	433	280	405	9.2
Ireland	512	599	731	585	:	:
Greece	303	412	442	495	:	:
Spain	505	653	588	468	*475*	*-5.9*
France	475	514	529	*527*	*527*	*10.9*
Croatia	:	*262*	*336*	391	432	:
Italy	454	509	546	504	499	9.9
Cyprus	595	628	688	657	:	:
Latvia	*264*	*271*	320	323	407	54.2
Lithuania	426	365	387	445	464	8.9
Luxembourg	587	654	672	652	*610*	*3.9*
Hungary	460	446	461	402	381	-17.2
Malta	387	533	623	590	640	65.4
Netherlands	539	598	599	549	511	-5.2
Austria	437	580	575	579	579	32.5
Poland	285	320	*319*	*317*	329	15.4
Portugal	352	457	452	453	508	44.3
Romania	342	*355*	*383*	251	272	-20.5
Slovenia	596	*513*	494	362	486	-18.5
Slovakia	295	254	273	306	414	40.3
Finland	413	502	478	506	551	33.4
Sweden	386	425	479	454	434	12.4
United Kingdom	498	577	581	477	463	-7.0
Iceland	426	462	516	511	:	:
Norway	624	613	426	477	739	18.4
Switzerland	600	656	661	694	703	17.2
Montenegro	:	:	:	494	530	:
North Macedonia	:	:	:	381	301	:
Albania	:	:	:	:	462	:
Serbia	:	:	:	364	319	:
Turkey	441	*465*	*458*	410	*424*	*-3.9*
Bosnia and Herzegovina	:	:	:	340	356	:
Kosovo (')	:	:	:	:	226	:

(:) data not available

Note: data presented in italic are estimated.

(') This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence

Source: Eurostat (online data code: env_wasmun)

eurostat

Table 1: Municipal Waste generated in selected years, 1995 – 2018 - Eurostat

Source: Eurostat

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In a graphic form, the differences in the Municipal waste production between 2005 and 2018 is presented in Figure 12:

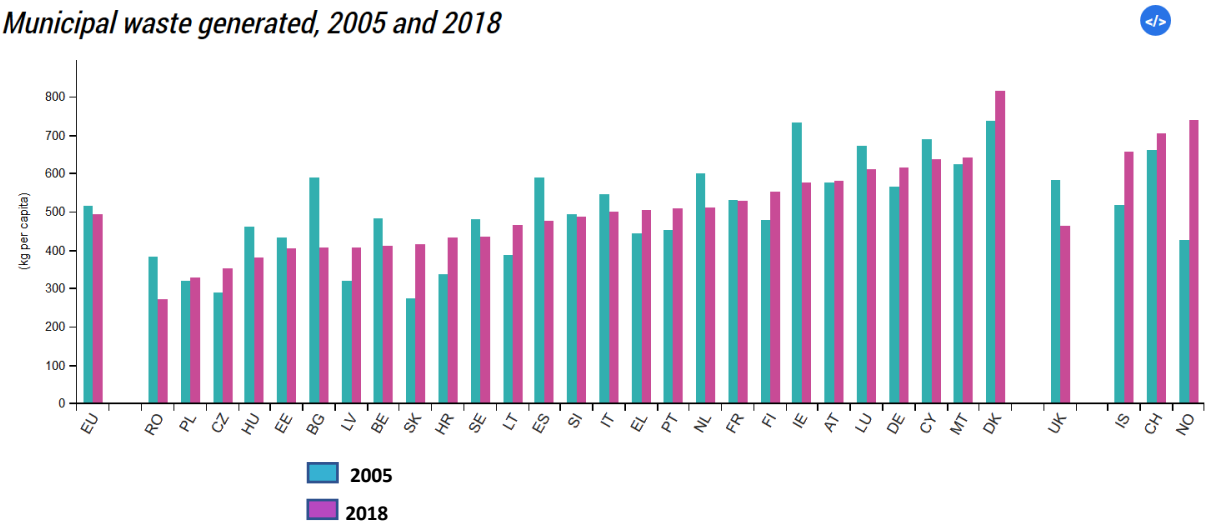

Figure 12: Municipal Waste Generated, 2005 and 2018- Eurostat

Source: Eurostat

What is apparent from the graph is that roughly in half of the EU countries, Municipal Solid Waste production per capita has decreased between 2005 and 2018, while in the rest it has increased. In the majority of the countries though, the differences between the two years are small. It is not clear due to lack of separate measures of food waste (as part of the MSW) during the same years, however it is possible that the production of food waste followed a similar pattern in most of the countries. So, we can potentially assume that in half of the EU countries the food waste has been decreasing and, while in the rest, it has been increasing. In a similar way we can assume that the differences over time are small.

The next important issue is the way the Municipal Solid Waste is treated. EU has missioned itself to become a recycling society. Recently, the efforts have been intensified with the introduction of the Circular Economy Package in 2018. The results of these efforts to boost recycling and limit the dependence on landfilling for a period of more than 20 years, are shown below in Table 2 and Figure 13:

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Municipal waste landfilled, incinerated, recycled and composted, EU-27, 1995-2018

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change 2018/1995 (%)
												million tonnes													
Landfill	121	117	117	114	113	112	107	104	99	93	88	88	87	83	82	79	74	67	63	59	57	54	53	52	-57
Incineration	29	30	33	33	34	36	37	39	39	41	45	48	49	51	52	53	55	54	55	56	56	58	59	58	101
Material Recycling	23	26	30	32	37	38	40	43	43	43	46	47	52	53	54	55	56	58	56	59	63	65	66	67	190
Composting	14	16	17	18	19	23	23	24	24	26	26	27	28	30	30	29	29	30	31	33	33	36	37	37	163
Other	10	13	12	11	12	11	12	12	12	13	16	13	11	10	7	6	6	6	5	5	5	5	5	5	-51
												kg per capita													
Landfill	286	276	276	266	263	262	250	241	229	215	202	202	199	190	186	178	167	153	142	134	127	121	118	117	-59
Incineration	34	36	39	39	79	84	87	90	90	95	103	111	112	116	117	121	125	122	125	126	127	130	132	131	285
Material Recycling	54	62	69	75	85	87	92	100	100	100	105	109	119	120	123	125	128	130	128	134	141	145	147	150	178
Composting	33	38	41	42	45	53	54	57	57	59	59	61	64	69	67	66	66	69	71	73	75	81	83	83	152
Other	60	66	66	65	28	27	26	27	26	31	37	30	23	23	17	13	13	14	12	11	10	11	11	11	-82

Note: estimated by Eurostat.
Source: Eurostat (online data code: env_wasmun)

eurostat

Table 2: Municipal Waste Landfilled, Incinerated, Recycled and Composted, EU, 1995 - 2018 - Eurostat
Source: Eurostat

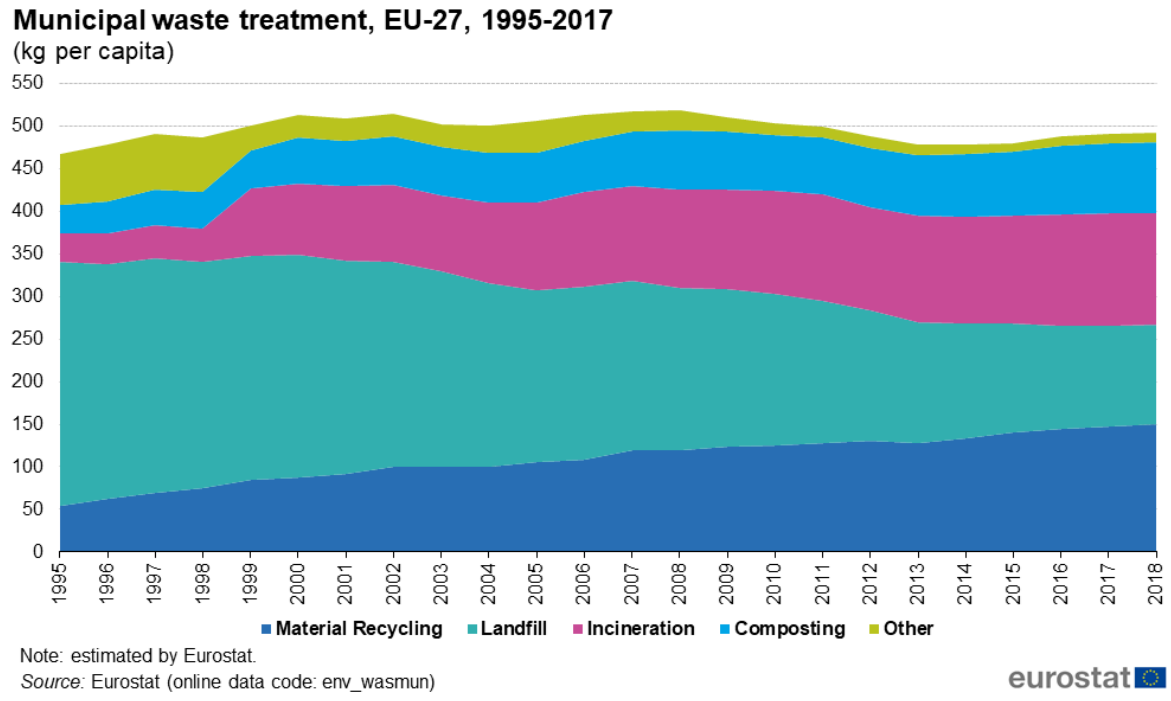

Figure 13: Municipal Waste Treatment, EU-27, 1995 – 2017 – Eurostat

Source: Eurostat

The results demonstrate during these years, a significant shift away from landfill which has been steadily decreasing over time, while the waste has been diverted to material recycling, incineration, and composting. There are of course significant differences between the results in different countries of the EU when analysing and comparing the equivalent results per country. A few countries have almost abandoned landfilling, while others are still landfilling a significant proportion of their waste.

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3.2 Food waste Data

Data and analysis on food waste in the EU and by country are not as readily available as for the MSW, as there was no specific requirement to collect such data. Data on food waste generation were so far based on ad hoc studies. The available data will be enhanced and become more uniform with the revised WFD. In October 2019, the Delegated Decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament entered into force which describes a common methodology to measure food waste along all the levels in the food supply chain[69]. It provides clarifications on the definition of food waste and provides guidelines for its measurement. All Member States should start collecting data in 2020 and report their national food waste measurements by mid-2022[70]. The availability of uniform food waste data will improve our understanding of the effectiveness of EU policies and food waste prevention programmes at national and at EU level, however it might be more difficult to measure small scale initiatives in city/neighbourhood levels which might be not precisely monitored[71].

Figure 14 below presents the composition of bio-waste in European Countries (2017) based on a study by ETC/WMGE.

[69] Commission Delegated Decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste (Text with EEA relevance.)
[70] "Frequently Asked Questions: Reducing Food Waste In The EU". 2021. https://food.ec.europa.eu/system/files/2021-09/fw_lib_reduce-food-waste-eu_faqs.pdf.
[71] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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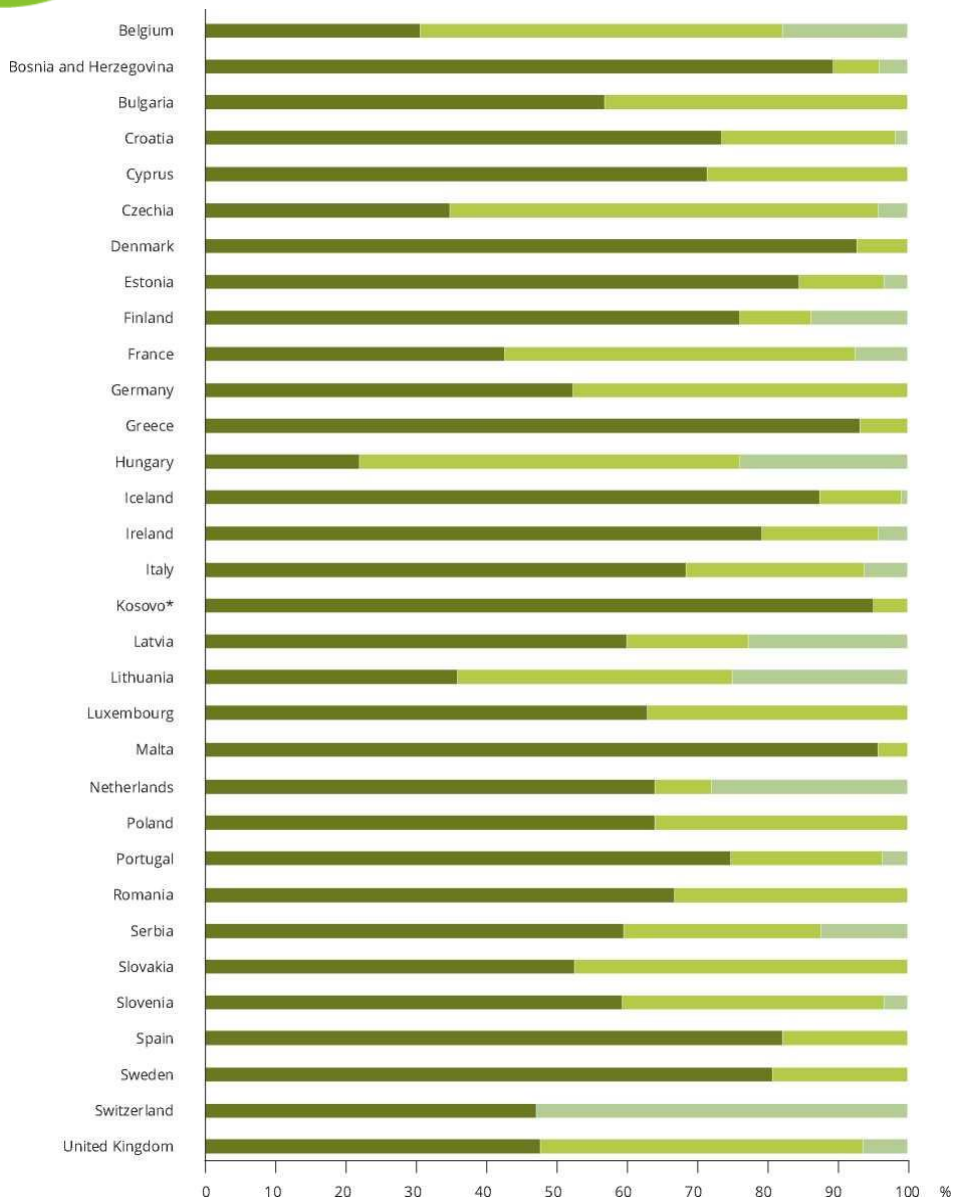

Figure 14: Composition of municipal bio-waste for 32 EEA member and cooperating countries, 2017

Notes: *Kosovo under UN Security Council Resolution 1244/99.

'Other bio-waste' may include mixed food and garden waste.

Source: ETC/WMGE compilation based on data provided by the European Environment Information and Observation Network (Eionet) through an EEA and European Topic Centre on Waste and Materials in a Green Economy (ETC/WMGE) survey (ETC/WMGE, 2019a), Eurostat (2020), and the European Reference Model on Municipal Waste (ETC/WMGE, 2019b) for Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Germany, Greece, Italy, Lithuania, Luxembourg, Malta, Poland, Spain and the United Kingdom.

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As evident in Figure 14, in most countries, food waste is more than 50% of the total bio-waste. There are large differences in bio-waste composition, and this may be attributed to the different ways data is being collected and the bio-waste collection methods followed in each country[72].

The revised WFD states that all EU Member States should collect bio-waste separately or ensure recycling at source from the end of 2023 onwards. This collection method for bio-waste is an important prerequisite for the production of good quality by-products such as soil improvers, fertilizers and biogas because it keeps the purity levels high[73]. Collecting bio-waste separately will also aid in the achievement of the targets set in the EU Landfill directive for the diversion of biodegradable waste from landfills[74]. The European Commission has proposed to develop a harmonised model for the separate collection and labelling of waste through the new Circular Economy Action Plan[75], however this has been met with certain reservations such that this model should allow for flexibility to meet the local needs and to ensure that additional costs are not only borne by the consumers[76].

Even though there are no available consolidated data on the separate collection of waste from which we can observe whether separate collection has become more widespread in recent years, we can look at the amount of waste composted or anaerobically digested as an alternative indicator. According to Eurostat data, the amount of municipal waste composted has increased from 26 to 40 million tonnes in the period 2004-2019, that is a 54% increase[77]. As mentioned previously, data of the separate collection of bio-waste will improve in the coming years (with the revised WFD) and these will improve the monitoring of bio-waste management.

Figure 15[78] presents separate bio-waste collection rates in 32 European countries in 2017 based again on the ETC/WMGE study. The figure shows that there is great disparity in the separate collection of municipal bio-waste. The EU average is about 50%, meaning that 50% of bio waste in municipal waste is collected separately and the rest 50% is collected in mixed

[72] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[73] Xevgenos, Dimitris & Papadaskalopoulou, Christina & Panaretou, Vasiliki & Moustakas, Konstantinos & Malamis, Dimitris. (2015). Success Stories for Recycling of MSW at Municipal Level: A Review. Waste and Biomass Valorization. 6. 10.1007/s12649-015-9389-9.
[74] 2020. Harmonisation of waste separate collection across Europe. *European Environmental Bureau & Zero Waste Europe*. Available at: https://zerowasteeurope.eu/wp-content/uploads/2020/07/2020_07_14_zwe_eeb_position-paper_harmonisation-of-waste-separate-collection_en.pdf
[75] 2020. Circular Economy Action Plan. [online] *EUGreenDeal.* Available at: https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf
[76] 2020. Harmonisation of waste separate collection across Europe. *European Environmental Bureau & Zero Waste Europe*. Available at: https://zerowasteeurope.eu/wp-content/uploads/2020/07/2020_07_14_zwe_eeb_position-paper_harmonisation-of-waste-separate-collection_en.pdf
[77] Ec.europa.eu. 2021. File: Municipal waste landfilled, incinerated, recycled and composted, EU, 1995-2020.png - Statistics Explained. [online] Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Municipal_waste_landfilled,_incinerated,_recycled_and_composted,_EU,_1995-2020.png
[78] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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municipal waste. Percentages vary from 80% in countries such as Austria to less than 10% in countries such as Cyprus and Bosnia & Herzegovina.

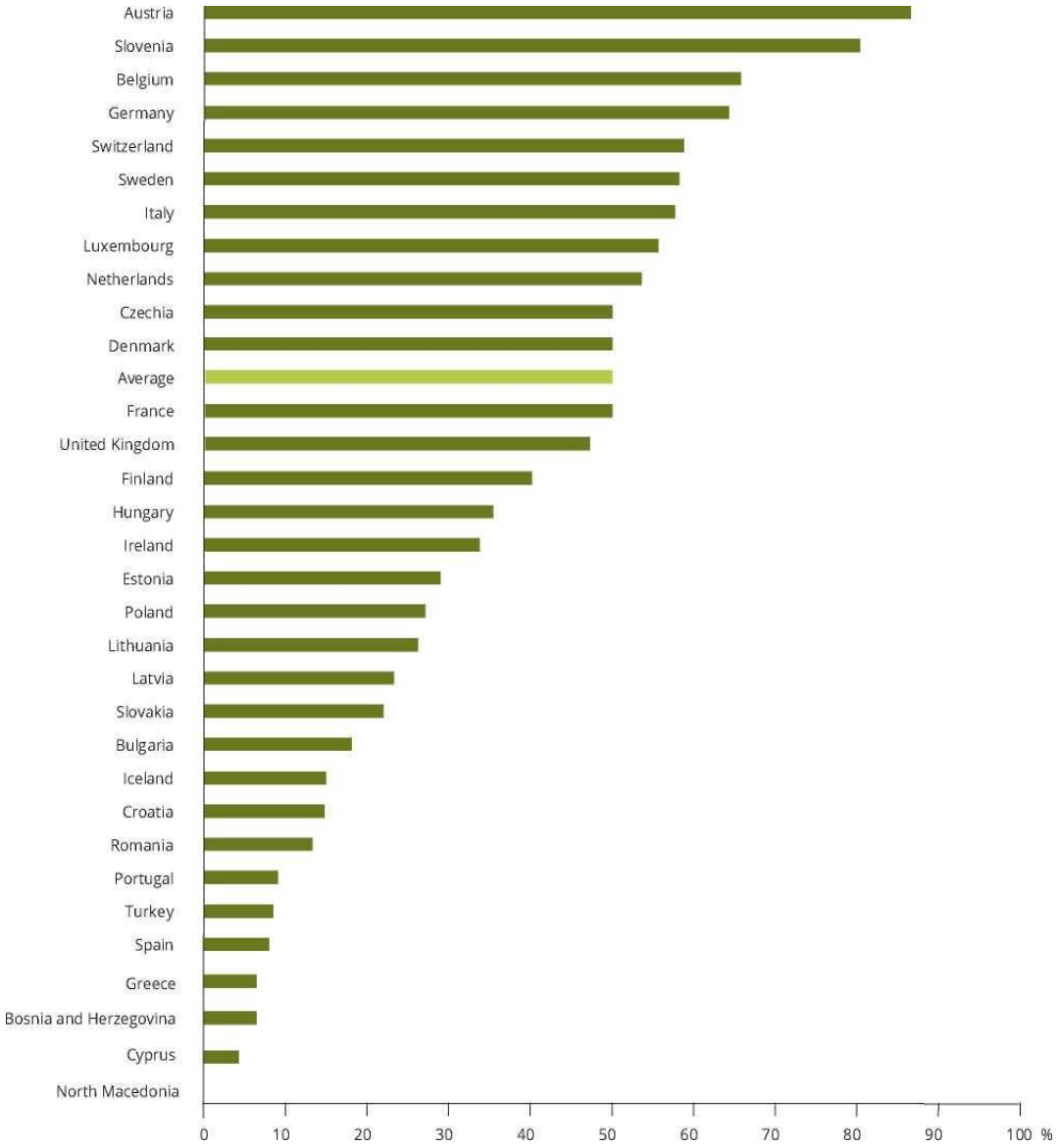

Figure 15: Bio-waste capture rate by country for 32 EEA member and cooperating countries, 2017

Notes: Excluding Albania, Kosovo, Liechtenstein, Malta, Montenegro, Norway, and Serbia due to a lack of data. Data excludes bio-waste composted at home. Austrian data include a considerable share of park and garden waste.

Source: ETC/WMGE compilation based on data provided by Eionet through an EEA and ETC/WMGE survey (ETC/WMGE, 2019a), Eurostat (2020), and the European Reference Model on Municipal Waste (ETC/WMGE, 2019b) for Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Germany, Greece, Italy, Lithuania, Luxembourg, Poland, Spain and the United Kingdom.

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Another study by Zero Waste Europe estimated the capture of bio waste in EU27+ at 32%. The EU estimated average for municipal (household and food service) bio waste generation was 222kg/person/year, based on a definition of bio-waste including both garden and food waste. Out of the 222kg, it was estimated that in 2017-18, about 71kg/person/year were captured. Therefore, concluding to an average EU capture rate of 32%[79] . This is quite different from the 50% collection rate reported in Figure 15, however the methodologies used, and definitions of bio-waste differ. Comparing figure 15 and the 'Zero Waste Europe' estimates for individual countries, capture rate in Austria was estimated at 44% (Zero Waste Europe) vs about 90% in Figure 15 and in Cyprus 16% (Zero Waste Europe) vs 5% in Figure 15.

The differences in the figures demonstrate the differences in the methodologies of measurement. It also demonstrates the fact that this is not a waste stream for which there has been an ongoing consistent effort to collect data. It is expected that under the new obligations coming from the WFD and other European policies mentioned earlier, the quality of data will improve, but most importantly the treatment of biowaste and food waste will improve.

3.3 Treatment of Bio-waste

In the next five years it is expected that very little bio-waste will be landfilled, with the implementation of EU Legislation. The latest regulations provide incentives or impose rules and targets for the diversion of bio-waste from landfills. The revised WFD (Directive (EU) 2018/851 amending Directive 2008/98/EC on waste) introduces the obligation that all member states should collect bio-waste separately or recycle at source by the end of 2023. In addition, as from 2027, bio waste treated aerobically or anaerobically will be considered recycled only of it is collected separately or separated at source[80]. Therefore, any compost derived from mixed municipal waste will not count towards the recycling targets for municipal waste.

Landfilling of biodegradable waste poses an environmental issue because it decomposes to produce landfill gas and leachate. If the gas is not captured it has a high global warming potential since landfill gas consists of mainly methane which is 23 times more powerful than CO_2 in its climate change impact. The leachate, if not captured, can lead to water and soil contamination[81]. The Landfill Directive 1999/31/EC with the amendments of the Directive

[79] "Bio-Waste Generation In The EU: Current Capture Levels And Future Potential". 2020. Brussels: Zero Waste Europe. https://zerowasteeurope.eu/wp-content/uploads/2020/07/2020_07_06_bic_zwe_report_bio_waste.pdf.
[80] EU, 2018b, Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (OJ L 150, 14.6.2018, pp. 109-140).
[81] "Green Paper On The Management Of Bio-Waste In The European Union {SEC(2008) 2936}". 2008. https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52008DC0811.

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(EU) 2018/850 does not allow the landfilling of bio waste either separately collected or mixed in municipal waste without pre-treatment[8283].

Even though there is great potential in the recycling of bio-waste, recycling rates are quite low in comparison to other waste streams. A high percentage of bio-waste is still lost through landfilling and incineration[84]. Separately collected bio-waste is mostly composted and some undergoes anaerobic digestion for biogas production. Other than biogas, which is a renewable energy source, more ways to utilise bio-waste are currently investigated for the production of high value products such as biofuels and volatile fatty acids, however with several challenges still to be resolved. Most countries choose to have several bio-waste treatment options as this allows to target the different types of bio-waste[85].

There are significant differences in the way countries deal with their bio-waste across Europe. The differences in the way bio-waste is collected (sorted at source Vs mixed with MSW), significantly affect the potential to better treat bio-waste and divert it away from landfilling. This means that many of the EU countries are far away from capturing more of the potential of their bio-waste, while losing much of its value and creating environmental challenges by landfilling most of it. However, implementing a separate bio-waste collection system is a lengthy and complex process, more challenging in most cases than separate collection systems for other waste streams (packaging, weee, batteries etc.). Bio-waste and specifically food waste is produced and wasted on a daily basis. It is a waste stream that decomposes quickly especially in hot climates, creating unpleasant odours and hygienic challenges. The collections need to be frequent and in special receptables to avoid attracting animals looking for food. It requires the daily attention and effort of citizens, and that makes it a challenge because it requires changing long embedded habits. Citizens need to be incentivised to engage with sorting at source, and the carrot may have to be complemented with a stick (penalties for not sorting at source correctly) for better engagement of the citizens. Specific bio-waste targets and pay-as-you-throw schemes can facilitate the effort to divert bio-waste from residual waste. The successful collection and utilisation of bio-waste can be achieved through awareness-raising campaigns to consumers and the establishment of infrastructure for the increasing amount and treatment of collected bio-waste[86]. Figure 16 below presents the steps for collection and utilisation of bio-waste in a circular model.

[82] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[83] "Building A Bridge Strategy For Residual Waste". 2020. *Zero Waste Eurpe.* https://zerowasteeurope.eu/wp-content/uploads/2020/06/zero_waste_europe_policy_briefing_MRBT_en.pdf.
[84] "A Policy Brief From The Policy Learning Platform On Environment And Resource Efficiency".2020. *Interregeurope.Eu.* https://www.interregeurope.eu/sites/default/files/inline/Policy_brief_on_waste_management.pdf.
[85] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[86] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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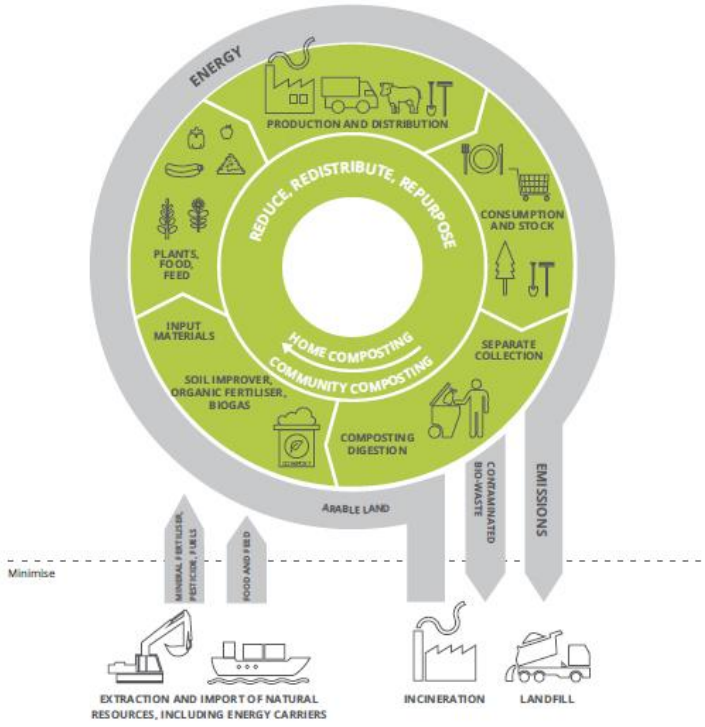

Figure 16: Bio – Waste in Circular Economy

Source: *European Environment Agency*

The two most common treatment methods for bio-waste are composting (treatment in the presence of oxygen) and anaerobic digestion (treatment in the absence of oxygen). The preferred treatment method will depend on the composition of the bio-waste, the properties of the separate collection system, the quality of sorting at source and the standards set for the derived compost[87]. Kitchen waste for instance that includes meats, poultry and fish leftovers (cooked or uncooked) is not well suited for composting and the derived compost is poor in quality. On the other hand, clean vegetables and garden cuttings can produce very high-quality compost. Overall, however, anaerobic digestion is associated with better environmental results than composting.

The amount of bio waste collected and requiring treatment is expected to increase in the coming years given the revised WFD requirement for separate collection of bio-waste or recycling at source and the higher targets for recycling of municipal waste. More bio-waste collected will also result in the installation of more treatment capacity for composting and anaerobic digestion[88].

[87] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[88] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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According to the European Compost Network (ECN) 2019 report[89] the total amount of bio-waste treated in the years 2016-17 in 18 EU countries was 47.5 million tonnes of which 30.5 million tonnes (64%) were composted, 12.4 (26%) were treated with anaerobic digestion and 4.6 (10%) were treated in combined composting and anaerobic digestion plants.

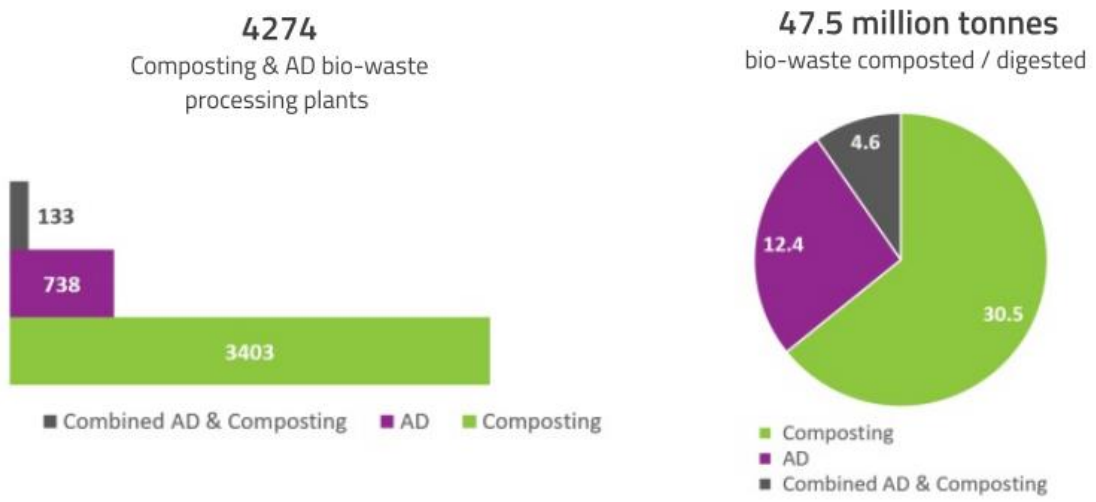

Figure 17: Number of bio-waste treatment plants and amount of bio waste treated.
Source: ECN Status report 2019

Using the amount of bio waste treated in each country ECN calculated the per capita bio waste treated per country. These are shown in Figure 18.

[89] "Treatment Of Bio-Waste In Europe - European Compost Network". 2022. European Compost Network. https://www.compostnetwork.info/policy/biowaste-in-europe/treatment-bio-waste-europe/.

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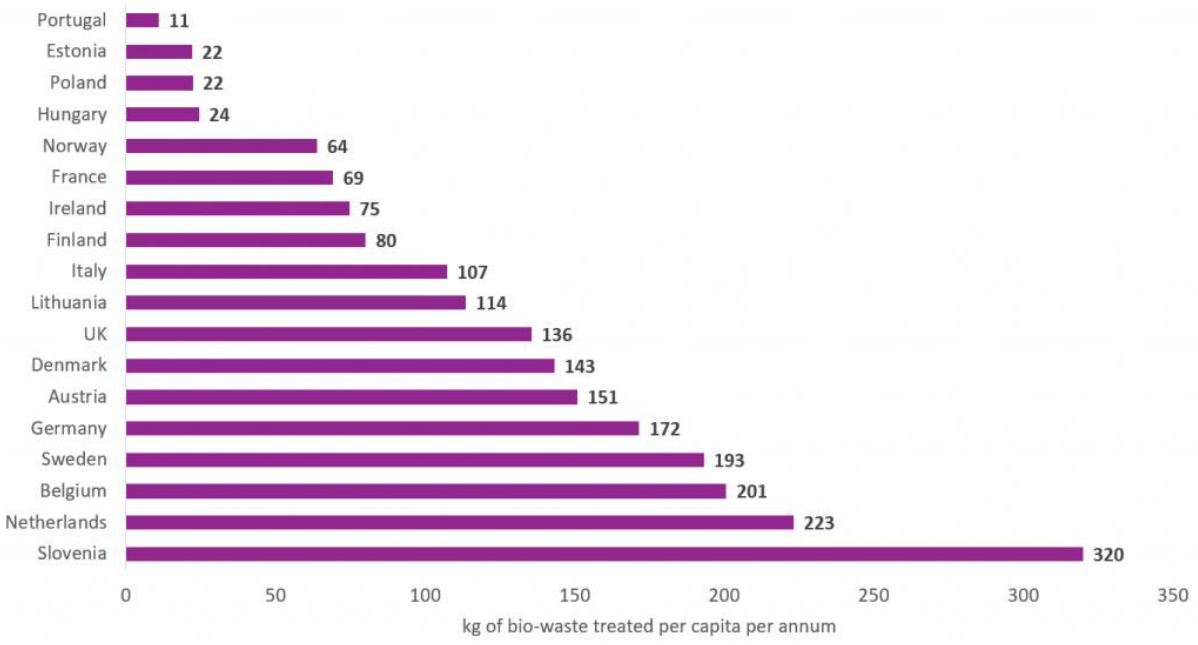

Figure 18: Per capita treatment of bio-waste

Source: European Compost Network

Slovenia has the highest per capita value of treated bio-waste at 320kg, then following are the Netherlands, Belgium, Sweden and Germany with the highest per capita treated bio waste values among the 18 EU countries. Figure 19 shows the total quantity of treated bio-waste in tonnes, per country, per annum. Results in this case show Germany leading the way in total bio-waste treated, and Italy, France and Belgium following suit.

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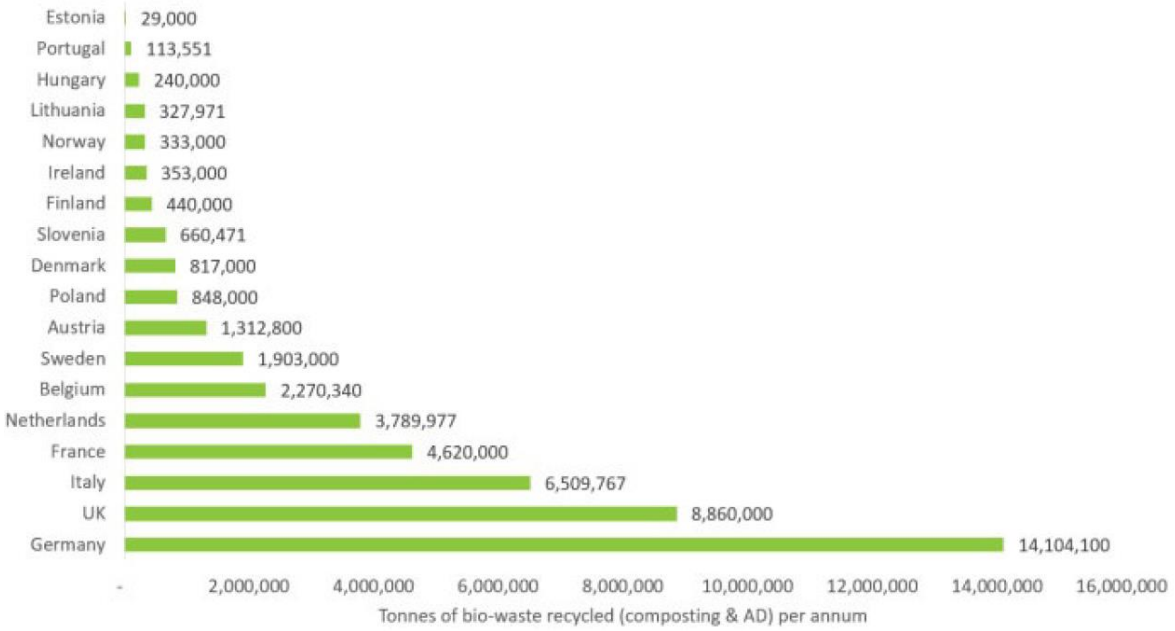

Figure 19: Total quantity of bio waste treated per annum

Source: European Compost Network

According to the EEA study[90] using data for 21 EU countries in 2017, the estimates for installed bio waste treatment capacity show that composting facilities account for 53%, while anaerobic digestion accounts for 47%, and no data are available on the volume of home composting.

Per capita bio waste treatment capacity is also varied across the European countries. According to the EEA study, it ranges from 356kg capacity per person to close to zero[91]. Figure 20 shows the link between treatment capacity, municipal bio waste generation and separate collection of bio waste for 21 EU countries. Given that there are several challenges in collecting uniform data between the countries and the unavailability of data on existing infrastructure capacities in other cases, certain conclusions can be drawn from these data. The countries evaluated can be categorised into three groups:

- Countries which have sufficient treatment capacity for all the municipal bio-waste produced: Austria, France, the Netherlands, Slovenia, Sweden, and the United Kingdom.
- Countries which have adequate treatment capacity for the separately collected municipal bio-waste but not for all of the municipal bio-waste produced: Belgium, Cyprus, Hungary, and Italy, Latvia, Poland, Portugal, Romania, Slovakia, and Spain.
- Countries which have insufficient treatment capacity for the separately collected municipal bio-waste: Estonia, Greece, North Macedonia, and Turkey. These countries

[90] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[91] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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are probably not in a position to treat the produced bio-waste whether mixed or separately collected. However, given the luck of data some countries may have MBT and AD plants for agricultural waste which can also be used to treat municipal bio waste, but were simply not included in the installed capacity data. Extending separate collection of bio-waste in any case, will require the installation of new treatment capacity in many of the EU countries.

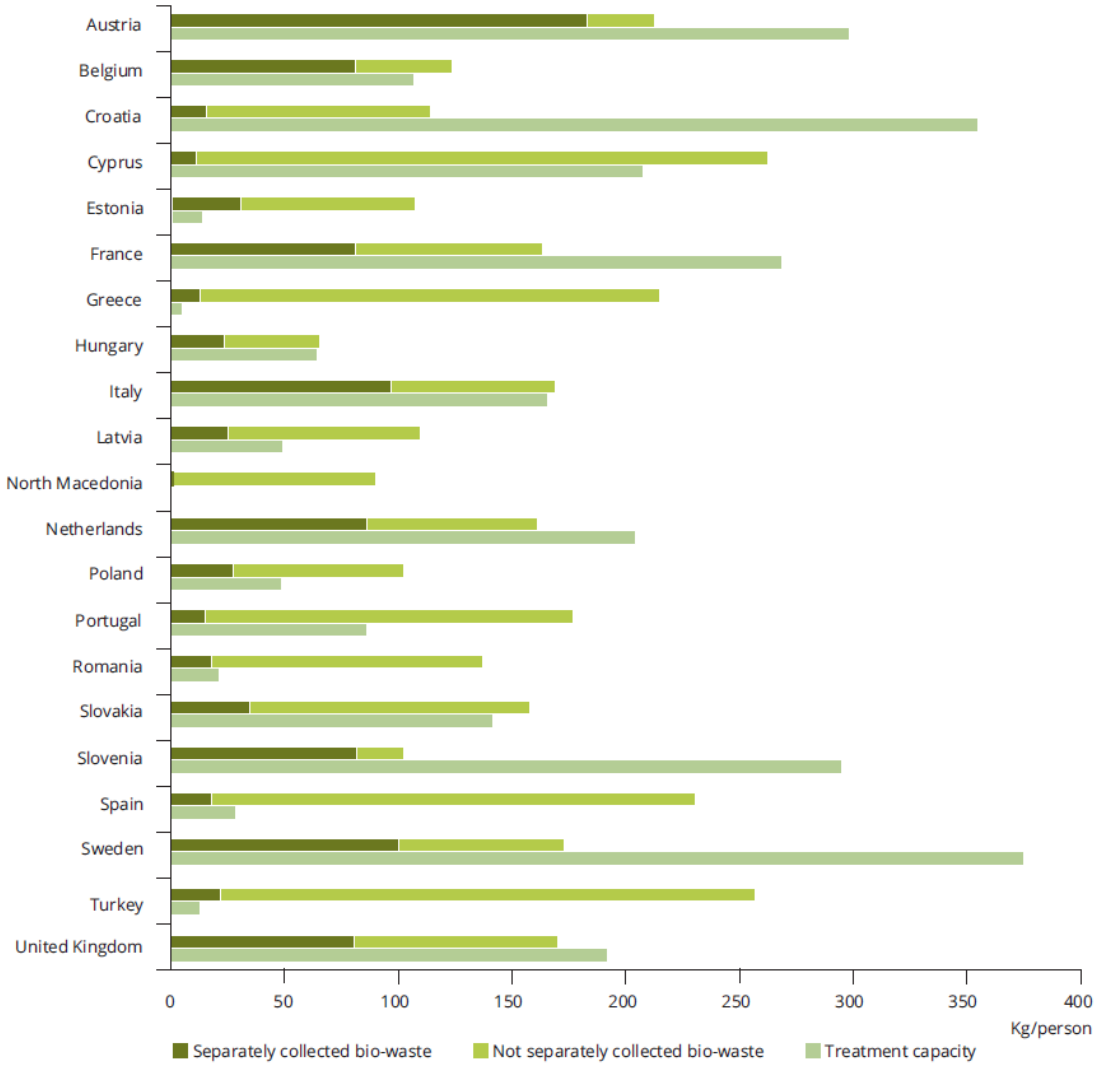

Figure 20: Bio-waste generation and treatment capacities for 21 EEA member and cooperating countries, 2017

Note: Home composting is not included because of a lack of data. Data refer to 2017 or latest available data.

Source: ETC/WMGE compilation based on data provided by Eionet through an EEA and ETC/WMGE survey (ETC/WMGE, 2019a), Eurostat (2020), and the European Reference Model on Municipal Waste (ETC/WMGE, 2019b) for Belgium, Croatia, Cyprus, Estonia, Germany, Greece, Italy, Poland, Spain and the United Kingdom.

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At country level, however, there are significant differences in the infrastructures for the treatment of bio-waste. Austria, Belgium, Cyprus, Italy, the Netherlands, Slovakia and Spain, for example treat bio waste mostly with composting, whereas Croatia, Poland, Portugal, Slovenia, Sweden, and Turkey, have more anaerobic digestion capacities than composting. Figure 21 shows the share of composting versus AD capacity in 21 EU countries[92].

It is important to note that the uptake and capacity of anaerobic digestion facilities can be affected by environmental regulations such as the Renewable Energy Directive 2009/28/EC[93]. The directive requires EU Member States to ensure that at least 10% of their transport fuels come from renewable sources by 2020 and establishes renewable energy targets for the EU of at least 20% by 2020 and 32% by 2030[94].

[92] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[93] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[94] DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Text with EEA relevance)

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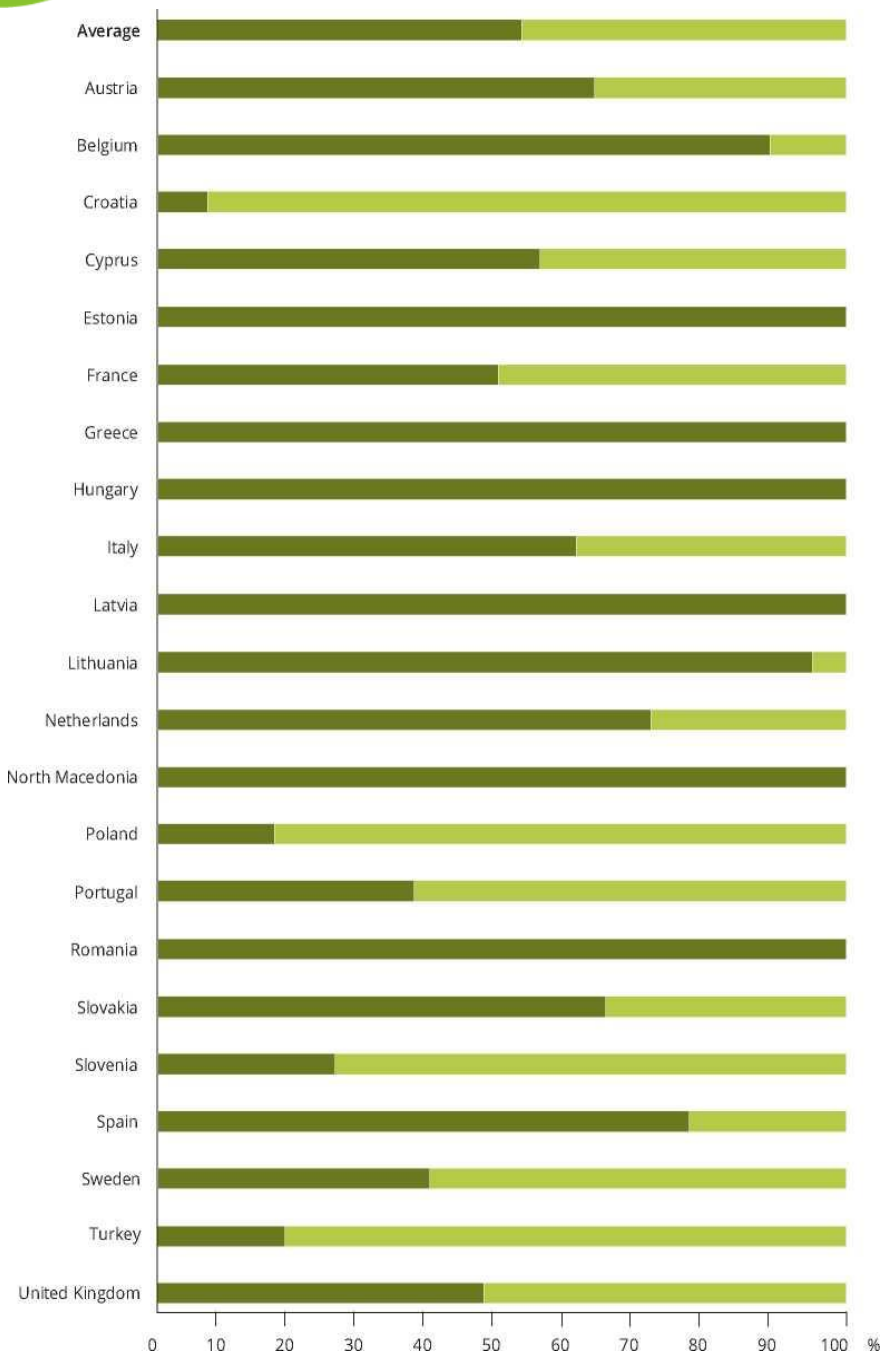

Figure 21: Shares of Treatment Capacities for bio-waste for 22 EEA member and Cooperating Countries, 2017

Note: The average refers to the weighted average across the 22 countries for which data are available. Home composting is not included because of a lack of data. Data refers to 2017 or latest available data.

Source: ETC WMGE compilation based on data provided by Eionet through an EEA and ETC/WMGE survey (ETC/WMGE, 2019a) complemented with data provided by the European Reference Model on Municipal Waste (ETC/WMGE, 2019b

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3.4 Food Waste Prevention

An estimated 60% of bio-waste is food waste, and a considerable share of this waste is avoidable. The EU's guiding and overarching principle with regards to waste related policies and initiatives is the principle of the waste hierarchy. According to this hierarchy and adapted specifically for the food waste stream, the priority is to prevent food waste, followed by re-use, recycling, recovery and lastly disposal.[95] The hierarchy for food waste is presented in Figure 22.

The food waste hierarchy

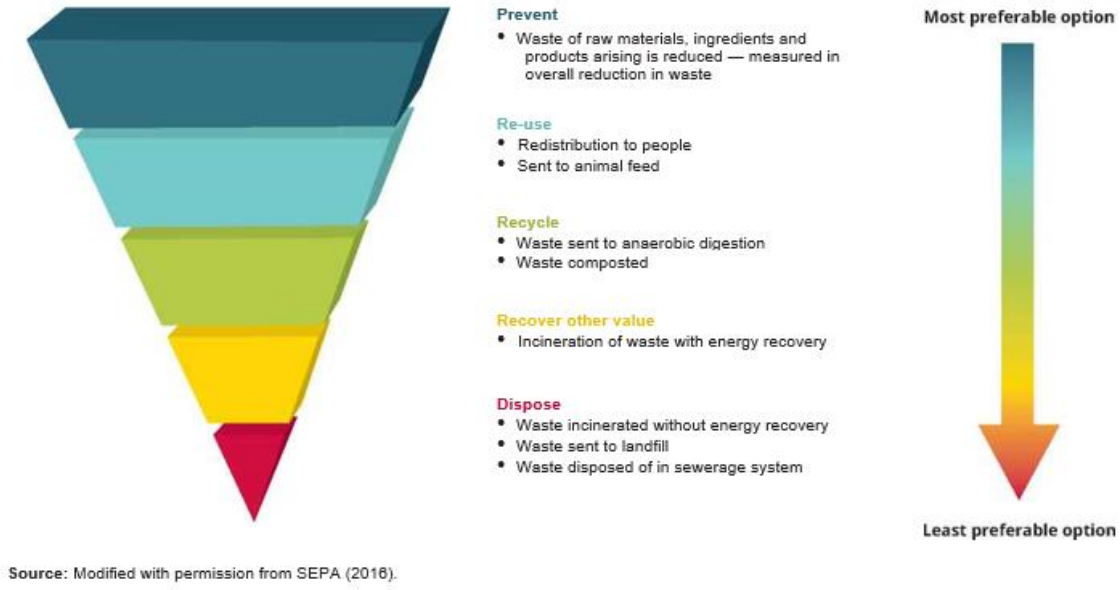

Figure 22: Food Waste Hierarchy

Source: EEA, SEPA, 2016

This hierarchy poses an intrinsic dilemma, the same way that it does for other significant waste streams (like packaging for instance). If more capacity for bio-waste treatment is installed, there might be limited incentive to prevent food waste (which remains the preferred option). On the other hand, not all food waste can be prevented, therefore investments in treatment capacity remain necessary. Also, the target setting is based on the hierarchy, which means there could be separate targets for prevention and separate targets for treatment of bio-waste.

[95] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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As was described in Section 2.2 most of the environmental impacts from food waste come from food production (73% of GHG emissions[96]), food waste prevention becomes relevant at all stages of the food value chain. The aim is to reduce overall demand for food and prohibit its production altogether rather than finding the most efficient ways to treat the waste of food. Therefore, any action should be targeted towards the end consumer (i.e. those who demand food). Targeting the households and the hospitality sector seems to have the greatest indirect effect for reducing the environmental impact of food waste. This is because these sectors have the highest fractions of avoidable food waste in terms of weight and because the environmental impacts of food at consumer level include all the accumulated impacts from the whole supply chain[9798]. However, responsibility for preventing food waste lies with all the stages and all the players of the food value chain.

Other than food waste generated at the different stages of the supply chain, food waste is further subdivided into edible and inedible parts as explained in the Commission Delegated Decision (EU) 2019/1597[99]. Meat bones and eggshells for example are considered inedible food waste and therefore unavoidable whereas meat and eggs are edible food waste which is avoidable, and this is the type of food to be targeted in food waste prevention[100]. The common methodology established in the Commission Delegated Decision (EU) 2019/1597 considers and monitors only the edible food waste production.

Figure 23 presents the distribution of food waste generation by the different contributing sectors.

[96] "Scherhaufer, Silvia et al. 2018. "Environmental Impacts Of Food Waste In Europe" 77: 98-113. doi: https://doi.org/10.1016/j.wasman.2018.04.038.
[97] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[98] "Scherhaufer, Silvia et al. 2018. "Environmental Impacts Of Food Waste In Europe" 77: 98-113. doi: https://doi.org/10.1016/j.wasman.2018.04.038.
[99] "Commission Delegated Decision (EU) 2019/1597 Of 3 May 2019 Supplementing Directive 2008/98/EC Of The European Parliament And Of The Council As Regards A Common Methodology And Minimum Quality Requirements For The Uniform Measurement Of Levels Of Food Waste (Text With EEA Relevance.)". 2019. EUR-Lex. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2019.248.01.0077.01.ENG#:~:text=Commission%20Delegated%20Decision%20(EU)%202019,(Text%20with%20EEA%20relevance.).
[100] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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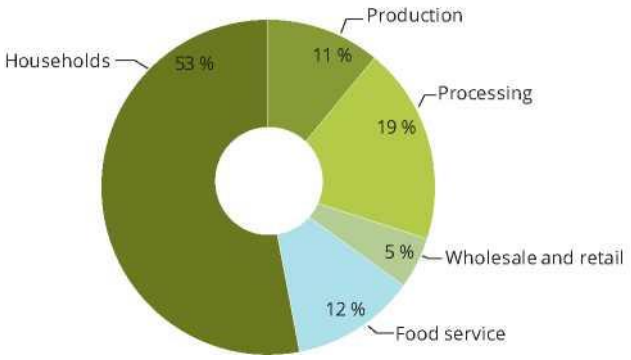

Figure 23: Food Waste Generation by Sector, EU, 2012

Note: Includes food and inedible parts associated with food.
The production sector includes harvested crops leaving the field/cultivation and intended for the food chain and mature crops not harvested, for example for economic reasons. Again, manure and gleanings are not counted as food waste. A detailed definition of the sectors is given in Tostivin et al. (2016).

Source: *Stenmarck et al. 2016.*

Figure 20 indicates that most food waste occurs in the households (53%) but these percentages include both edible and inedible food waste. There have been several attempts to calculate only the edible part of food waste, and these suggest that the percentage of edible food in household food waste is high. For example, a study by EU Fusions[101] estimated that edible food waste in households for the EU-28 amounts to 60%. Other estimates of edible food in household food waste include 30% in Greece[102] and 35% in Sweden[103]. Estimates of edible food waste seem to vary.

However, in reality household waste cannot be seen in isolation from other stages of the food supply chain[104]. Food waste in households may occur by actions taken further back in the food chain, like for example, incomprehensible expiry date labels, packaging that is not resalable, and sales promotion strategies such as 1+1 and bulk packaging.

[101] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.
[102] Abeliotis, Konstadinos & Lasaridi, Katia & Costarelli, Vassiliki & Chroni, Christina. (2015). The implications of food waste generation on climate change: The case of Greece. Sustainable Production and Consumption. 3. 8 - 14. 10.1016/j.spc.2015.06.006. https://www.researchgate.net/publication/279925552_The_implications_of_food_waste_generation_on_climate_change_The_case_of_Greece
[103] Bernstad Saraiva Schott A, Andersson T. Food waste minimization from a life-cycle perspective. J Environ Manage. 2015 Jan 1;147:219-26. doi: 10.1016/j.jenvman.2014.07.048. Epub 2014 Sep 26. PMID: 25264296. https://pubmed.ncbi.nlm.nih.gov/25264296/
[104] Karin Schanes, Karin Dobernig, Burcu Gözet,Food waste matters - A systematic review of household food waste practices and their policy implications,Journal of Cleaner Production,Volume 182,2018,Pages 978-991,ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2018.02.030

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If the objective is to reduce the environmental impact of food waste, then it must be taken into consideration that different food categories generate substantially different environmental impacts per kilogram across their life – cycle and these impacts are not only relevant to GHG emissions. For example, meat has a large impact on climate change per kilogram, while coffee, cocoa, and some fruit, such as citrus fruit, have relatively greater impacts on biodiversity. Therefore, although food waste on average can contain only about 5-12% of meat, this fraction contributes 25-55% of the climate impacts of food waste. In contrast, the larger amount of bread and starch, around 20% of all food waste, contributes less than 10% of the climate impacts[105][106] . Therefore, in measuring the environmental impacts, it is not just an issue of how much food is wasted by weight, but also the composition of the food waste stream.

In any case, any strategy to minimise food waste will result in lower greenhouse gas emissions than in the current situation. Most studies have pointed out that, despite the positive impacts of better treatment of food waste, preventing food waste yields far greater life-cycle savings of greenhouse gas emissions than incineration and anaerobic digestion[107].

Literature on the drivers to reduce food waste show that in general, personal concerns such as saving money are a stronger incentive than environmental and social concerns[108]. Therefore, another important parameter in understanding the scale of food waste may be the measurement of the monetary cost. Estimates for the cost of food waste per kilogram of edible food waste range between 3.2 to 6.1 euros per kg of waste[109][110]. Moreover, the European Commission's Joint Research Centre has developed a calculator to quantify the environmental and economic savings that can be achieved through preventing food waste[111].

[105] "Scherhaufer, Silvia et al. 2018. "Environmental Impacts Of Food Waste In Europe" 77: 98-113. doi: https://doi.org/10.1016/j.wasman.2018.04.038.
[106] Claudio Beretta, Stefanie Hellweg, Potential environmental benefits from food waste prevention in the food service sector,Resources, Conservation and Recycling,Volume 147,2019,Pages 169-178,ISSN 09213449, https://www.sciencedirect.com/science/article/abs/pii/S0921344919301284
[107] Bernstad Saraiva Schott A, Andersson T. Food waste minimization from a life-cycle perspective. J Environ Manage. 2015 Jan 1;147:219-26. doi: 10.1016/j.jenvman.2014.07.048. Epub 2014 Sep 26. PMID: 25264296. https://pubmed.ncbi.nlm.nih.gov/25264296/
[108] Karin Schanes, Karin Dobernig, Burcu Gözet,Food waste matters - A systematic review of household food waste practices and their policy implications,Journal of Cleaner Production,Volume 182,2018,Pages 978-991,ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2018.02.030
[109] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[110] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.
[111] EC, 2020a, 'Calculator for impacts of food waste prevention actions', EU Platform on Food Losses and Food Waste ,https://eplca.jrc.ec.europa.eu/permalink/valeria/prevention_action_calculator.xlsm

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In monetary terms it is estimated that across the whole food supply chain, two thirds of the cost is associated with food wasted by households. The cost of food waste in the EU in 2012 is estimated to be EUR 143 billion, of which approximately EUR 98 billion is attributed to household food waste[112]. This is because households generate more edible food waste than any other supply chain stage and the fact that the costs associated with a tonne of food, for processing, packaging, and retailing, for example, accumulate along the supply chain[113].

3.6 Policies applied in the EU to reduce food waste

The EU revised WFD gives particular emphasis on the prevention of food waste through the development of specific food waste prevention programmes such as awareness campaigns on good practices and information about the food waste issue, utilisation of unwanted food through donations and use for animal feed and the creation of tools and platforms for the efficient use of food resources.

These programmes may be in the form of national initiatives and policies or local initiatives. An analysis conducted of 32 national and regional waste prevention programmes[114] shows that measures on food waste are already included in the prevention programmes of 28 countries and regions.

In a recent 2019 survey by ETC/WMGE[115], countries reported a total of 91 examples of new waste prevention measures, among which information-based measures were mentioned most frequently. Other measures reported were economic measures, redistribution platforms, voluntary agreements and monitoring of food waste. The number of activities per type are depicted in Figure 24 for the 32 EEA members and cooperating countries.

Figure 25 presents the number of countries reporting new activities to prevent food waste in the 32 EEA member and cooperating countries. Information-based measures/activities were mentioned by 23 countries, food distribution platforms by 7 countries, monitoring systems of food waste by 5 countries, while 7 countries mentioned ongoing analyses and/or the development of monitoring systems, 12 in total. 5 countries, Croatia, Estonia, Greece, Latvia,

[112] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.
[113] Stenmarck, Åsa et al. 2016. "FUSIONS - Estimates Of European Food Waste Levels". Stockholm: FUSIONS Reducing food waste through social innovation. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf.
[114] EEA, 'Waste prevention in Europe', European Environment Agency (https://www.eea.europa.eu/ themes/waste/waste-prevention/waste-prevention) accessed 6 December 2019
[115] ETC/WMGE, ETC/WMGE elaboration based on data provided by EIONET through an EEA-ETC/WMGE survey, 2019, European Topic Centre on Waste and Materials in a Green Economy, Mol, Belgium

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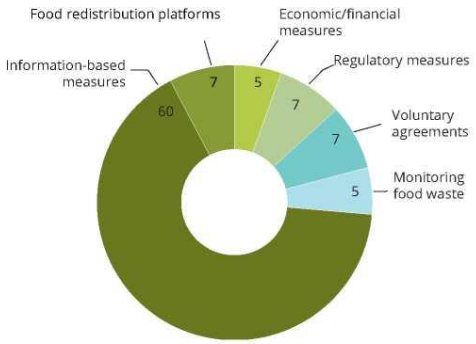
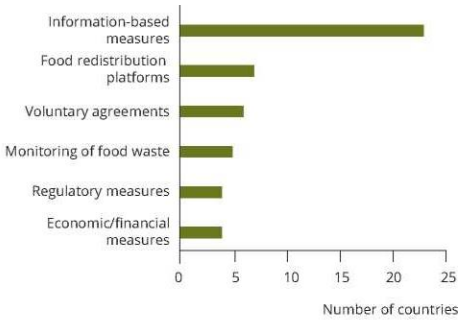
and Switzerland reported that they have dedicated plans and measures in preparation for preventing food waste.



Source: ETC/WMGE (2019a).

Figure 24: Number of food waste prevention measures not included in waste prevention programmes reported by 32 EEA member and cooperating countries, 2019



Source: ETC/WMGE (2019a).

Figure 25: Number of countries reporting new food waste prevention measures not included in waste prevention programmes for 32 EEA member and cooperating countries, 2019

Concentrating on these key areas of inetervention as shown in figures 24 and 25 the following paragraphs describe each type of measure with several current examples in the EU.

3.6.1 Information-based measures

Awareness raising activities are essential, starting at an early age. These initiatives are carried out either as part of wider national campaigns or on site through programmes providing communication materials that usually target consumers, restaurants, and food services. As seen in Figure 24, information-based measures is the dominant policy option for the prevention of food waste. Figure 25 data show that the most targeted group are the consumers, however there are also several campaigns targeting the catering industry (12 countries in total) and these policies include general awareness raising, training, technical support and ecolabelling. Education on preventing food waste has also been taken up by primary schools and kindergartens in 7 countries. Cooperation with industry was mentioned by 5 countries and included sharing best practice[116].

[116] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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Supporting the share of information between the member states, the EU has established the EU Platform on Food Losses and Food Waste in 2016[117] which includes recommendations on actions to prevent food waste and information on initiatives across Europe. It also aims to evaluate the progress made over time and to better define the necessary measures to combat food waste. Examples of information campaigns include:

- "Feeding the 5000 events": This is a charity run initiative implemented in several EU countries such as Poland, Spain, Greece and more. The aim of each event is to prepare 5000 meals using food that would otherwise have been waste. Through these events, the idea is to bring together a coalition of organisations that offer solutions to food waste, raising the issue up the political agenda and inspiring new local initiatives against food waste[118].
- "Stop Wasting food movement Denmark" events: An NGO initiative, where events are organised to increase public awareness of the throwaway society, to mobilise the press and media, and encourage discussion, debate and events of all kinds, aiming to reduce food waste[119].
- Other campaigns include the "Stop Food Waste Programme" in Ireland, "Lebensmittel sind kostbar!" in Austria, "Think.Eat.Save Reduce your Foodprint" in Europe and "Love Food Hate Waste" in Britain[120].

According to Schanes et al. (2018), in order for information campaigns to be effective they have to address specific knowledge gaps that drive wasteful practices. These are food storage practices such as habits to prolong the life of food and better use of the freezer. In addition, it is important to inform and educate regarding the shelf life of fresh food leftovers and the meaning of date labelling[121].

3.6.2 Economic/financial measures

"Market-based instruments (MBIs) are policy tools that encourage behavioural change through market signals by providing economic incentives rather than through traditional

[117] "EU Platform On Food Losses And Food Waste". 2022. https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste_en.
[118] "Feeding The 5000 - Feedback". 2022. Feedback. https://feedbackglobal.org/campaigns/feeding-the-5000/.*Dk.* https://www.stopspildafmad.dk/inenglish.html.
[119] "Stop Wasting Food Movement Denmark (Stop Spild Af Mad)". 2020. *Stopspildafmad.Dk.* https://www.stopspildafmad.dk/inenglish.html.
[120] Karin Schanes, Karin Dobernig, Burcu Gözet,Food waste matters - A systematic review of household food waste practices and their policy implications,Journal of Cleaner Production,Volume 182,2018,Pages 978-991,ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2018.02.030
[121] Karin Schanes, Karin Dobernig, Burcu Gözet,Food waste matters - A systematic review of household food waste practices and their policy implications,Journal of Cleaner Production,Volume 182,2018,Pages 978-991,ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2018.02.030

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regulations[122]". They comprise of fees, taxes and subsidies and are considered a powerful tool for shifting consumption patterns towards more sustainable food practices[123].

Based on FUSIONS EU report market-based instruments are important tools which if designed well, they have the potential to decrease compliance costs, compared to command-and-control regulatory tools[124]. Figure 26 illustrates examples of price-based instruments.

Figure 26: Potential price-based instruments to reduce and prevent food waste
Source: EU FUSIONS[125]

A promising tool is "pay as you throw" schemes (PAYT). Under such schemes businesses and consumers are expected to change their behaviour and implement measures to reduce food waste in order to pay less and even find alternative ways to use leftover food such as storing for later use or donating (ref.97). Experience from the US, Canada, Sweden, Japan and other countries showed that PAYT schemes are effective tools for the reduction of food waste(ref.86). Another example in Italy is reductions in Value added tax (VAT) on the sales of leftover food to boost their sale[126].

3.6.3 Regulatory measures

[122] Sejm, 2019, Dz. U. 2019 poz. 1680, US TAWA z dnia 19 lipca 2019 r. o przeciwdziałaniu marnowaniu żywności.
[123] Karin Schanes, Karin Dobernig, Burcu Gözet,Food waste matters - A systematic review of household food waste practices and their policy implications,Journal of Cleaner Production,Volume 182,2018,Pages 978-991,ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2018.02.030
[124] Sejm, 2019, Dz. U. 2019 poz. 1680, US TAWA z dnia 19 lipca 2019 r. o przeciwdziałaniu marnowaniu żywności.
[125] Sejm, 2019, Dz. U. 2019 poz. 1680, US TAWA z dnia 19 lipca 2019 r. o przeciwdziałaniu marnowaniu żywności.
[126] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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Several EU countries choose to adopt regulatory measures in order to achieve their targets. Such measures include waste reduction targets such as laws and standards, mandatory management plans, restrictions or covenants and penalties for non-compliance. Examples of such measures are:

- In France Law 2016-138 on fighting against food waste obliges all supermarkets and retailers with a surface larger than 400 square meters to donate their surplus food[127],
- In Italy Law no. 166/2016 established the national consultative round table to support food waste prevention and food aid in order to discuss, amongst others, issues relevant for food recovery and redistribution[128].
- In Romania the amended "food waste" Law no. 217/2016 stipulates that FBOs may donate food to the receiver organisations and final consumers[129].
- France also obliges restaurants providing more than 180 meals a day to allow customers to take leftover food home, providing them with a container if requested[130].
- In Poland a new act to counteract food waste entered into force in September 2019. It regulates the obligations of food sellers and organisations distributing food for public benefit[131].

Another potential regulatory instrument could be to review and eliminate any unnecessary food waste standards that lead to more food waste[132].

3.6.4 Voluntary agreements

Voluntary agreements are typically a form of cooperation between public administrations and participating stakeholders, usually businesses[133]. They can be in the form of accreditation schemes, voluntary commitments by firms, and use of toolboxes for better planning and forecasting including digital solutions etc. [134]. Examples of such voluntary agreements are:

[127] "Redistribution Of Surplus Food: Examples Of Practices In The Member States". 2019. EU Platform on Food Losses and Food Waste (FLW). https://food.ec.europa.eu/system/files/2019-06/fw_eu-actions_food-donation_ms-practices-food-redis.pdf.
[128] "Redistribution Of Surplus Food: Examples Of Practices In The Member States". 2019. EU Platform on Food Losses and Food Waste (FLW). https://food.ec.europa.eu/system/files/2019-06/fw_eu-actions_food-donation_ms-practices-food-redis.pdf.
[129] "Redistribution Of Surplus Food: Examples Of Practices In The Member States". 2019. EU Platform on Food Losses and Food Waste (FLW). https://food.ec.europa.eu/system/files/2019-06/fw_eu-actions_food-donation_ms-practices-food-redis.pdf.
[130] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[131] Sejm, 2019, Dz. U. 2019 poz. 1680, US TAWA z dnia 19 lipca 2019 r. o przeciwdziałaniu marnowaniu żywności.
[132] Karin Schanes, Karin Dobernig, Burcu Gözet,Food waste matters - A systematic review of household food waste practices and their policy implications,Journal of Cleaner Production,Volume 182,2018,Pages 978-991,ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2018.02.030
[133] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[134] "EU Platform On Food Losses And Food Waste". 2021. *European Commission*. https://food.ec.europa.eu/system/files/2022-02/fw_lib_stud-rep-pol_flw_act-report_2021.pdf.

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- Ireland's Food Waste Charter: Through this initiative companies and organisations commit to take positive actions – through measuring; reducing; and reporting their food waste. During the first 3 years companies should monitor and track their food waste and report on the progress made. Several major supermarket chains in Ireland have signed the charter[135].
- Austria's Agreement 2017-2030 to avoid food waste in food companies: The agreement envisages to reduce edible food waste in consumption and retail by 50% by 2030 and also in the other parts of the supply chain to reduce this waste. It is a voluntary commitment by which both retailers and food producers can show their commitment to the SDG 12.3. The agreement was created by the Federal Ministry of Agriculture, Forestry, Environment and Water Management[136].
- EU Code of Conduct for Responsible Business and Marketing Practices is a set of guiding principles for food manufacturers, food service operators and retailers, who can voluntarily align, commit and contribute to in support of the transition towards sustainable food systems. It is one of the first deliverables of the 'EU Farm to Fork' strategy[137].
- Champions 12.3 10x20x30 initiative: The Initiative was launched by Champions 12.3 and has brought together 10 of the world's biggest food retailers and providers, committing to halve food loss and waste by 2030 in collaboration with their 20 most important suppliers[138].

Other examples of voluntary agreements are partnerships between companies and start-ups to sell fresh food at discounted prices or with food donation charities for the giveaway of leftover food[139].

3.6.5 Targets

Targets are already an effective tool to tackle the food waste challenge. Data collected by the recent 2019 survey by ETC/WMGE[140][141] (see figure 21) showed that six countries specifically reported they have set targets for reducing food waste, which are generally in line with the

[135] "THE CHARTER - Food Waste Charter". 2022. *Food Waste Charter*. https://foodwastecharter.ie/.
[136] "Vereinbarung 2017–2030 Zur Vermeidung Von Lebensmittelabfällen Bei Lebensmittelunternehmen Berichtszeitraum 2018–2020". 2021. *Bmk.Gv.At*. https://www.bmk.gv.at/themen/klima_umwelt/abfall/abfallvermeidung/publikationen/vereinbarung-vermeidung-lebensmittelabfaelle.html.
[137] "EU CODE OF CONDUCT ON RESPONSIBLE FOOD BUSINESS AND MARKETING PRACTICES". 2021. https://food.ec.europa.eu/system/files/2021-06/f2f_sfpd_coc_final_en.pdf.
[138] "10X20x30 Food Loss And Waste Initiative". 2022. PACE. https://pacecircular.org/10x20x30-food-loss-and-waste-initiative#:~:text=Project%20description,loss%20and%20waste%20by%202030.
[139] "EU Platform On Food Losses And Food Waste". 2021. *European Commission*. https://food.ec.europa.eu/system/files/2022-02/fw_lib_stud-rep-pol_flw_act-report_2021.pdf.
[140] ETC/WMGE, ETC/WMGE elaboration based on data provided by EIONET through an EEA-ETC/WMGE survey, 2019, European Topic Centre on Waste and Materials in a Green Economy, Mol, Belgium
[141] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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target of SDG 12.3 of halving retail and consumer food waste per person by 2030. However, EU Member states have and utilise the option to go over and above the targets set in the EU Legislation for food waste reduction. France for example has set a target to halve food waste by 50% by 2025 instead of 2030.

3.6.6 Food redistribution platforms

Food redistribution practices are rapidly evolving in Europe either as measures/policies introduced nationally or through local initiatives. All measures and initiatives for food donation should follow the EU guidelines on food donation[142][143] and comply with certain EU legislation on food hygiene, labelling, VAT and other national regulations such as liability and taxation. "The EU guidelines on food donation clarify the relevant provisions of EU legislation which apply when food products are made available by the holder, free of charge. However, the process of food redistribution, whereby surplus food that might otherwise be wasted is recovered, collected and provided to people, may not in all cases be free of charge[144]".

Food redistribution and donation platforms usually facilitate the distribution of "food waste" to consumers in demand. Retail operations and catering companies for example use these platforms to donate or sell at lower prices leftover or second-class food products. The impact of these measures on food waste prevention can be easily monitored[145].

The EU Platform on Food losses and food waste published a report in 2019 providing an overview of these measures for 27 EU countries[146]. All countries had 'food donation' in their national food waste prevention strategy except Croatia, Czech Republic, Estonia, Hungary and Latvia of which some were in the process of developing their strategy on food waste prevention. Examples of measures for food waste prevention include:

- In Denmark the government is to provide funding to support and test new initiatives for food redistribution,
- In France the Law 2016-138 obliges all supermarkets and retailers with a surface larger than 400 square meters to donate their surplus food,

[142] "Food Donation". 2022. https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-donation_en#:~:text=EU%20Food%20donation%20guidelines&text=facilitate%20compliance%20of%20providers%20and,liability%2C%20VAT%2C%20etc.)%3B.
[143] "Redistribution Of Surplus Food: Examples Of Practices In The Member States". 2019. EU Platform on Food Losses and Food Waste (FLW). https://food.ec.europa.eu/system/files/2019-06/fw_eu-actions_food-donation_ms-practices-food-redis.pdf.
[144] Gram-Hanssen, I., et al., 2016, Food redistribution in the Nordic region. Phase II: Identification of best practice models for enhanced food redistribution, Nordisk Ministerråd, Copenhagen.
[145] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.
[146] Gram-Hanssen, I., et al., 2016, Food redistribution in the Nordic region. Phase II: Identification of best practice models for enhanced food redistribution, Nordisk Ministerråd, Copenhagen.

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- In Ireland they have developed technological and logistical solutions (redistribution "hubs" managed by FoodCloud) to facilitate food donation at national level,
- In Greece, municipalities and the competent bodies for solid waste management will undertake and coordinate actions to facilitate food donation at local level.

The list in not exhaustive[147]. One of the problems identified for the operation and maintenance of these platforms is that traditionally they are provided on a non-profit and voluntary basis and usually these organisations are in need of support[148]. If food waste prevention relies on donations and charities' work only, then if charities' demand for free food declines, then the problem of surplus food will return as its underlying causes have not been adequately tackled[149].

3.6.7 EU Platform on Food Losses and Food Waste

To support achieving the EU goals, the EU Platform on Food Losses and Food Waste was established in 2016, bringing together public entities (Member States/EFTA countries, EU bodies and international organisations) and actors in the food value chain including consumer and other non-governmental organisations. The Platform aims to support all actors in defining measures needed to prevent food waste; sharing best practice; and evaluating progress made over time.

To examine the progress and specific problems on food waste the platform has several thematic subgroups which are:

- Sub-group on Action & implementation
- Sub-group on Date marking and food waste prevention
- Sub-group on Food donation
- Sub-group on Food loss and waste
- Sub-group on Consumer food waste

The platform has published in 2019 the "key recommendations for action of the EU Platform on Food Losses and Food Waste" which addresses action required by public and private players at each stage of the food supply chain (including food redistribution). The Platform recommendations build on the work of the Joint Research Centre of the European

[147] Gram-Hanssen, I., et al., 2016, Food redistribution in the Nordic region. Phase II: Identification of best practice models for enhanced food redistribution, Nordisk Ministerråd, Copenhagen.
[148] "EU Platform On Food Losses And Food Waste". 2022. https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste_en.
[149] "Bio-Waste In Europe — Turning Challenges Into Opportunities". 2020. https://www.eea.europa.eu/publications/bio-waste-in-europe.

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Commission (JRC) to develop a common evaluation framework for food waste prevention actions[150].

[150] "Feeding The 5000 - Feedback". 2022. Feedback. https://feedbackglobal.org/campaigns/feeding-the-5000/.

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4. Food Waste in Cyprus

The Cypriot production of household waste per capita is among the highest in Europe. According to the Statistical Service of the Republic of Cyprus in 2017 the waste generation reached 636 kg per capita, placing Cyprus second only to Denmark which generates 781 kg. Overall European Union averages 486 kg per capita, a third of which (i.e., 88 million tons) is Food Waste.

4.1 Municipal Solid Waste to Landfills

In Cyprus, the Municipal Solid Waste challenge in terms of production, is above Europe's average. Nevertheless, the treatment of waste is also a challenge, as the country is still significantly dependent on landfilling of Municipal Solid Waste, when the EU is targeting the eventual abundance of landfilling. According to Cyprus Statistical Service, more than 76% of municipal solid waste is still (latest data 2017), disposed in landfills as shown in Figure 27.

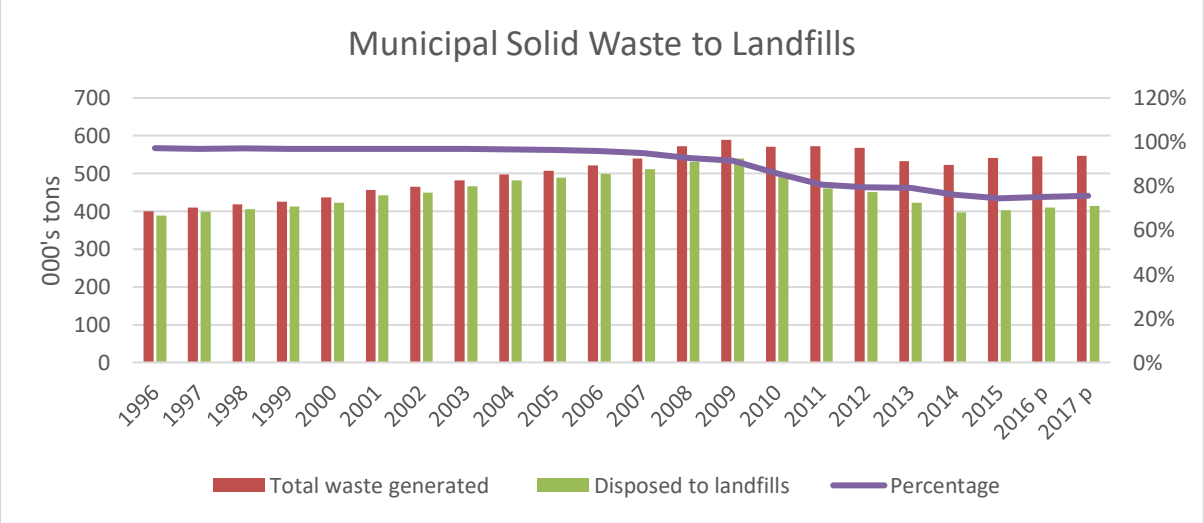

Figure 27: Municipal Solid Waste to Landfills – Cyprus Statistical Service (1996 – 2017)
Source: Cyprus Statistical Service

At the same time, not even 10% of biodegradable solid waste is sorted, as shown in Figure 28, despite some improvements in the last decade or so.

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Sorting of Bio-waste out of Municipal Solid Waste

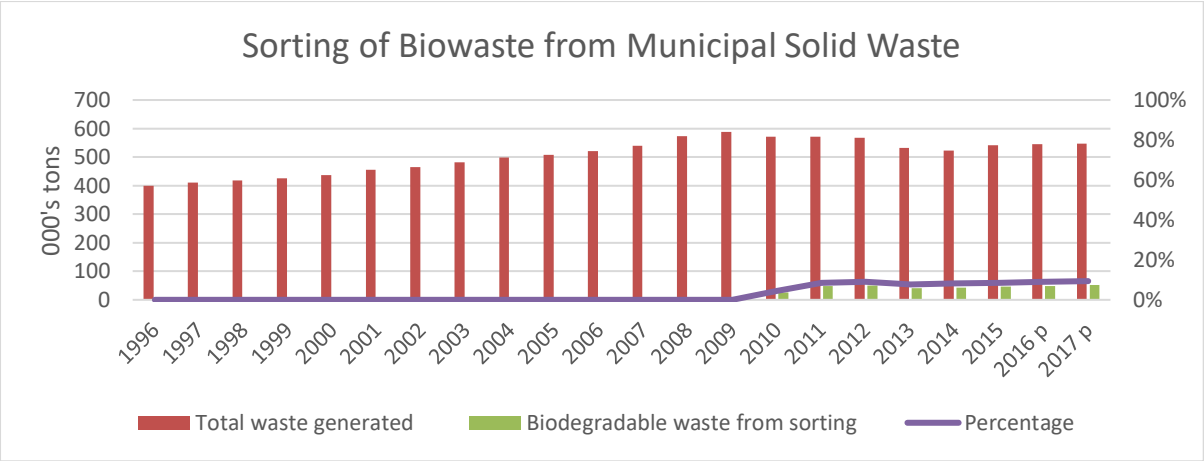

Figure 28: Sorting of Bio - Waste out of Municipal Solid Waste – Cyprus Statistical Service (1996 – 2017)
Source: Cyprus Statistical Service

The availability of local statistics on biodegradable waste in general, and more specifically on food waste in Cyprus, is really low. According to the Cyprus Department of Environment, the bio-waste that ended up in Koshi MBT plant between 2011 and 2018 reached on average almost 42% of total waste transferred to the plant (Figure 29).

Organics in Koshi MBT plant

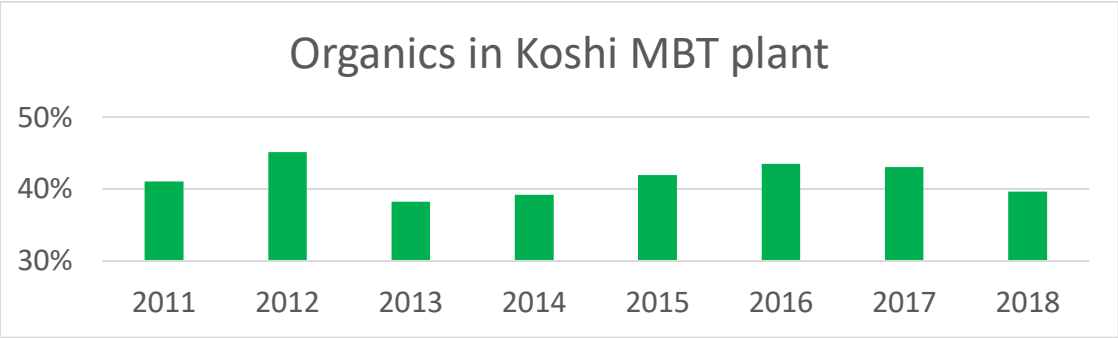

Figure 29:Organics in Koshi MBT Plant – Cyprus Environment Department

Source: Cyprus Environment Department

The results from the second MBT plant of the island in Pentakomo (Limassol area), indicate that during 2018 the bio-waste share of total waste taken to the plant, was almost 40% on average (Figure 30).

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Organics in Limassol MBT plant

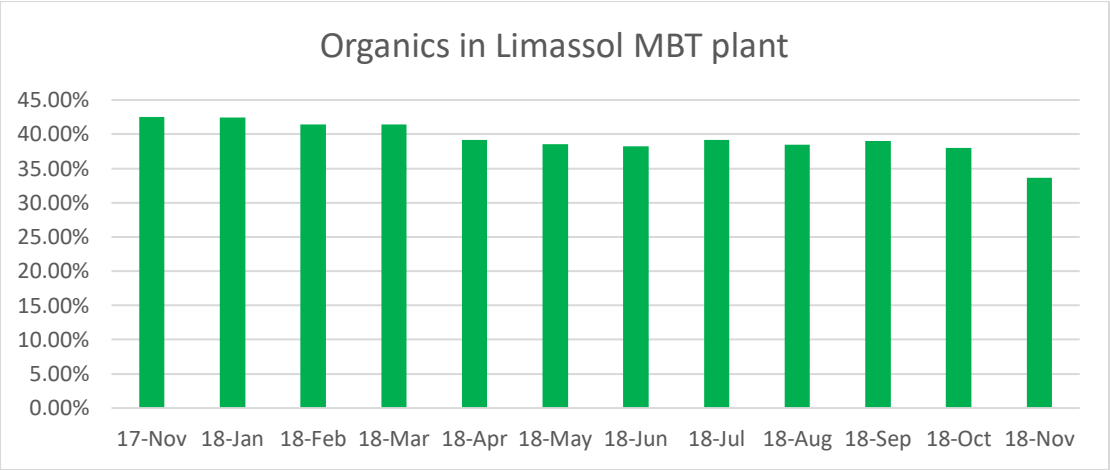

Figure 30: Organics in Limassol MBT Plant– Cyprus Environment Department

Source: Cyprus Environment Department

4.2 Food Waste Data

The latest official data in Cyprus by the Department of Environment refer to 42% of bio-waste in the Municipal Solid Waste (2016–2017). A latest unofficial measure by the Aglantzia Municipality (May 2019) found a higher amount of bio-waste, at 50 - 52% of the total Municipal Solid Waste collected at the Municipality.

Another rather recent study on the quantitative and qualitative analysis of solid municipal waste in the two largest geographical and by population cities of the island, Nicosia and Limassol, showed that kitchen and restaurant waste exceeds 50% of the composition of municipal solid waste (IACO 2016).

Based on the above data, is has been considered by the project team safe to assume that bio-waste should be around 47% of municipal solid waste produced in Cyprus. Figure 31 presents this estimate of biowaste based on the MSW production in the period 1996 – 2017.

Bio-waste portion in total Municipal Solid Waste

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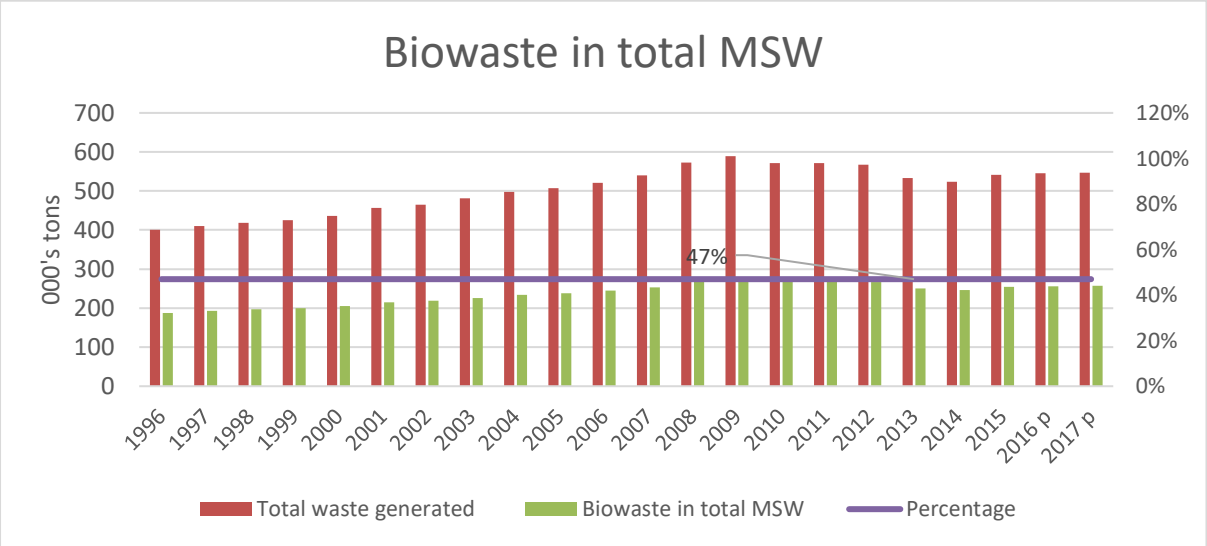

Figure 31: Bio - Waste in Total MSW – Cyprus Environment Department

Source: Cyprus Environment Department

Based on the data from 2017 for the Municipal Solid Waste produced, the 47% percentage of bio-waste translates to 257,260 tonnes of organic waste. However, from the bio-waste generated, only 20% or 51,190 tonnes were sorted and treated (including compost-like output from MBT plants). Figure 28 presents this share of sorted bio-waste Vs the total production of MSW in the period 1996 – 2017 (Figure 32).

Sorted Bio-waste VS Total Bio-waste in Municipal Solid Waste (inc. Compost-like output)

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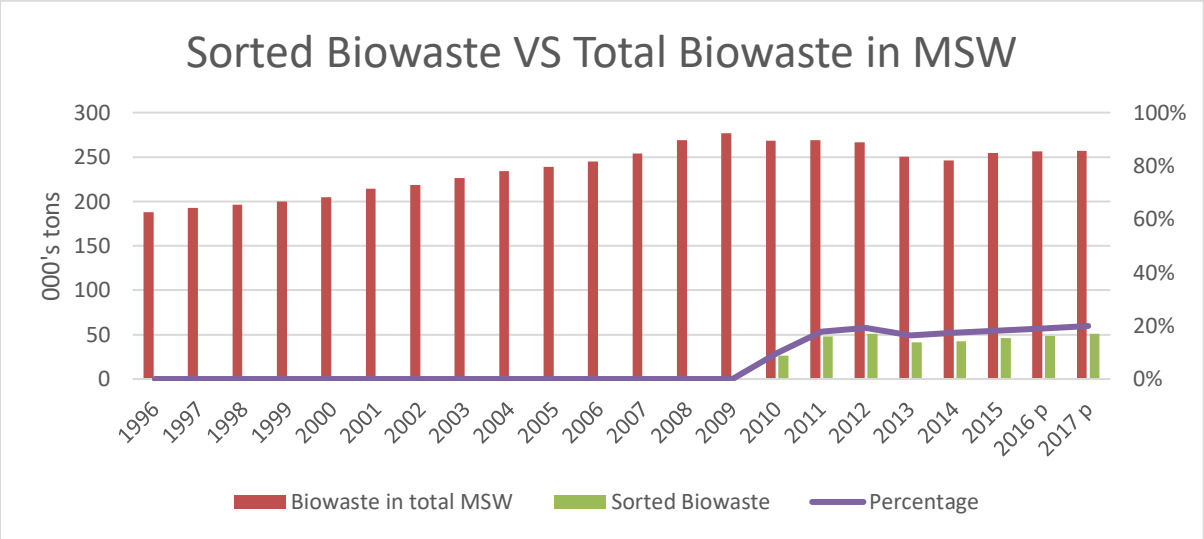

Figure 32: Sorted Bio - Waste Vs Total Bio-waste in MSW – Cyprus Environment Department
Source: Cyprus Environment Department

Based on the data above and considering that according to various studies, around 60% of bio-waste is estimated to be food waste, we can estimate that in 2017 about 155,000 tonnes of food waste was generated in Cyprus, representing 28,2% of total municipal solid waste generated for the same year. Consequently, almost one third of the infrastructure and operational cost for waste management in Cyprus, is expensed to deal with food waste.

Wasting food, however, is not only an ethical and economic issue, but it also depletes the environment of limited natural resources. In Cyprus, it is estimated that the solid waste contributes around 14% of the Cyprus GHG emissions (National Plan for Energy & Climate 2021-2030). Food waste is the most significant contributor to these waste derived GHG emission. Therefore, minimizing food waste will have an important positive impact on the balance of the GHG emissions of the country.

Food waste represents one of the main targets of the EU for the period 2018–2030, with focus on separate collection and reduction by 50%, by 2030. Different waste plans such as the Cyprus waste prevention plan 2015–2021 include a variety of measures aiming to tackle bio-waste, however, Cyprus lacks a specific national Food waste strategy. Starting in 2020, the Municipal Waste Management Strategy and Prevention Plan will be revised through EU technical assistance and are expected to include revised actions on food waste. Hence the Life Footprint project has the potential during this period to contribute to policy development and implementation on a local, national and EU level. The Department of Environment is a partner in this project and can use the findings of the project to enrich the work done to revise

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the Municipal Waste Management Strategy and the Waste Prevention Plan of the country with regards to bio-waste policies for the future.

As has been analysed earlier, the whole food supply chain contributes to the food waste challenge, as there are losses associated with every link of the chain (production, processing, transportation, retailing, catering, households). In fact, in a country with a significant tourism sector like Cyprus, it is expected that the catering business (hotels, restaurants, fast food chains) will have a more significant role to play in the wasting of food compared to other countries. It is for this reason that this project has been designed with a specific focus on the catering industry and catering professionals as well.

There are around 10,400 food-related businesses in Cyprus operating in the primary (9%), secondary (23%) and tertiary (63%) sector (OEB, 2020). Enterprises in the primary and secondary sectors are related to food loss, whereas enterprises in the tertiary sector are mainly related to food waste. It is anticipated that companies implementing food waste reduction initiatives are bound to reap financial benefits. However, in Cyprus there are not many initiatives on food waste awareness, or in the form of 'best use before they become waste' at a national level, but some scattered ones from local authorities and private entities. This project aims to improve awareness of food waste parameters, train professionals in the sector and facilitate the sharing of experiences and the spread of good practices happening locally or internationally.

4.3 Environmental Policy

The absence of a comprehensive and coherent policy for the protection of the environment, the dispersed responsibilities between many governmental institutions, and the political expediency favouring financial interests over environmental protection in many instances, place Cyprus very low on many relevant EU ratings. The country is failing on some of its EU obligations, despite warnings from Brussels and pressure from local and international organizations.

Awareness-raising efforts and pressure from environmental groups since the late 1980s, has achieved little to convincing the authorities to halt projects with a destructive environmental impact. Politicians and financial interests involved in large project and investments are persistently seeking from the authorities to relax environment protection rules. The country's response to demands for climate protection, remains insufficient in many respects.

Along with limiting GHG emissions, better water management and forest protection, the reduction and eventual abandonment of landfilling (as per the EU strategy), is a major

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challenge for the country. Despite the Commission's warnings and eventually the threats for sanctions against the country, the waste management problems remain unresolved or at the best is only slightly improved, yet on a very slow pace. The issue of the failure to act timely on tackling the waste problems has also addressed in a report by the Auditor General of the republic in a late 2017 report. Furthermore, in 2018, Cyprus received warnings from Brussels for failing to integrate EU directives on the environment into national laws, failing to meet recycling targets, and failing to efficiently manage waste. At the same time, the 2018 EU Early Warning Report for Cyprus, highlighted the biggest waste challenges, and proposed specific measures for improvement, which include the mandatory installation of PAYT schemes country-wide, the mandatory sorting of organic waste at source and its treatment, the installation of a landfill tax to incentivise the diversion of waste from landfilling, and other. However, in the midst of an economic crisis existing EU rules and obligation are often ignored by the institutions and new projects are approved with additional negative effects on ecosystems.

4.4 National Regulatory Framework

The Cypriot policy on waste management is based mainly on the well-known EU waste hierarchy (prevention, reuse, recycling, recovery, and disposal) and the correct environmental handling of waste. The aim is to protect the environment and human health. This is achieved through the reduction/elimination of the negative effects of the generation and management of waste, the promotion of reuse, recycling, and recovery and generally the environmentally sound management in order to reduce waste disposal in landfills and improve the use of resources by improving the efficiency and effectiveness of their use.

4.4.1 ΚΔΠ 562/2003

According to ΚΔΠ 562/2003, derived from Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste the targets are:

a) no later than June 15, 2010, landfill of biodegradable municipal waste should be reduced to 75% of the total by weight of biodegradable municipal waste generated in 1995, or the last year before 1995 for which standard Eurostat data are available;
b) no later than 15 June 2012, landfill of biodegradable municipal waste should be reduced to 50% of the total by weight of biodegradable municipal waste generated in 1995, or in the last year before 1995 for which standard Eurostat data are available; and
c) no later than 15 July 2016, landfill of biodegradable municipal waste should be reduced to 35% of the total by weight of biodegradable municipal waste generated in 1995 or the last year before 1995 for which standard Eurostat data are available;

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4.4.2 Municipal Waste Management Strategy 2015-2021

The waste management in Cyprus is based on the Waste Law of 2011 (L.185(I)/2011), a series of Regulations under the waste law and the Packaging and Packaging Waste Law of 2002 (L.32(I)/2002). The national legislation is derived from the EU relevant directives.

In accordance with article 28 of Directive 2008/98/EC (corresponding to article 35 of the Cyprus Waste Law L.185(I)/2011), Member States shall establish one or more waste management plans, which define the framework, directions, activities, procedures, and measures for the protection of the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste, using the EU waste hierarchy.

In the above context the Department of Environment has developed the 2012 Management Plan for Household and Similar Type of Waste which, after public consultation (2012) and new political decisions, was changed into the 2015-2021 Municipal Waste Management Plan. At the same time, a summary description of the Municipal Waste Management Plan entitled "Municipal Waste Management Strategy" was prepared for the period 2015-2021. The Strategy and Plan for municipal waste has been developed following wide consultation with all interested parties as well as consultation with the European Commission.

The main axes of the strategy, upon which the Plan is developed, are the following: compliance with the obligations arising from the European Directives on waste management, full utilization of existing private and State waste management infrastructure, maintaining the waste management hierarchy, with emphasis on prevention and sorting of waste and the adoption of best practices with the lowest cost.

Within this context, qualitative and quantitative objectives have been set. The main quantitative objectives are the following: (a) 40% separate collection of municipal solid waste by 2021, and 50% and 2027 (up from 20% in 2012), (b) 50% of recyclable materials (paper, plastic, metal, glass) in municipal waste to be prepared for reuse by 2020, (c) 15% of municipal organic waste to be collected separately by 2021, (d) the amount of biodegradable waste that is directed to landfilling, not to exceed 95,000 tonnes after processing (compared to 459,940 tonnes of waste that were sent to landfills in 2011) and (e) the achievement of the objectives of the European Directives on packaging waste, electrical and electronic equipment waste generated from the residential sector and other sources that are similar in type to those of the domestic sector and waste from household batteries and accumulators.

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According to estimates by the Cyprus Statistical Service, the total amount of municipal solid waste produced in Cyprus amounted to 547,000 tons in 2017 compared to 545,000 tons in 2016, recording a small increase of 0.36%.

Of the 521,000 tons managed in 2017, 79.5% ended up in landfills, 15.0% was separated for recycling, 2.0% was composted, 3.2% was used for backfilling and 0.3% was incinerated for energy recovery purposes.

To achieve the objectives and fulfil the obligations arising from the European Directives, it is imperative to obtain the active involvement of local authorities, the introduction of plans and programmes for the promotion of separate collection, the reduction of the volume and the recycling of municipal waste.

4.4.3 National Waste Prevention Programme

In accordance with Article 29 of Directive 2008/98 /EC (corresponding to article 36 of L.185(I)/2011) on waste, Member States (MS) shall establish waste prevention programmes not later than 12 December 2013. In these programmes, specific waste streams are targeted for prevention. The main objective of these programmes is to take measures to decouple economic growth from the environmental impact associated with the generation of waste.

In compliance with the above obligations, the Department of Environment of the Ministry of Agriculture, Rural Development and Environment has prepared an independent waste prevention Programme for the period 2015 – 2021, which addresses the requirements of article 29 of the Directive. The Waste Prevention Programme has been extensively discussed with all stakeholders and the European Commission. This programme among others, (a) establishes quality objectives which focus on changing the consumption patterns associated with the generation of waste, limiting the generation of certain waste streams, the promotion of re-use, the reduction of organic waste for landfilling and reducing the generation of hazardous municipal waste, (b) sets out the waste prevention measures for organic waste streams.

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5. Public Opinion Surveys

According to the analysis so far, there is international and EU data on the types and quantities of food produced and lost at various stages of the life - cycle, from production to consumption. There is also a clear picture of the damage caused both socially and economically by food waste. To a certain extent, some of the root causes of food waste that are related to public behaviours, are also known. However, we know less of the public opinion and the habits of people in Cyprus regarding food waste. To design an effective communication campaign, it is imperative to have a better baseline of the existing opinions and behaviours of people. At the same time, this baseline will serve as a base for the measurement of the effectiveness of the campaign to be deployed in the next months.

It is necessary to understand the extent of the food waste problem in Cyprus, the reasons causing it, the rates at which food waste is produced and where this happens most intensely. Understanding and recording any negative habits and mentalities of the public, as well as any possible disincentives for the proper food waste management is important and will be utilised for the design of an effective communication campaign with the aim to positively influence the public opinion and habits and facilitate the prevention and treatment of food waste.

To facilitate the design of the Life Footprint project baseline, two quantitative surveys were conducted during October and early November 2020. The main survey was based on structured questionnaires (Annex A) and a stratified sample of 554 people over the age of 18, run in the period 21 – 23 October 2020. The second, was a shorter online questionnaire (Annex C) via the Dias group websites with a larger sample (total 1828 participants, out of which 1104 with complete answers) and participation from other countries (Greece, UK, other).

5.1 Main Quantitative research (Oct 2020)

The main research covered 554 people aged 18 and over, who are either responsible for household shopping or household food preparation. The sample was focused to ensure that the feedback comes from people with good knowledge of the food production and food waste in the household. The methodology used was the Computer Aided Web Interviewing (CAWI) and the Sample was selected from a panel of participants in online surveys. The Data collection was between 21- 23/10/2020. The geographical distribution of the sample was proportional to the actual distribution of the population. The data was not weighted during processing. Details of the sample of the survey are found in Annex B.

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During the period of the project implementation, two more surveys are planned. One around the middle of the duration of the project, and one towards the end of the project. These two future surveys will be designed partially to investigated further issues relating to food waste but also to follow up on issues identified in the first survey to examine the impact of the project intervention on these parameters. The second survey, which can provide results of the impact of the campaign during the first months of the campaign, can potentially be used to fine tune and better target the messages. The last survey will serve as an overall evaluation of the impacts of the campaigns on the knowledge and beliefs of people. The intention is to structure the sample of these two surveys similarly to the first survey to facilitate the comparability of the data.

Some of the questions in the follow-up surveys, can be repeated in the second and third waves of the research of this project to measure potential changes in attitudes and behaviours of the public due to the project interventions and other exogenous influences. For example, the first wave has been performed during a period of lockdowns due to the COVID 19 pandemic, and hopefully the second and third wave will be executed after the pandemic is dealt with and life will return to normal for most people. This is expected to potentially influence the results and the second wave will be executed early in 2022 (March 2022) and the third early in 2023 (April 2023). Because of uncertainties in the evolution of the pandemic over the next months, the design of the questionnaires for the follow up surveys will be done later on and closer to the period of implementation of the surveys, to better reflect the conditions of each period.

The main results of the first wave of research and the derived conclusions are presented below.

Food purchase frequency

Half of consumers respond that they buy food 2-3 times a week. Two out of ten are more frequent buyers (daily, 4-5 times a week), while three out of ten are more sparse buyers (once a week). On average, each household goes shopping 2.5 times a week.

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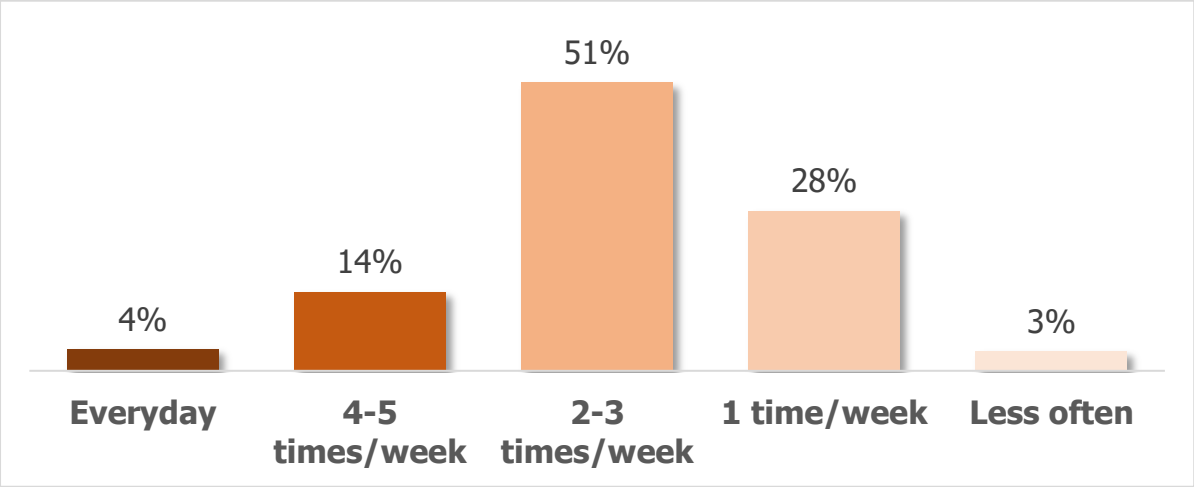

Figure 33: Food Purchase Frequency

Food preparation frequency

Half of the households cook daily, while three out of ten cook 4-5 times a week. More rarely (2-3 times a week) they cook two out of ten, while a low percentage (5.24%) cook once a week or less often. On average, each household cooks 5 times a week.

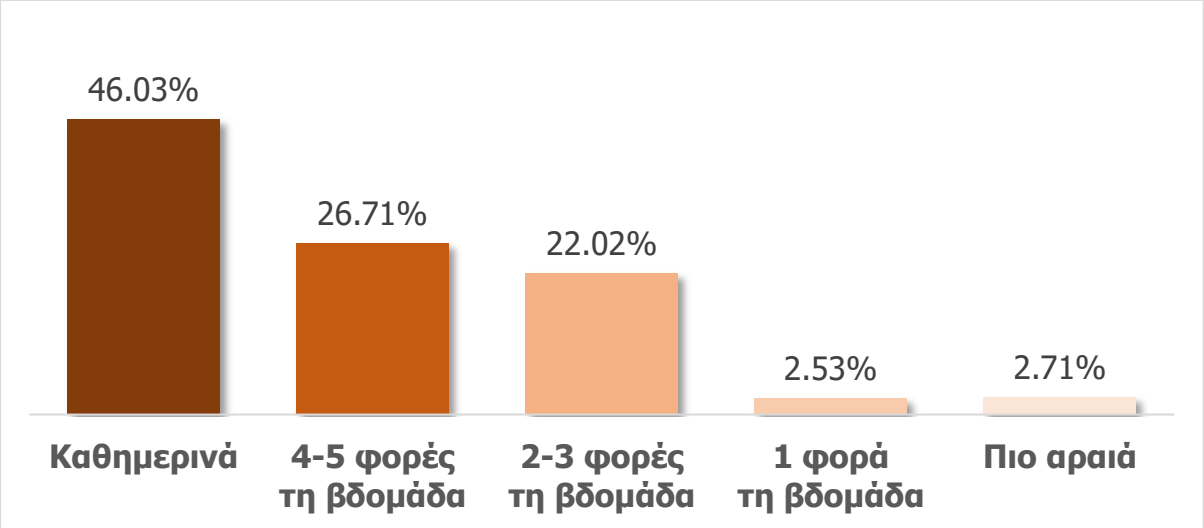

Figure 34: Food Preparation Frequency

Ready meals purchase frequency

A quarter of respondents are regular buyers of ready meals (2-3 times a week or more often), while a third buy ready meals on a weekly basis. The rest (42,6%) buy ready-made food more

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sparsely, 2-3 times a month once a week. On average, each household buys ready-made food 1.2 times a week.

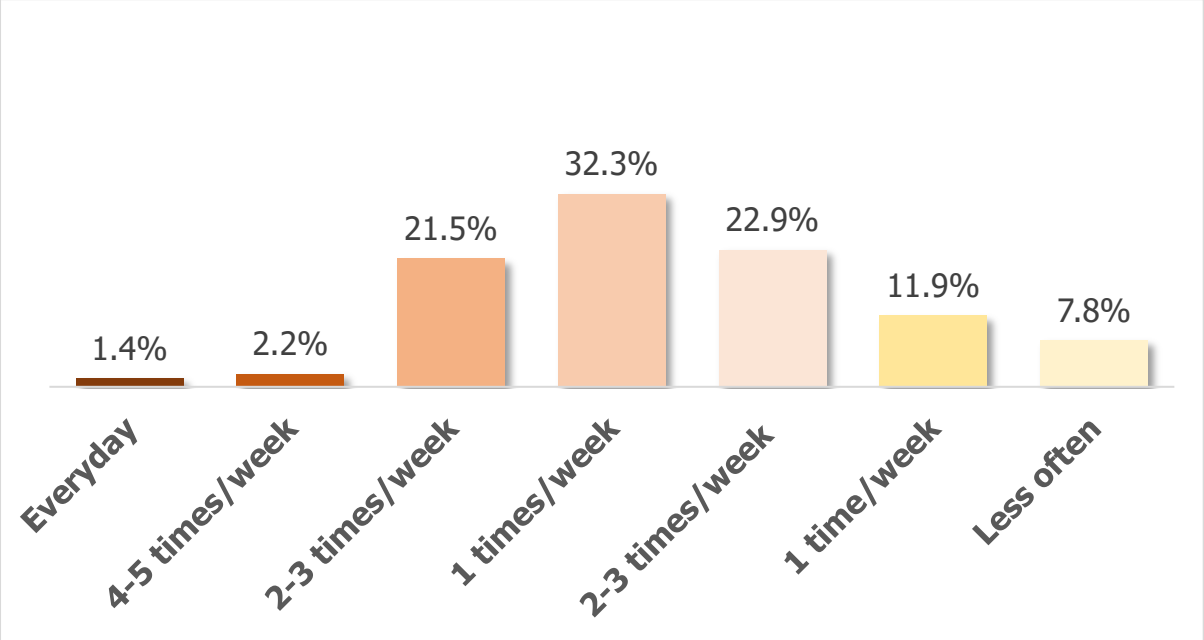

Figure 35: Ready Meals Purchase Frequency

Buying more food than needed

Seven out of ten consumers tend to buy more than the required quantities of food. This habit roots into issues of security. They want to maintain stocks in case of emergencies (40%) and be prepared for visitors at home (30%), while keeping enough food at home gives the feeling of security (29%). Other reasons for buying more than the required quantities are related to the different food preferences of family members (29%) and the inability to calculate the amount of food needed for the family.

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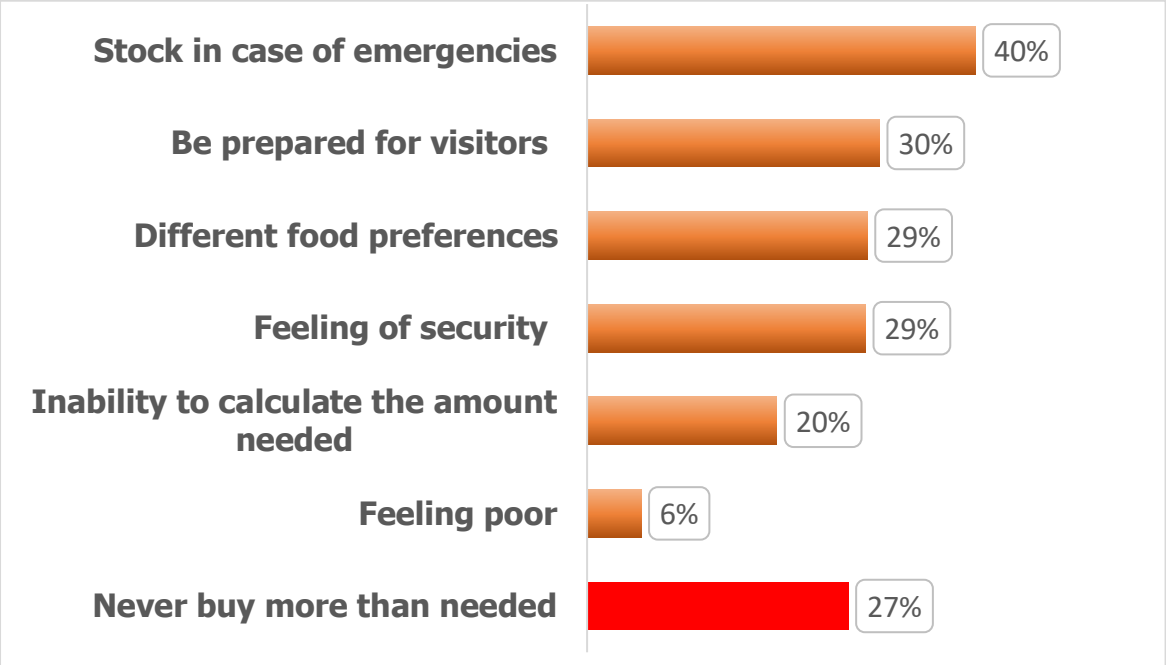

Figure 36: Buying more Food than Needed

Food surplus frequency

In most households, when food is prepared or ordered, there is a surplus of food that is not consumed. In two out of ten households this happens most of the time, while in almost seven out of ten, sometimes. Only 14,4% of households almost never have leftovers.

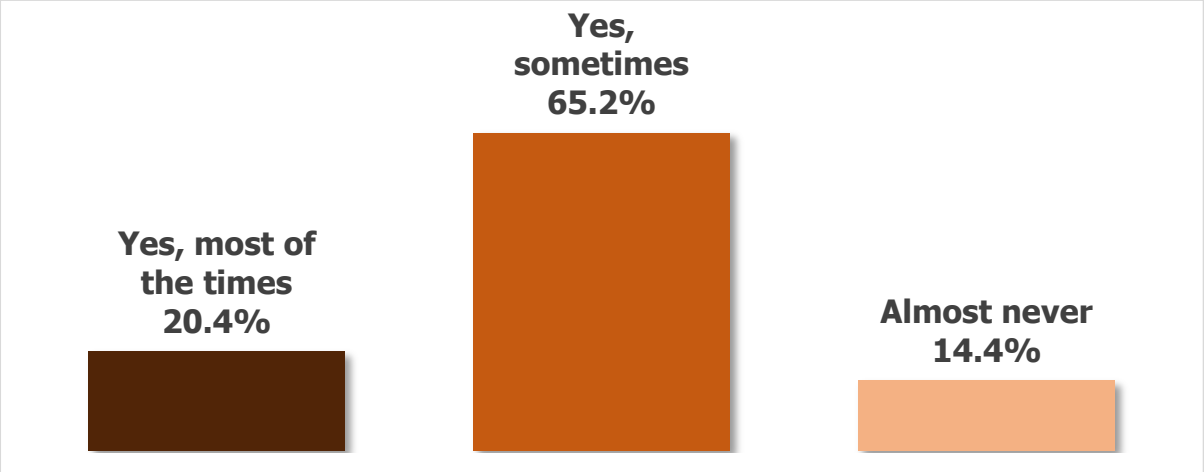

Figure 37: Food Surplus Frequency

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Surplus food management

Two-thirds consume surplus food in the following days, while one-third tend to give leftover food to pets. In rural areas, it is much more common to use food that is left over as livestock feed (33% in rural areas vs. 10% in urban areas).

One in six households, quite often or always throws surplus food in the trash. 22,93% keeps the surplus food that often / always occurs in the freezer, while 17.51 % uses it in the preparation of other foods. Of the various actions considered, the rarest action was using surplus food for composting (8,12%).

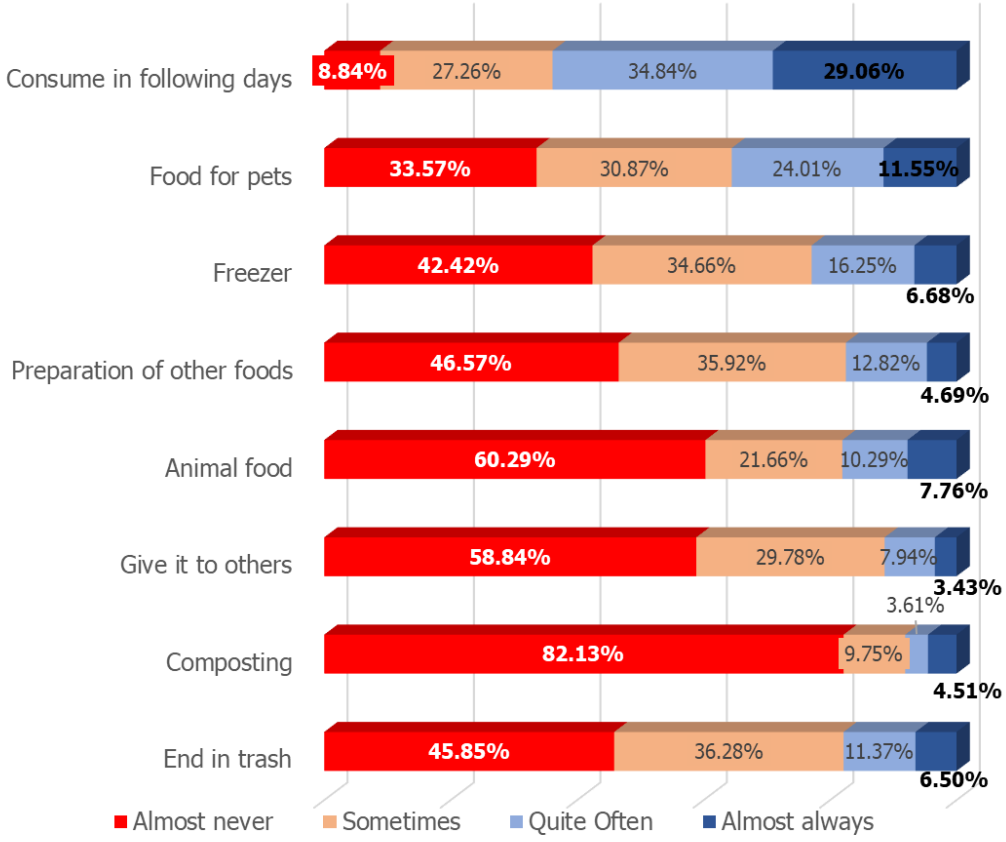

Figure 38: Surplus Food Management

Reasons to throw food away

Two-thirds of those who throw away surplus food, do so because they worry food is going to become inedible.

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Half of households that throw away food do so because family members do not want to eat it again: they always want it fresh (23%); family members do not like it (23%), it is not considered tasty (20%).

Other reasons that lead to throwing away surplus food, to a much lesser extent, though, are the lack of storage space 18% and the perception that its nutritional value is reduced (16%).

Almost two out of ten throw away food without any particular reason, mainly because this is how they are used.

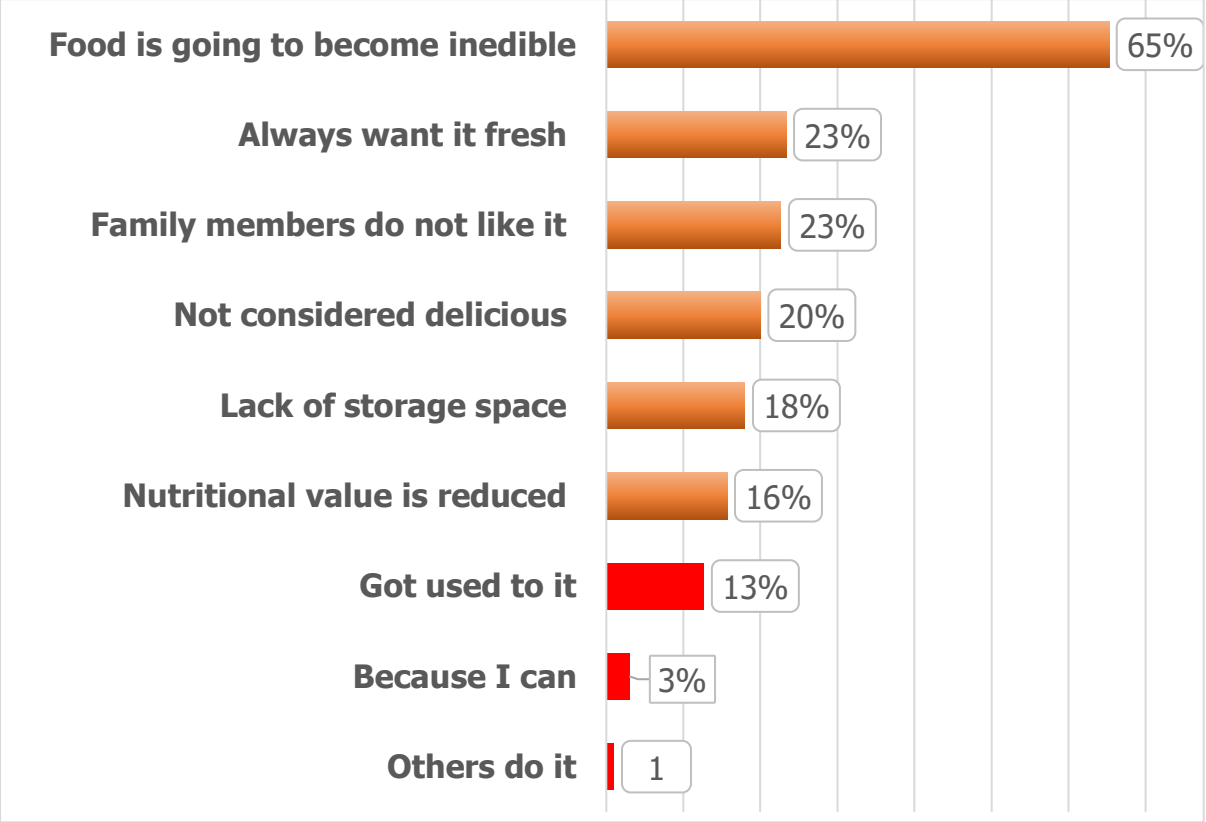

Figure 39: Reasons to Throw Food Away

Frequency of food waste generation by category

Vegetables and fruits are the food categories that are most often thrown away. 58,3% of consumers throw vegetables at least once a week, while the corresponding percentage for fruit is 52%.

Pasta and bakery items are thrown away at least once a week by 40,5%, meat by 36,1% and dairy by 31%.

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Fish and sweets are thrown away more rarely (respectively 16,8% and 25,3% at least once a week).

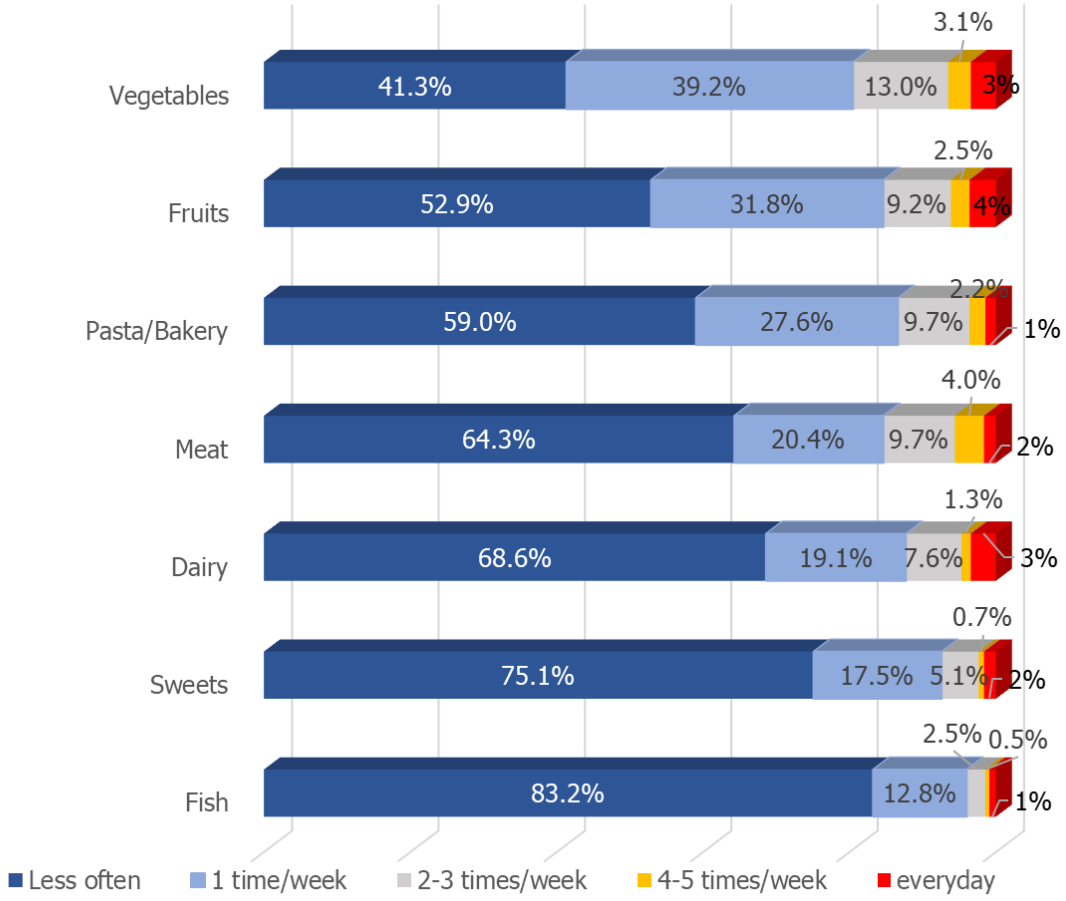

Figure 40: Frequency of Food Waste Generation by Category

Food waste generation reasons

The main reason that food waste is generated is because it is not consumed at the expected rate, which is reported to a much greater extent by all participants in the research. To a lesser extent, consumers report that they forget to consume food and that they buy more than they need.

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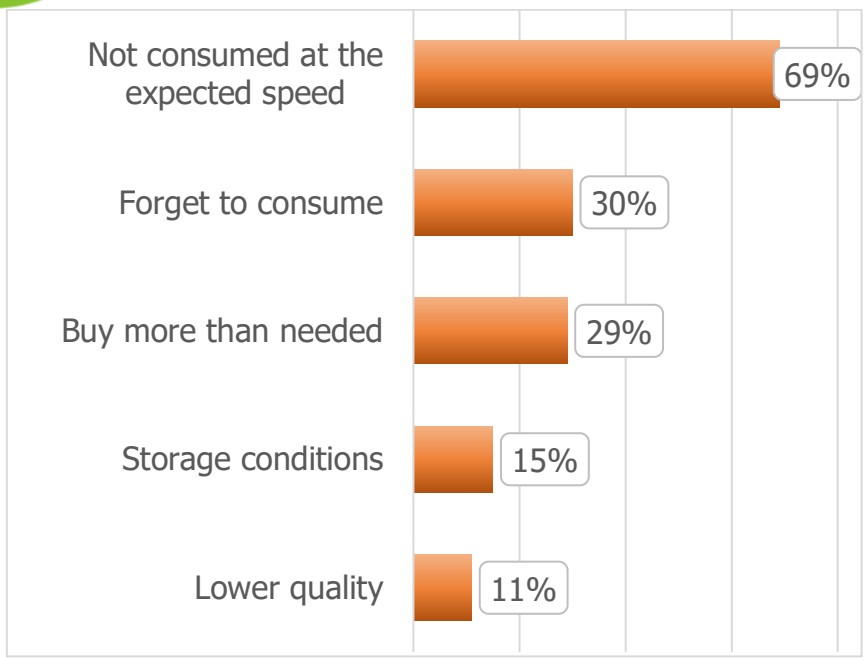

Figure 41: Food Waste Generation Reasons

Food waste management

Most consumers throw away the food they consider unsuitable for consumption (72%). Three out of ten give this food to pets, while to a much lower degree some report that they compost it.

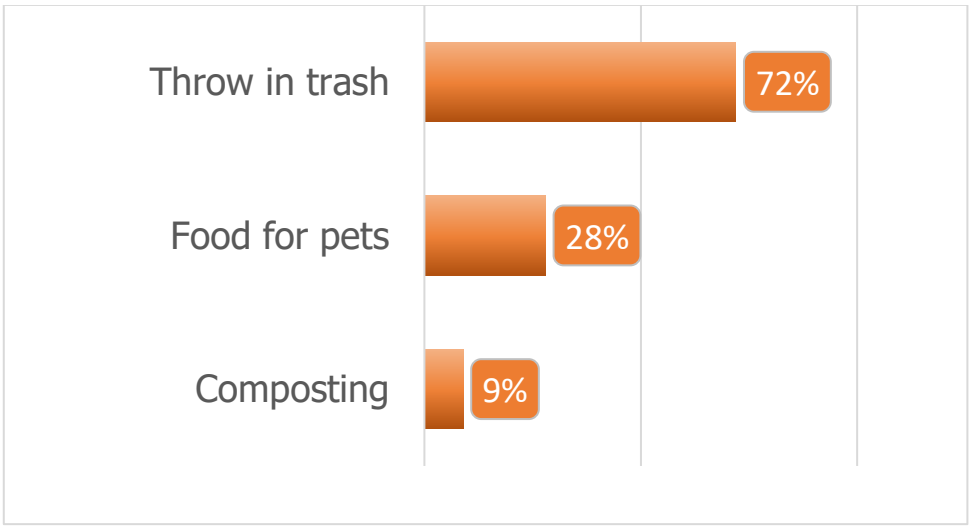

Figure 42: Food Waste Management

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Household food waste percentage

The majority of consumers (81,7%) state that they throw away 10% -30% of food they buy in a typical week. The average in the whole sample is 23%. That is, almost a quarter of the food purchased, ends up in the trash.

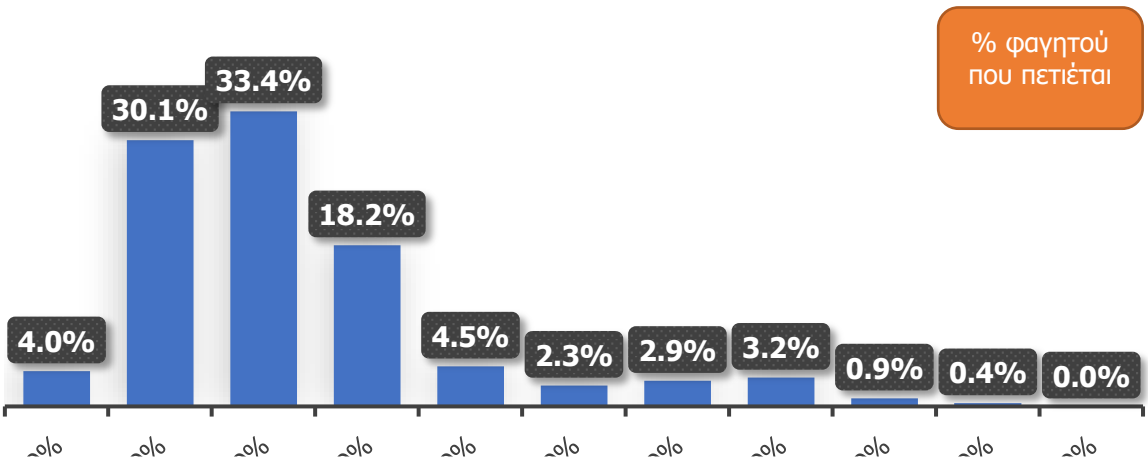

Figure 43: Household Food Waste per percentage

Reasons to throw food away

Consumers throw food in the trash mainly because the expiration date has passed (49%) and because they do not consider leftover food will be safe for consumption (31%).

Similarly, a quarter of consumers report throwing away food either because household members do not consume all of their food, or because they prepare more food than they need, or because they buy more than the household needs.

At the same time, two out of ten are forced to throw away fruits and vegetables due to improper storage.

Only one in ten consumers say they do not throw food away.

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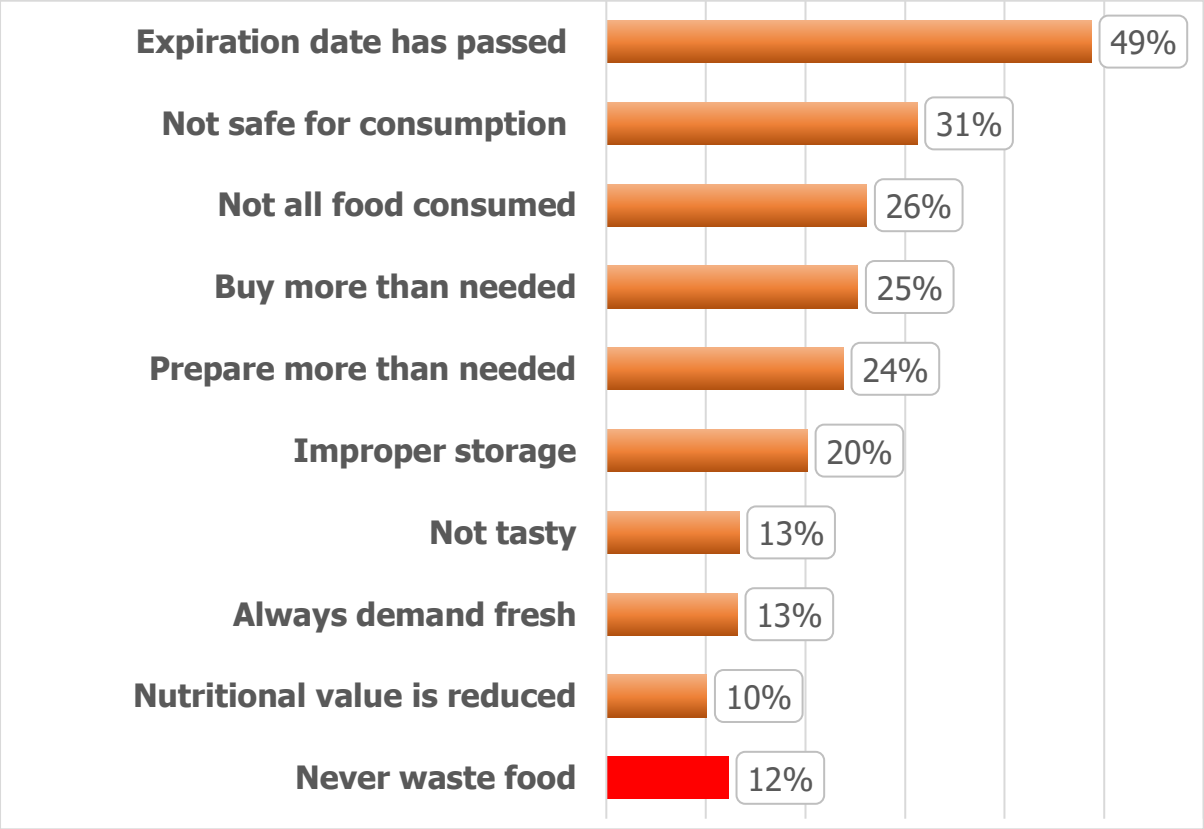

Figure 44: Reasons to Throw Food Away

Purchase and consumption food behavior

The most common consumer's behaviour referred regarding the purchase and consumption of food, is to check the expiration date of food, which is done by almost all consumers.

The following behaviours are also common, reported by 8-9 out of ten consumers:

- Check the food in the refrigerator before purchasing more
- Pay attention to proper food preservation
- Prepare a shopping list
- Cooking planning
- Consumption of surplus food in the following days

Behaviours involving 6-7 out of ten consumers:

- Cooking only the necessary amount
- Buy only what is needed
- Maintaining enough stocks at home

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- They do not throw away the old when they have fresh products

Less common behaviours mentioned by 4-5 out of ten consumers:

- They take with them the surplus food after eating out
- Use the leftovers to prepare other foods

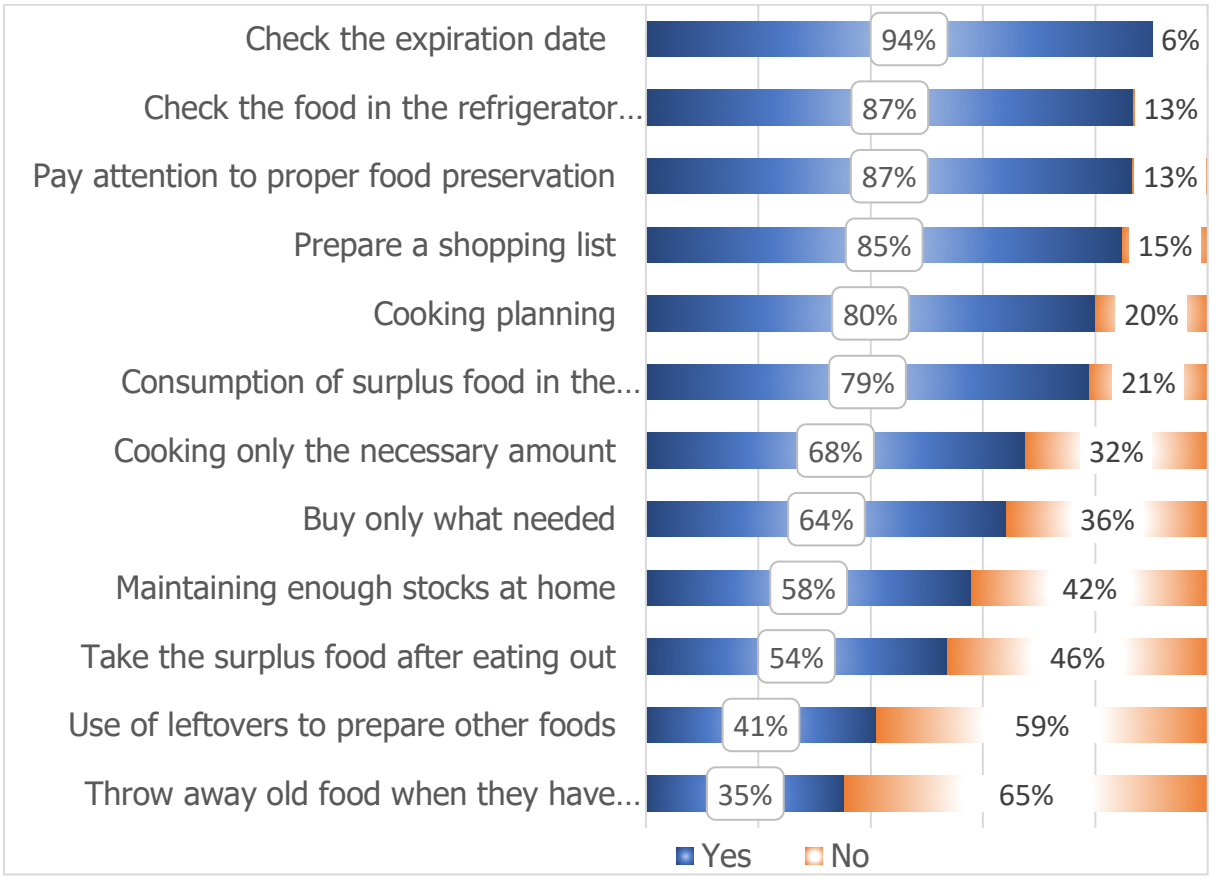

Figure 45: Purchase and Consumption of Food Waste

Feelings when wasting Food

The main feeling mentioned by consumers when they throw food away, is a feeling of guilt (56%) and secondly that of waste of money (46%). Environmental impact is the concerns of only three out of ten consumers. One out of ten is completely indifferent.

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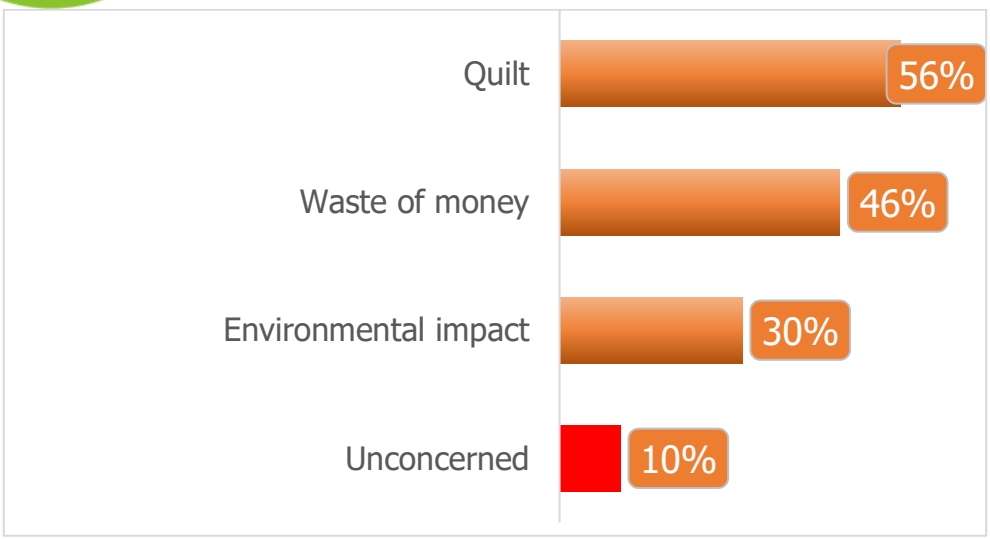

Figure 46: Feelings when Wasting Food

What consists of food waste? Public opinion

One of the aims of the research was to discover what consumers consider as food waste. Eight out of ten consumers understand food waste as leftover cooked food and expired cold cuts and cheese, while seven out of ten include spoiled fruits and vegetables in this category.

Peels from fruits and vegetables are considered food waste to a lesser extent (56%).

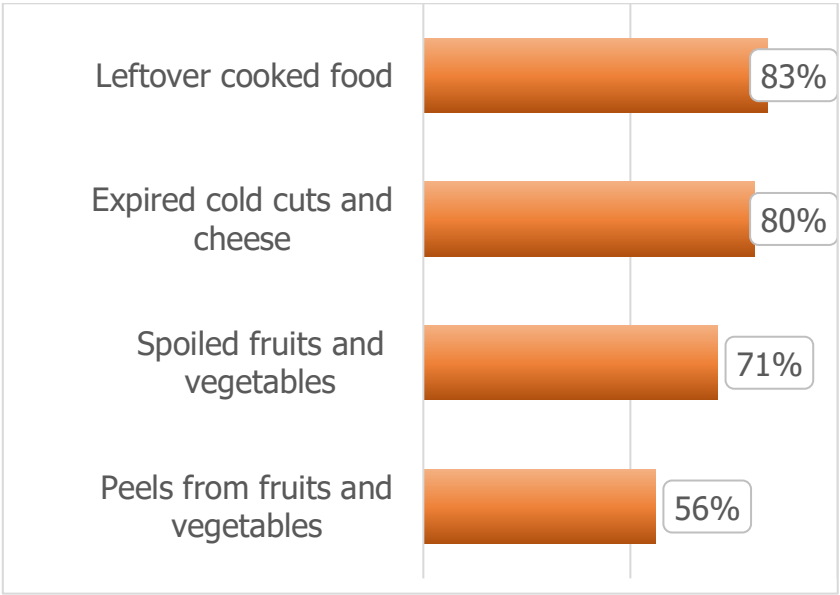

Figure 47: Food Waste Contents

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Summarized research Results

The main results of the research can be summarized as follows:

a) Based on cluster analysis, three main profiles of consumers can be derived:
   i. Consumers who order cooked food regularly and cook less (26% of population): younger people, men, upper social classes, more educated, living in cities and living alone
   ii. Consumers who cook often, and buy cooked food once a week (38% of population): people of age 35-44, women, middle social classes, living in cities, having kids
   iii. Consumers who cook daily and order cook food rarely (35% of population): people of age above 45, women from lower social classes and less educated. Also, highly represented in this group is people living alone and households with more than 5 people.

b) 73% consumers buy more than the necessary quantities of food, to keep stocks at home in case of need, to satisfy the preferences of different family members and to feel more secure.

c) 85% of consumers state that when preparing or ordering food there are leftovers. The most common uses of leftovers are to eat it in the next few days or to use it as pet food. Nevertheless, 17% always or quite often throw leftovers in the trash.

d) The main reasons why surplus food is thrown away, are food spoilage concerns and preferences for eating freshly prepared food.

e) The average household throws away 23% of its weekly purchases of food.

f) Among the categories of food purchased, vegetables and fruits are the items most often thrown in the trash.

g) The main reason that food is spoiled and wasted, are because it's not consumed at the rate expected and the expiration date passes.

h) The youngest people, the upper social classes, the group of people who shop more often and the group of people who order ready-made food more often throw more food in the trash.

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i) Regarding shopping, cooking, and eating habits: Almost all consumers mention that they check expiration dates, 8-9 out of 10 check what they have at home before shopping, make a list, watch how they store food, plan what to cook and eat leftovers at a later stage, 6-7 out of 10 buy and cook only the necessary quantities, keep enough supplies at home and do not throw away old products when they buy fresh, while 4-5 out of 10 take leftover food from eateries with them and use leftovers to prepare other meals.

j) When consumers throw food in the trash, they mostly feel guilty (56%) and that they wasted their money (46%). The feeling that this is not good for the environment is less important (30%).

k) Among the participants in the online survey: 65% agree that buying food with a longer shelf life is a very / quite important action for environmental protection (35% find it of limited importance), 79% agree that the subsequent consumption of food that remains after its use for the preparation of other foods is very / quite important action for the protection of the environment (21% find it of limited importance), 65% agree that composting is a very / quite important tool in the protection of the environment (35% find it of limited importance) , 63% agree that taking food left over from outings is a very important action to protect the environment (37% find it of limited importance).

5.2 Quantitative Online Poll via the Dias Media Group websites

In parallel to the main surveys that will be performed in three waves, during the duration of the project, additional web-surveys will be performed on a quarterly basis via the websites of Dias Group. These web-surveys will also serve two purposes. One is to further investigate issues that cannot be investigated in the main surveys due to the limitation of the number of questions (for a successful survey). They will give the project team the chance to investigate also potential lack of knowledge for parameters that are related to food waste. For this purpose, the questions for the first 5-6 surveys have been structured to do that. The second purpose of these surveys will be to see the impacts of the project interventions over time. Therefore, the questionnaires for the surveys following the first 5-6 surveys, will be more structured to evaluate progress over time in the knowledge and beliefs of people. The questions for the surveys that will follow the first 5-6 surveys will be prepared in due time and when there is a better knowledge of the conditions during that period of time.

This section presents the results of the first online survey conducted among visitors to DIAS Group websites (Sigmalive, Sportime.com.cy, I love Style, City.com.cy, Check In, Economy

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Today, MuCyprusTravel.com), between 5-9/11/2020. The survey was designed to complement the questions in the main survey, therefore enriching the findings of the baseline research

Using the Dias websites for the online poll, enabled the participation of people from Cyprus, but also from other countries. This allows the comparison of opinions and behaviours of people residing in different countries (Cyprus, Greece, UK, and EU).

Long shelf-life food products significance

Almost half of the participants in the online poll mention that buying food with a longer shelf life is a very important action for the protection of the environment (46%). In addition, 19% consider the purchase of food with a longer shelf life to be quite significant.

More than a third of respondents do not believe that buying food with a longer shelf life is important.

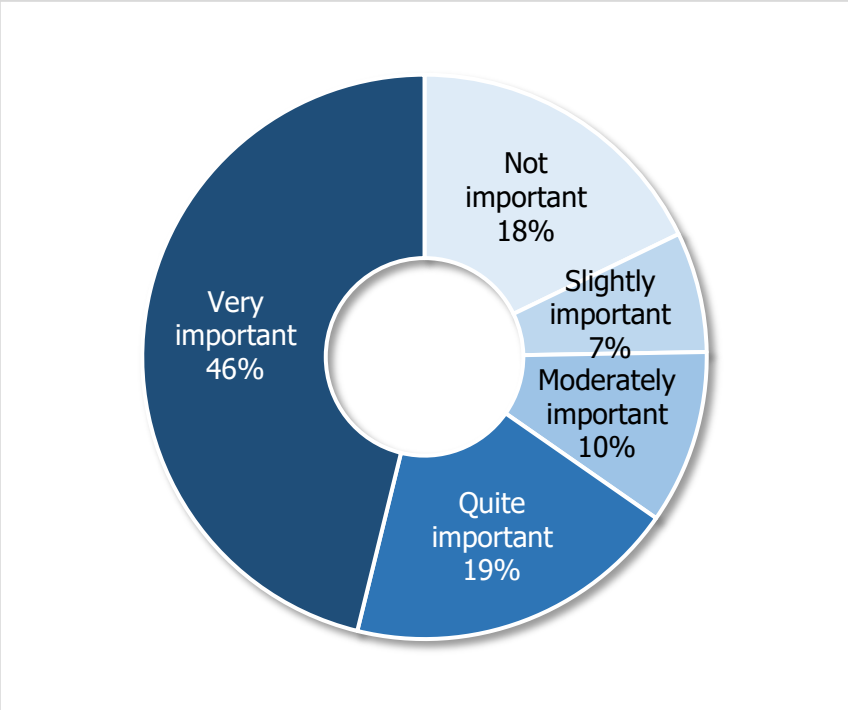

Figure 48: Long shelf-Life Food Products Significance

By comparison, respondents from Cyprus give more importance to food products with a longer shelf life for environmental protection (3.80) than participants from Greece (3.19) and participants from other EU countries and the UK (3.51).

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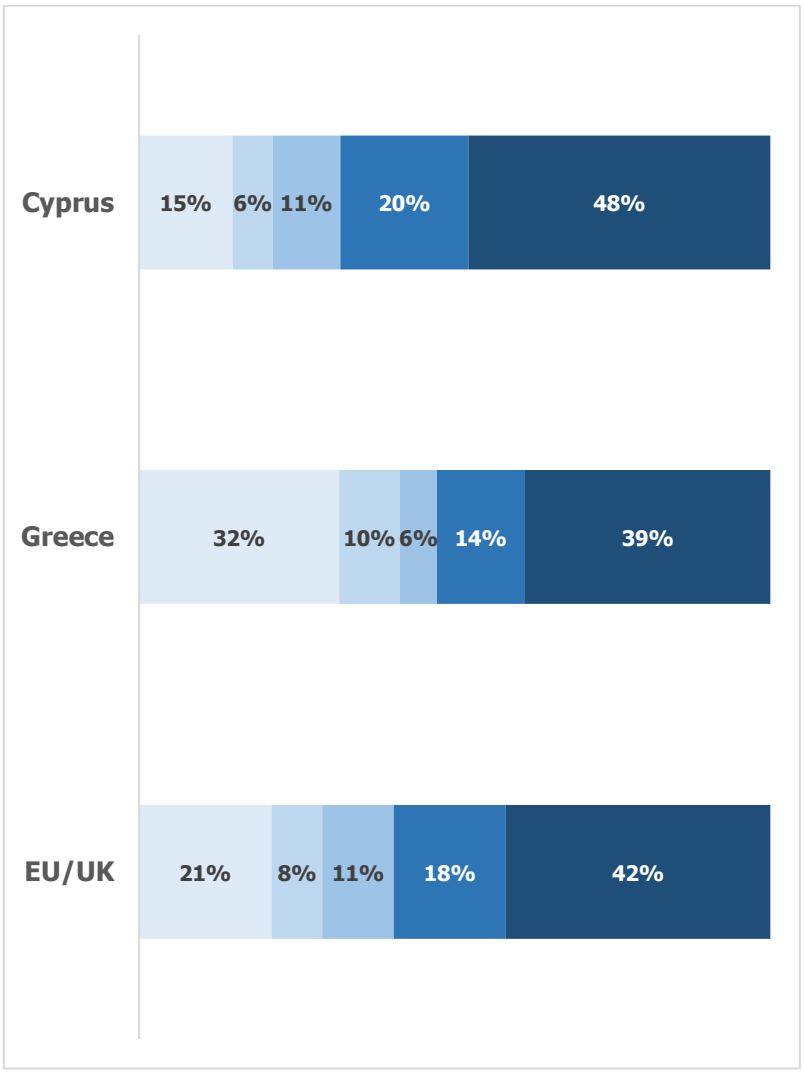

Figure 49: Differences for Long shelf-Life Food Products Significance per participants' origin

Importance of surplus food consumption

Nearly six out of ten participants agree that consuming leftover food and using it to prepare other foods is a very important action to protect the environment (57%), while an additional 22% consider this action to be quite important.

One fifth of the participants do not consider the subsequent consumption / use of food waste as a particularly important action to protect the environment.

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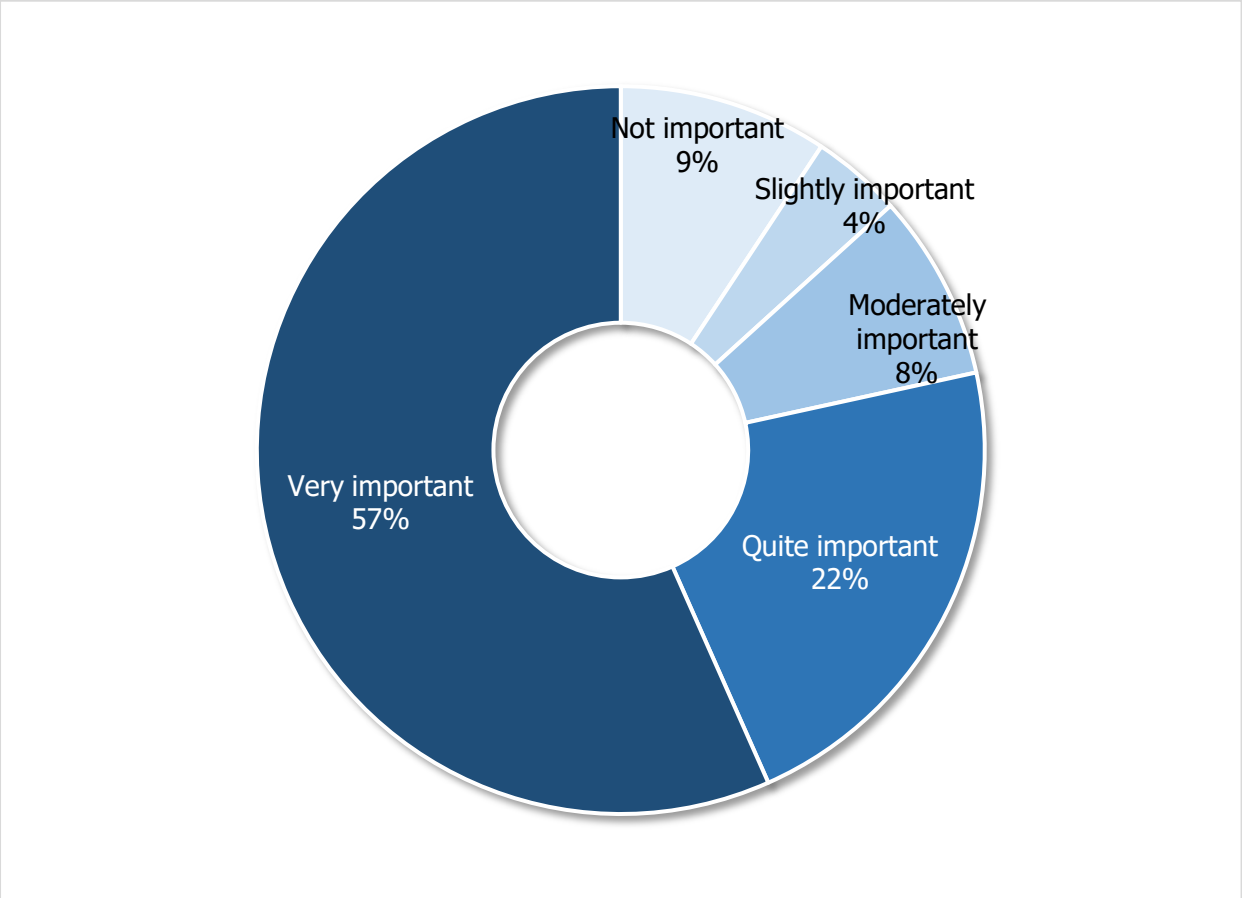

Figure 50: Importance of surplus food consumption

In comparison, the participants from Cyprus consider the subsequent consumption of surplus food and its use in the preparation of other foods as more important (4.21) than the participants from Greece (3.54) and less important than participants from other EU and UK countries (4.38).

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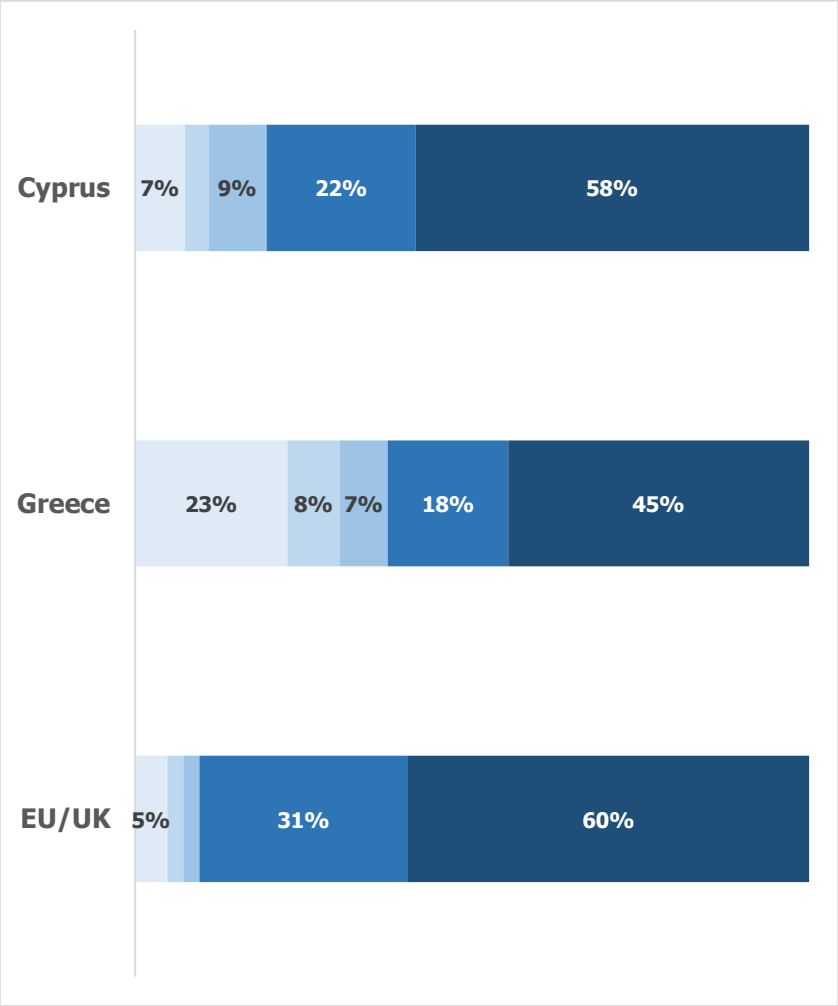

Figure 51: Differences in the Importance of surplus food consumption per participants' origin

Importance of composting

Four out of ten participants in the online poll, agree that composting is a very important tool in environmental protection (42%) and an additional 23% consider it quite important.

However, more than one third of the participants do not consider composting to be particularly important in protecting the environment (35%).

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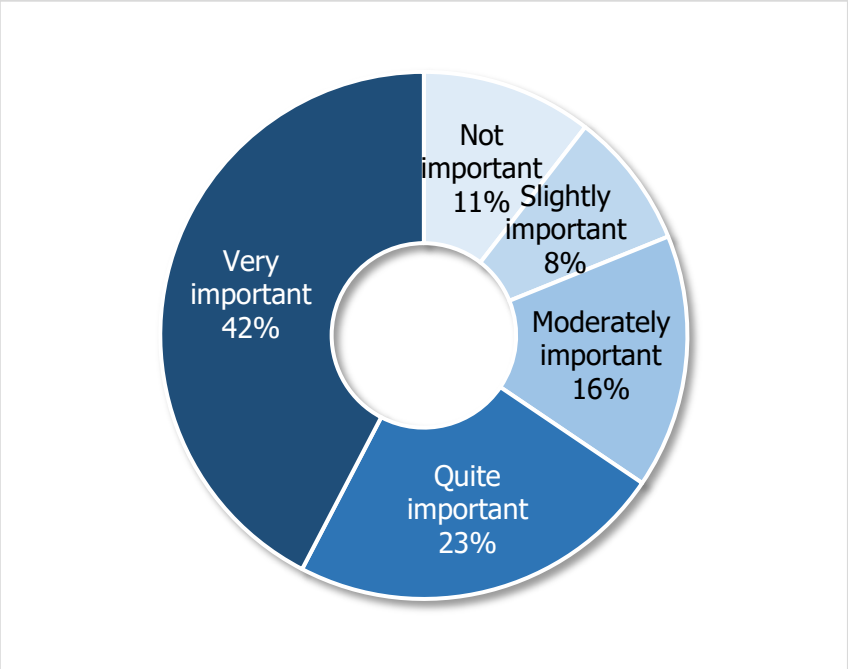

Figure 52: Importance of Composting for the protection of the Environment

In comparison, respondents from Cyprus place more importance on composting as an action for the protection of the environment (3.80) than participants from Greece (3.58), but less than participants from other EU countries and the UK (4.15).

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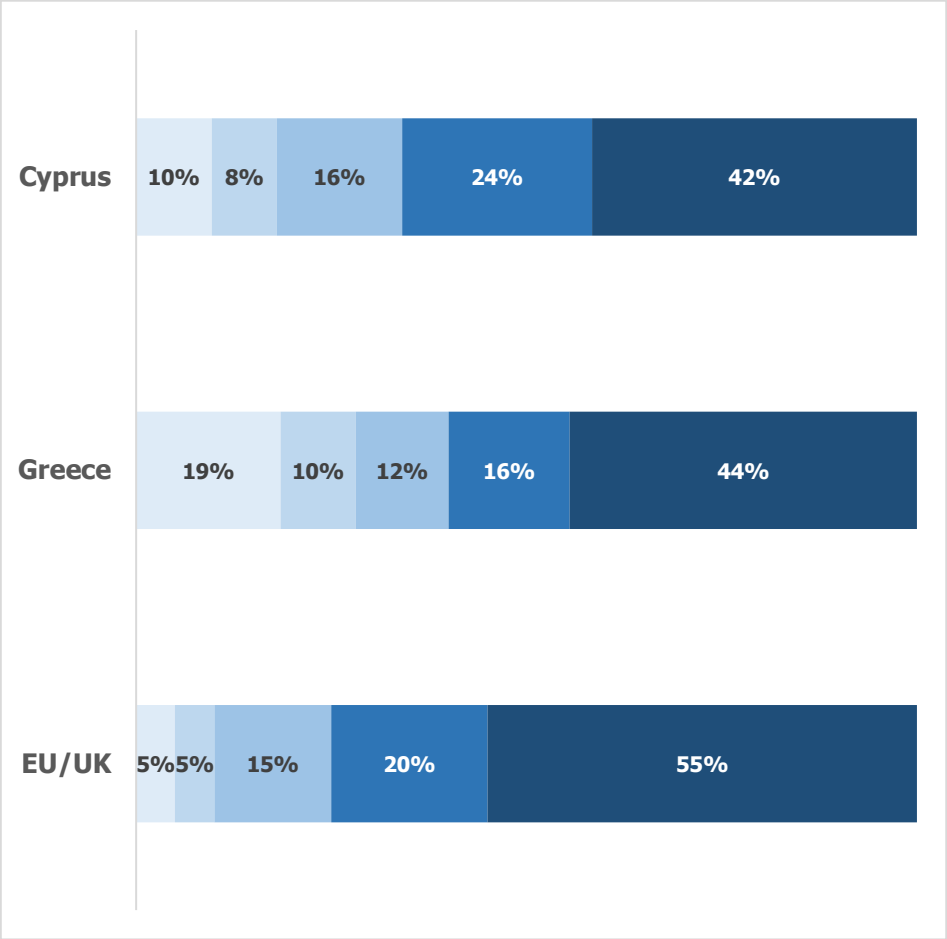

Figure 53: Importance of Composting for the protection of the Environment per participants' origin

Taking food leftover from outings

Almost four out of ten participants in the online poll agree that taking food leftover from outings is a very important action for the protection of the environment (38%), while 25% consider it a quite important action.

The percentage that does not consider it particularly important for the protection of the environment amounts to 38%.

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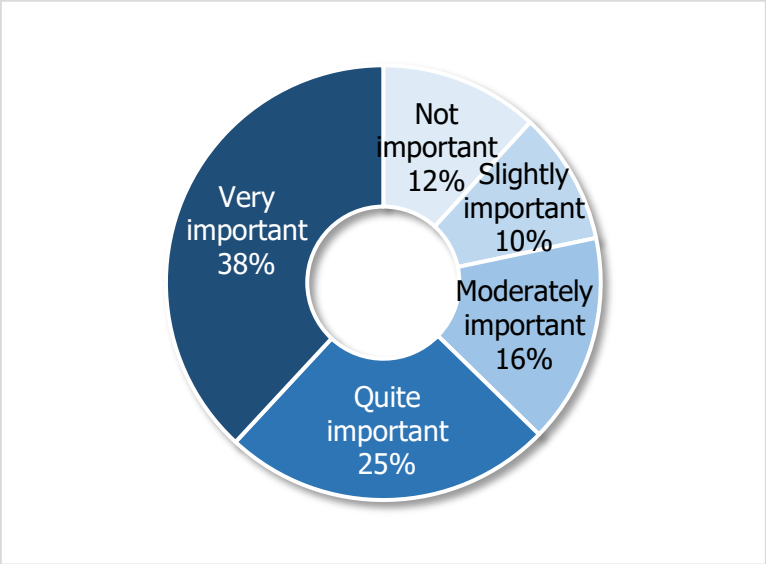

Figure 54: Importance of taking leftover from outings

In comparison, the people who participated in the survey from Cyprus attach more importance to getting a package of food leftover after eating out (3.70) than the participants from Greece (3.34), but less than participants from other EU countries and the UK (4.08).

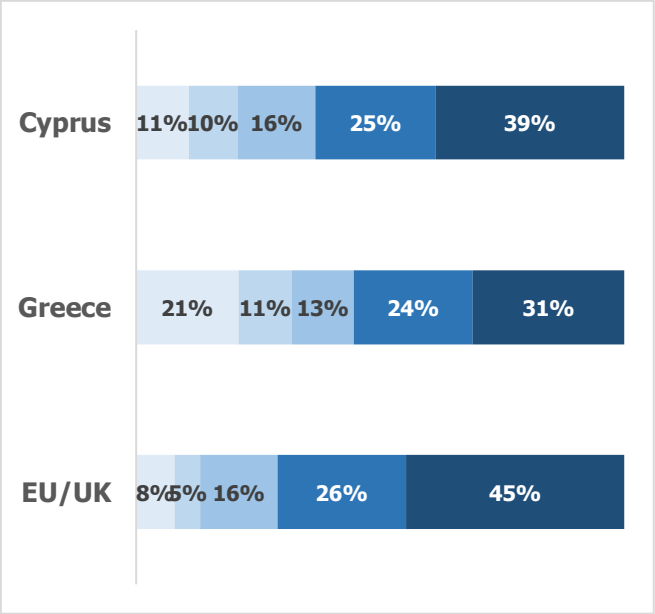

Figure 55: Differences in the Importance of taking leftover from outings per participants' origin

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Taking food leftover from outings (opinions Vs actions)

The next question was aimed to measuring deviations between claims of importance of taking food leftover from outings and the real behaviors. In the whole sample, only 25% always take food leftovers from outings, 25% do it quite often, 20% do it sometimes and 30% do it rarely or never.

The habit of taking food leftover from outings, is more common among those living in other EU countries and the United Kingdom than among those participated from Cyprus or Greece.

Among the participants from Cyprus, 18% consider it very important to take food that is left over after eating out but does not always do so. Among participants from Greece, it amounts to 16% and among participants from other EU countries and the UK it amounts to 14%.

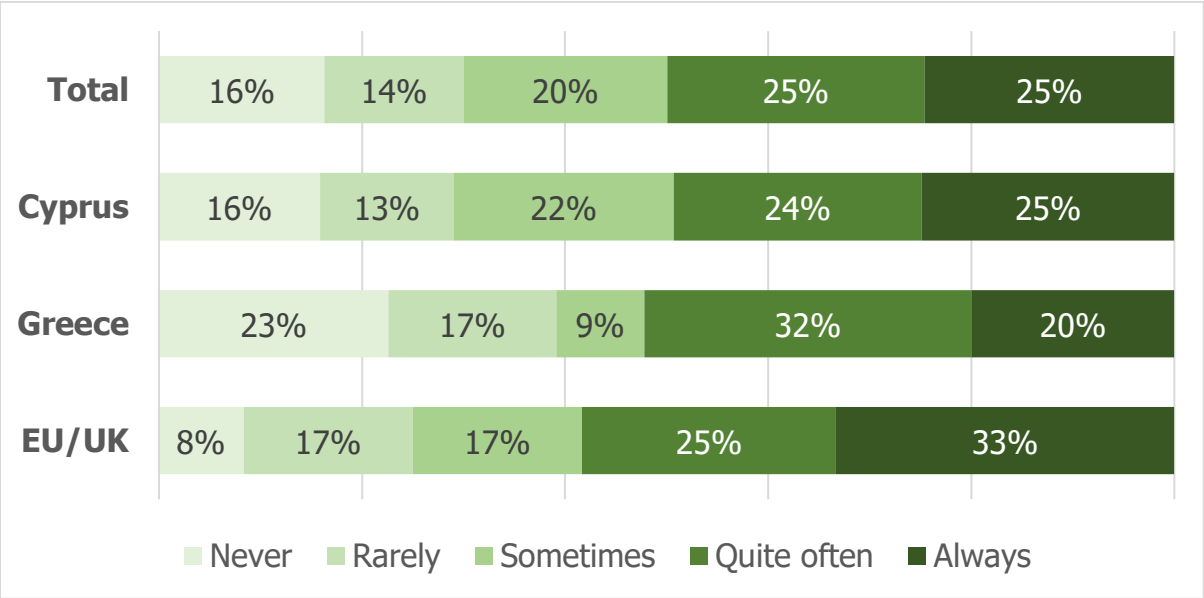

Figure 56: Taking Food Leftover from outings

Summarized Online Polls Results

Among the participants in the online poll, we observe the following:

- 65% agree that buying food with a longer shelf life is a very / quite important action for the protection of the environment (35% find it of limited importance).
- 79% agree that the subsequent consumption of leftover food and its use for the preparation of other foods is very / quite important energy for the protection of the environment (21% find it of limited importance).

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- 65% agree that composting is a very / quite important tool in the protection of the environment (35% find it of limited importance).
- 63% agree that taking food left over from outings is a very important action to protect the environment (37% find it of limited importance).

5.3 Overall Research Conclusions

As can be seen from the two surveys, **the vast majority of Cypriot consumers buy more than the necessary quantities of food on a regular basis**. This is done mainly for two reasons, to satisfy the different preferences of family members, and to maintain a sense of security and adequacy.

Even more, **the percentage that indicates that during every meal, there are leftovers is high**. In most cases they are consumed in the next few days, or given for pet food, but there are **many cases in which the extra food is simply thrown away**. This is the second challenge beyond the excessive food purchases. **The poor management of food stocks results in about one in four cases, to surplus food simply ending up in the trash.**

The **food types that are wasted the most are fruits and vegetables**. However, while meat and other products are classified lower in terms of quantities wasted, they are more harmful for the environment in terms of their GHG emissions.

The main reason for wasting food by consumers, is because they **do not consume it before the expiration date**, which means **poor planning of stocks**. This, coupled with the excessive purchase of food, also shows **limited knowledge of food storage and preservation techniques, and poor refrigeration and food management practices**.

Another point that deserves attention is that the **greatest contributors to food waste** are the **youngest people, the upper social classes, the people who shop more often and the people who more often order ready-made food**.

The results of the research also highlight some **contradictions between the answers**. While most consumers state that **they buy more and as a result throw more food away**, they also claim that they **carefully prepare a list before going for shopping, they pay special attention to the storage of food, they plan carefully what to cook and consume leftovers at a later stage**. So, they consider that they buy and cook only the necessary quantities and manage their food stocks in an effective way. However, if good planning of food purchasing and good food waste management was in place (as claimed) they shouldn't buy more than needed and they shouldn't throw too much food away. Obviously, there are **positive intentions to better**

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manage food, but to an extent this is not reflected in the actual behaviours of the consumers.

It is also importnat that **consumers do not consider the wasting of food as a serious environmental problem**. Instead, they feel **guilty when they waste food** (possibly because they throw food away while others are in need of food) and also that they **waste their money**. So **financial concerns and charity feelings prevail** when food is wasted, and **much less the environmental concerns**. Apparently, this is an outcome of the attention given so far to other types of waste (even in the EU), like plastics, packaging, WEEE, hazardous etc, creating an illusion that food waste is not a problem for the environment. The fact that food is organic waste that biodegrades in the environment to create compost, makes people believe that this being a natural process, is not harmful to the environment. This prevailing public opinion is most probably **a result of misinformation on the greenhouse gas emissions associated with the composting of organic waste**. It is also obvious that the focus on other waste streams so far, has left food waste low in the priority of citizens as a waste stream to be addressed. They see food waste mostly through an ethical and financial lense, and less as an environmental challenge.

Another important parameter that is derived from the online poll, is the small percentage of people that have a habit to take food left over during an outing. **The results demonstrate roughly that half of the participants do not or very seldomly take leftovers with them after an outing, a quarter of the left do it quite often and only a quarter always take food leftovers from outings.** This combined with the fact that the characteristic traditional Taverna or Restaurant in Cyprus competes with others on the size of its menu (Cyprus catering is well known for that), results in a lot of food wasted in each outing. Therefore, educating people to take leftovers from their outings and consume them, thereafter, is important in tackling food waste in Cyprus.

5.4 Tackling Food Waste

There are several outcomes of the research performed that provide grounds for the design of an effective communication campaign for the public to tackle the food waste issue. At the same time, the total quantities of food wasted and the contribution of the business and commercial sector to this waste are significant, which makes the interventions of this project in the business and commercial sector essential in the effort to tackle the problem of food waste. Taking into account that we speak for a touristic market that in normal times accepts 4 million tourists every year, each of which stays and consumes for a few days on the island, it is easy to appreciate the importance of changes in the food processing, catering and management of foods and left overs in this important sector.

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From the research, some issues are more striking and will be used to design an effective campaign for the public, the main of which are:

- People are wasting almost a third of the food they buy
- They buy more than needed and they throw much of that away (they do not manage it)
- The younger people waste more than older people
- More affluent consumers waste more
- Consumers buy more, mostly for security reasons (to feel safe)
- They do not consume at the same rate they buy (over-consumerism)
- Consumers are having difficulties to manage their food (freezing, storing etc.) and consequently they throw more food away
- More than 70% of people throw their food waste in the trash, and less than 10% compost it
- There is a fallacy that people plan their purchases and manage their food properly, but the actual behaviours do not support that
- There are good intentions to better manage food, but little real action to do so
- Consumers do not consider food waste a serious environmental problem
- Consumers feel guilty when they waste food (possibly because they throw food away while others need food) and also that they waste their money (financial and charity feelings prevail)
- There is poor utilisation of food expiration labelling
- There is poor knowledge or limited attention to methods to prevent food waste
- Most consumers do not have a consistent habit to take with them the leftovers from their outings, when it is common to have significant quantities of left-overs as by culture tavernas and restaurants tend to compete on the size of their menu
- Consumers are not used to share their food leftovers and instead they throw them in trash.

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Annexes

Annex A

Questionnaire for Survey 1

Στοιχεία επαφής:

Ώρα έναρξης		Ώρα λήξης		Διάρκεια	
Ημερομηνία		Μέρα			

Δευ.	Τρ.	Τετ.	Πεμ.	Παρ.	Σαβ.	Κυρ.
1	2	3	4	5	6	7

ΕΙΣΑΓΩΓΗ:
Καλημέρα / καλησπέρα. Αυτή την περίοδο κάνουμε μια έρευνα κοινής γνώμης για διάφορα θέματα που αφορούν τις συνήθειες αγοράς και χρήσης φαγητού στο σπίτι. Θα θέλαμε να συζητήσουμε για λίγο μαζί σας για να ακούσουμε και τις δικές σας απόψεις. Η επιλογή σας στο δείγμα έγινε εντελώς τυχαία και οι απαντήσεις σας θα παραμείνουν απολύτως εμπιστευτικές. Δεν θα πάρουμε πάνω από 10 λεπτά από τον χρόνο σας.

Φ1. Ξεκινώντας, θα ήθελα να σας ρωτήσω κατά πόσο συμμετέχετε στην αγορά τροφίμων (ψώνια) για το νοικοκυριό σας;

Ναι, Αποκλειστικά	1
Μοιράζομαι την ευθύνη με άλλο μέλος του νοικοκυριού	2
Δεν ασχολούμαι καθόλου	3

Φ2. Συμμετέχετε στην ετοιμασία του φαγητού στο νοικοκυριό σας

Ναι, Αποκλειστικά	1	
Μοιράζομαι την ευθύνη με άλλο μέλος του νοικοκυριού	2	
Δεν ασχολούμαι καθόλου	3	**ΕΑΝ Φ1=3 ΚΑΙ Φ2=3 ΤΕΡΜΑΤΙΣΤΕ ΣΥΝΕΝΤΕΥΞΗ**

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ΚΥΡΙΟ ΕΡΩΤΗΜΑΤΟΛΟΓΙΟ:

1. Πόσες φορές περίπου τη βδομάδα αγοράζετε τρόφιμα, φρούτα και λαχανικά στο νοικοκυριό σας;

Καθημερινά	1
4-5 φορές τη βδομάδα	2
2-3 φορές τη βδομάδα	3
1 φορά τη βδομάδα	4
Πιο αραιά	5

2. Πόσο συχνά εσείς ή κάποιο άλλο μέλος του νοικοκυριού σας μαγειρεύετε στο σπίτι για την οικογένεια σας;

Καθημερινά	1
4-5 φορές τη βδομάδα	2
2-3 φορές τη βδομάδα	3
1 φορά τη βδομάδα	4
Πιο αραιά	5

3. Πόσο συχνά αγοράζετε έτοιμο φαγητό για να το καταναλώσετε στο σπίτι;

Καθημερινά	1
4-5 φορές τη βδομάδα	2
2-3 φορές τη βδομάδα	3
1 φορά τη βδομάδα	4
2-3 φορές το μήνα	5
1 φορά το μήνα	6
Πιο αραιά	7

4. Όταν μαγειρεύετε στο σπίτι ή αγοράζετε έτοιμο φαγητό, μένουν υπολείμματα φαγητού;

Ναι τις περισσότερες φορές	1
Ναι, κάποιες φορές	2
Σχεδόν ποτέ	3

5. Πόσο συχνά κάνετε τα πιο κάτω σε σχέση με φαγητό που περισσεύει:
ΜΙΑ ΑΠΑΝΤΗΣΗ ΓΙΑ ΚΑΘΕ ΔΗΛΩΣΗ
RANDOMISE STATEMENTS.

	Σχεδόν πάντοτε	Αρκετά συχνά	Κάποιες φορές	Σχεδόν ποτέ
1. Το καταναλώνετε τις επόμενες μέρες	4	3	2	1
2. Το φυλάτε στην κατάψυξη για μελλοντική κατανάλωση	4	3	2	1
3. Το χρησιμοποιείτε για ετοιμασία άλλων φαγητών	4	3	2	1
4. Το δίδετε σε άλλα άτομα (φίλους, συγγενείς, ιδρύματα)	4	3	2	1
5. Το δίνετε για τροφή για κατοικίδια ζώα	4	3	2	1
6. Το πετάτε στα σκουπίδια	4	3	2	1

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7. Το κομποστοποιείτε	4	3	2	1
8. Το δίδετε για τροφή σε ζώα εκτροφής (κότες, πάπιες, κουνέλια (κτλ)	4	3	2	1

ΌΣΟΙ ΑΠΑΝΤΗΣΑΝ ΣΤΗΝ ΕΡ.5.6 (3 ,4, 2)

6. Για ποιους λόγους πετάτε συνήθως το φαγητό που περισσεύει;
ΣΗΜΕΙΩΣΤΕ ΟΣΑ ΙΣΧΥΟΥΝ.
RANDOMISE STATEMENTS.

Δεν είναι εύγεστο	1
Μειώνεται η θρεπτική αξία του φαγητού	2
Δεν αρέσει στα μέλη της οικογένειας	3
Ανησυχίες ότι μπορεί να χαλάσει/δεν είναι ασφαλές για κατανάλωση	4
Η οικογένεια επιθυμεί πάντοτε φρέσκο φαγητό	5
Από συνήθεια	6
Επειδή έτσι κάνουν όλοι	7
Επειδή μπορώ (δεν μου κοστίζει κάτι)	8
Περιορισμένος αποθηκευτικός χώρος	

7. Για κάθε μια από τις ακόλουθες κατηγορίες τροφίμων, θα ήθελα να υποδείξετε πόσο συχνά τυχαίνει να έχετε είδη τα οποία πετάτε στα σκουπίδια;
RANDOMISE STATEMENTS.

	Καθημερινά	4-5 φορές τη βδομάδα	2-3 φορές τη βδομάδα	1 φορά τη βδομάδα	Πιο αραιά
1. Φρούτα	5	4	3	2	1
2. Λαχανικά	5	4	3	2	1
3. Κρεατικά	5	4	3	2	1
4. Ψαρικά	5	4	3	2	1
5. Γαλακτοκομικά	5	4	3	2	1
6. Ζυμαρικά/αρτοσκευάσματα	5	4	3	2	1
7. Γλυκά	5	4	3	2	1

8. Ποιοι είναι οι πιο συχνοί λόγοι που αλλοιώνονται τα τρόφιμα, φρούτα και λαχανικά στο σπίτι σας;
ΣΗΜΕΙΩΣΤΕ ΟΣΑ ΙΣΧΥΟΥΝ.
RANDOMISE STATEMENTS.

Αγοράζουμε περισσότερα από ότι υπάρχει ανάγκη	1
Δεν τα καταναλώνουμε με την ταχύτητα που αναμένεται	2
Συνθήκες αποθήκευσης/φύλαξης τους	3
Ξεχνούμε να τα καταναλώσουμε	4
Είναι κατώτερης ποιότητας (π.χ. Β ή Γ), για οικονομικούς λόγους ή προσφοράς	5

9. Τι κάνετε με τα τρόφιμα, φρούτα και λαχανικά που κρίνετε ότι δεν είναι κατάλληλα για κατανάλωση;
ΣΗΜΕΙΩΣΤΕ ΟΣΑ ΙΣΧΥΟΥΝ.

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Τα πετάμε	1
Τα κομποστοποιούμε	2
Τα δίνουμε για κατανάλωση σε κατοικίδια ζώα	3

10. Σε μία τυπική/ συνηθισμένη εβδομάδα, εάν όλα τα τρόφιμα, φρούτα και λαχανικά που αγοράσατε αντιστοιχούν με 10 μονάδες, πόσα από αυτά πετάξατε στα σκουπίδια;
USE SLIDING SCALE FROM 0 TO 10.

11. Από τους ακόλουθους, ποιοι είναι οι 3 κυριότεροι λόγοι που πετάτε στα σκουπίδια τρόφιμα, φρούτα και λαχανικά στο νοικοκυριό σας;
ΣΗΜΕΙΩΣΤΕ ΜΕΧΡΙ 3 ΛΟΓΟΥΣ.
RANDOMISE STATEMENTS. ITEM 1 ALWAYS 1st AND CANNOT BE CODED WITH OTHER ITEMS

Δεν πετάμε φαγητά και τρόφιμα **(EXCLUSIVE ITEM)**	1
Κάποια μέλη του νοικοκυριού δεν καταναλώνουν όλο το φαγητό τους	2
Το φαγητό που περισσεύει και φυλάγεται δεν είναι εύγεστο μετά	3
Το φαγητό που περισσεύει και φυλάγεται χάνει από τη θρεπτική του αξία	4
Το φαγητό που περισσεύει και φυλάγεται χαλά και δεν είναι ασφαλές για κατανάλωση	5
Η οικογένεια επιθυμεί πάντα φρέσκα τρόφιμα, φρούτα, λαχανικά	6
Ετοιμάζεται περισσότερο φαγητό από ότι υπάρχει ανάγκη για κατανάλωση	7
Αγοράζονται περισσότερα από τις πραγματικές ανάγκες του νοικοκυριού	8
Περνά η ημερομηνία λήξης/κατανάλωσης	9
Τρόφιμα, φρούτα και λαχανικά δεν αποθηκεύονται ορθά και αλλοιώνονται	10

12. Εδώ είναι κάποιες ενέργειες σχετικά με την αγορά και κατανάλωση τροφίμων. Ποιες από αυτές κάνετε εσείς στο νοικοκυριό σας;
ΜΙΑ ΑΠΑΝΤΗΣΗ ΓΙΑ ΚΑΘΕ ΔΗΛΩΣΗ
RANDOMISE STATEMENTS.

	Ναι	Όχι
Ελέγχουμε τι έχουμε στο ψυγείο πριν αγοράσουμε κάτι	1	2
Κάνουμε λίστα για το τι χρειαζόμαστε πριν πάμε για αγορές	1	2
Προγραμματίζουμε τι θα μαγειρέψουμε	1	2
Αγοράζουμε μόνο ότι χρειαζόμαστε	1	2
Ελέγχουμε την ημερομηνία λήξης/κατανάλωσης	1	2
Προσέχουμε για το πως διατηρούμε/αποθηκεύουμε το φαγητό/τρόφιμα στο ψυγείο	1	2
Μαγειρεύουμε την ποσότητα που χρειαζόμαστε	1	2
Χρησιμοποιούμε τα υπολείμματα φαγητού για ετοιμασία άλλων φαγητών	1	2
Καταναλώνουμε το φαγητό που περισσεύει τις αμέσως επόμενες ημέρες	1	2

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Όταν έχουμε φρέσκα πετούμε τα παλιά	1	2
Μας αρέσει να διατηρούμε αρκετά αποθέματα στο σπίτι	1	2
Παίρνουμε μαζί μας το φαγητό που περισσεύει από εξόδους σε εστιατόρια	1	2

13. Για ποιους λόγους αγοράζετε περισσότερες από τις απαραίτητες ποσότητες τροφίμων και φαγητού;
ΣΗΜΕΙΩΣΤΕ ΟΣΑ ΙΣΧΥΟΥΝ.
RANDOMISE STATEMENTS. ITEM 1 ALWAYS 1st AND CANNOT BE CODED WITH OTHER ITEMS

Δεν αγοράζω περισσότερες από τις απαραίτητες ποσότητες **(EXCLUSIVE ITEM**	1
Νοιώθω ασφάλεια όταν υπάρχει πολύ φαγητό/τρόφιμα στο σπίτι	2
Θέλω να τηρώ αποθέματα σε περίπτωση που τύχει κάτι	3
Θέλω πάντα να είμαι προετοιμασμένος/η για επισκέπτες στο σπίτι	4
Δεν μπορώ να υπολογίσω τις ποσότητες που θα χρειαστώ	5
Δεν τρώνε όλα τα μέλη της οικογένειας το ίδιο φαγητό	6
Νοιώθω 'φτωχός' εάν δεν υπάρχει πολύ φαγητό σπίτι	7

14. Όταν απορρίπτετε στα σκουπίδια φαγητά και τρόφιμα αισθάνεστε:

Αδιαφορία/τίποτα	1
Ότι σπατάλησα άδικα τα χρήματα μου	2
Ότι κάνω ζημιά στο περιβάλλον	3

15. Εδώ είναι κάποιες κατηγορίες αποβλήτων. Θα θέλαμε την άποψη σας κατά πόσο η κάθε μια είναι απόβλητο φαγητού (food waste) ή άλλου είδους απόβλητο.
ΜΙΑ ΑΠΑΝΤΗΣΗ ΓΙΑ ΚΑΘΕ ΔΗΛΩΣΗ
RANDOMISE STATEMENTS.

	Απόβλητο φαγητού	Άλλου είδους απόβλητο
Μαγειρεμένο φαγητό που περισσεύει	1	2
Φλούδες από καθάρισμα λαχανικών και φρούτων	1	2
Χαλασμένα φρούτα και λαχανικά	1	2
Ληγμένα αλλαντικά και τυριά	1	2

ΔΗΜΟΓΡΑΦΙΚΑ:

S1. Φύλο

Άντρας	1
Γυναίκα	2

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S2. Ποια χρονολογία γεννηθήκατε;	..... Χρονολογία

S3. Επαρχία

Λευκωσία	1
Λεμεσός	2
Λάρνακα	3
Αμμόχωστος	4
Πάφος	5

S4. Περιοχή

Αστική	1
Αγροτική	2

S5. Υψηλότερο επίπεδο μόρφωσης που ολοκληρώσατε

Πρωτοβάθμια	1
Δευτεροβάθμια / τεχνική σχολή	2
Τριτοβάθμια (πτυχίο)	3
Τριτοβάθμια (μεταπτυχιακό)	4

S6. Ποια από τις ακόλουθες δηλώσεις περιγράφει καλύτερα την οικονομική κατάσταση του νοικοκυριού σας;

Άνετη ζωή, υπάρχουν πάντα χρήματα για απρογραμμάτιστες αγορές / έξοδα και ψυχαγωγία	1
Διατηρούμε ένα καλό βιοτικό επίπεδο, δεν στερούμαστε τίποτα	2
Σταθερό εισόδημα, αλλά με κάποιους περιορισμούς στα έξοδα	3
Κάποιοι περιορισμοί στο εισόδημα / οικονομικά, οι οποίοι έχουν επιβάλει κάποιες περικοπές	4
Πολύ δύσκολη οικονομική κατάσταση, είναι δύσκολο να τα βγάλουμε πέρα	5

S7. Σύνθεση νοικοκυριού

Ένα άτομο	1
Ζευγάρι χωρίς παιδιά	2
Ζευγάρι με παιδιά	3
Συγκατοίκηση με ενήλικες, μη-συγγενείς	4

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IF S7=3 OR 4

S8. Αριθμός μελών στο νοικοκυριό:

Αριθμός ανήλικων στο νοικοκυριό	
Αριθμός ενήλικων στο νοικοκυριό	

S9. Είδος οικίας

Σπίτι	1
Διαμέρισμα	2
Φοιτητική εστία	3

S10. Στην κατοικία σας διαθέτετε:

	Ναι	Όχι
Ψυγείο	1	2
Καταψύκτη	1	2
Κάδο κομποστοποίησης	1	2
Κάδους ανακύκλωσης	1	2

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Annex B

Details of the sample for Survey 1 (Main Quantitative research, Oct. 2020)

		No.	%
Age	18-24	59	11%
	25-34	131	24%
	35-44	111	20%
	45-54	103	19%
	55-64	98	18%
	65+	52	9%
Gender	Male	269	49%
	Female	285	51%
Social Class	A-B	25	5%
	C1	169	31%
	C2	239	43%
	D-E	121	22%
Education	Up to secondary education	149	27%
	Tertiary (degree graduate)	269	49%
	Tertiary (postgraduate)	136	25%
Province	Nicosia	213	38%
	Limassol	170	31%
	Larnaca	88	16%
	Famagusta	32	6%
	Pafos	51	9%
Area	Urban	421	76%
	Rural	133	24%
	Total	554	100%

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Annex C

Questionnaire for Survey 1 (Quantitative Online Poll via the Dias Media Group websites)

1. Συγκριτικά με άλλες ενέργειες που μπορείτε να κάνετε για προστασία του περιβάλλοντος, πόσο σημαντική θεωρείτε την μείωση των απορριμμάτων φαγητού μέσω της αγοράς τροφίμων με μεγαλύτερη διάρκεια ζωής;

Πολύ σημαντική	1
Αρκετά σημαντική	2
Κάπως σημαντική	3
Όχι και τόσο σημαντική	4
Καθόλου σημαντική	5

2. Συγκριτικά με άλλες ενέργειες που μπορείτε να κάνετε για προστασία του περιβάλλοντος, πόσο σημαντική θεωρείτε την κατανάλωση μαγειρεμένου φαγητού που σας έχει μείνει είτε αργότερα ή την επόμενη μέρα, ή τη χρήση του για ετοιμασία άλλων φαγητών;

Πολύ σημαντική	1
Αρκετά σημαντική	2
Κάπως σημαντική	3
Όχι και τόσο σημαντική	4
Καθόλου σημαντική	5

3. Συγκριτικά με άλλες ενέργειες που μπορείτε να κάνετε για προστασία του περιβάλλοντος, πόσο σημαντική θεωρείτε την μείωση των απορριμμάτων φαγητού μέσω της κομποστοποίησης;

Πολύ σημαντική	1
Αρκετά σημαντική	2
Κάπως σημαντική	3
Όχι και τόσο σημαντική	4
Καθόλου σημαντική	5

4. Συγκριτικά με άλλες ενέργειες που μπορείτε να κάνετε για προστασία του περιβάλλοντος, πόσο σημαντική θεωρείτε την μείωση των απορριμμάτων φαγητού με το να παίρνετε μαζί σας στο σπίτι φαγητό που περισσεύει από εξόδους σας σε εστιατόρια και καφέ;

Πάντα	1
Αρκετά συχνά	2
Κάποτε	3
Σπάνια	4

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Ποτέ	5

5. Κατά τις εξόδους σας σε εστιατόρια και καφέ, όταν περισσεύει φαγητό, πόσο συχνά το παίρνετε μαζί σας για κατανάλωση στο σπίτι;

Πάντα	1
Αρκετά συχνά	2
Κάποτε	3
Σπάνια	4
Ποτέ	5

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