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Subject:	COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT on measures addressing food waste to complete SWD (2014) 207 regarding the review of EU waste management targets - Accompanying the document

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Delegations will find attached document SWD(2014) 289 final - PART 2/4.

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Brussels, 23.9.2014  
SWD(2014) 289 final

PART 2/4

**COMMISSION STAFF WORKING DOCUMENT**

**IMPACT ASSESSMENT**

**ON MEASURES ADDRESSING FOOD WASTE TO COMPLETE SWD (2014) 207  
REGARDING THE REVIEW OF EU WASTE MANAGEMENT TARGETS**

*Accompanying the document*

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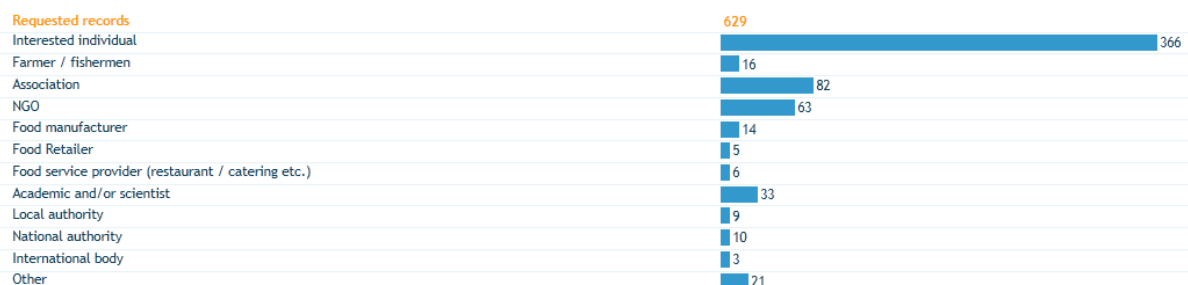
### **Annex 1 - Timing of the Development of this impact assessment**

<b>April – September 2012</b>	Establishment of the steering group; identification and evaluation of the available evidence base; first series of hearings of experts and interested parties; problem identification and framing of a diagnosis; commissioning of thematic papers.
<b>October 2012 – June 2013</b>	Hearings of actors involved in initiatives on food sustainability; drafting of thematic contributions; design of the thematic options; preparation of the public consultation and Impact Assessment skeleton.
<b>July – September 2013</b>	Launch of the consultation; discussion and finalisation of intermediate simulation results, analytical notes and thematic papers.
<b>September - October 2013</b>	Analysis of stakeholders' contributions; clarifying actors' positions towards the objectives; complementary hearings; design of the strategy's architecture; finalising the thematic actions; revising of objectives; articulating the evidence base according to the options; designing the monitoring framework; completing the annexes of the IA report; drafting the IA synthesis report.
<b>November - December 2013</b>	Finalising and submitting the IA to the IAB.

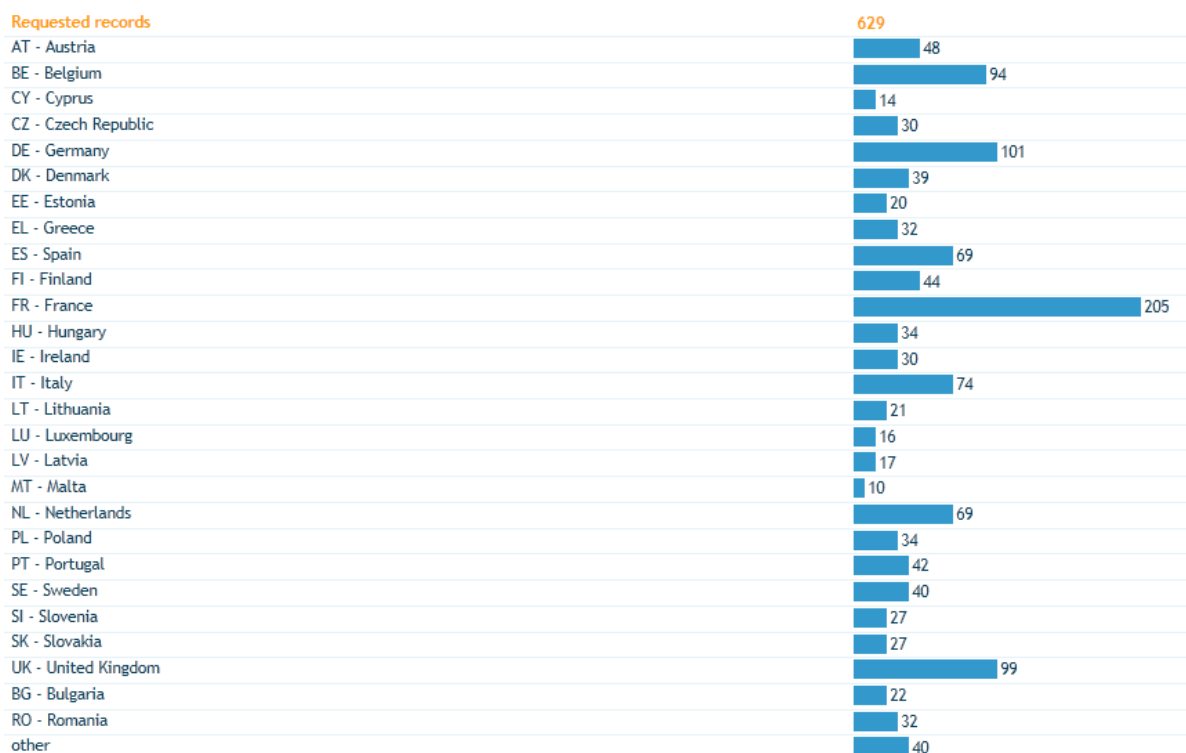
## Annex 2 - Summary of public consultation results

### Introduction

The public consultation received 629 responses, broken down as shown in the following chart:



27 Member States responded, with a least 10 responses each. The highest number of responses came from France, with 205, followed by Germany (105), United Kingdom (99) and Belgium (94).



87% of respondents considered themselves very well, or fairly well informed about the subject of sustainable production and consumption of food.

85% considered it important to have an agreed definition of sustainable food, but only 41% used a specific definition or criteria to guide their work.

A broad range of issues were considered as falling within the scope of a strategy on the sustainability of the food system, with the most frequently selected issue being biodiversity and natural habitats, at 84%. Over 70% of respondents also supported inclusion of climate

change, water scarcity, toxic emission to air and water, soil degradation and food security, closely followed by fair trade and animal welfare. The least frequently selected issues were economic growth and competitiveness of the EU food sector, with less than 30% support.

Climate change	485	(77.1%)
Biodiversity and natural habitats	528	(83.9%)
Water scarcity	517	(82.2%)
Toxic emission to air and water (nitrogen / phosphorus)	511	(81.2%)
Soil degradation	514	(81.7%)
Food security (which means a combination of 'food availability' - having available sufficient quantities of food on a consistent basis, and 'food access' - having sufficient resources, both economic and physical, to obtain the appropriate foods for a nutritious diet.)	491	(78.1%)
Food price stability / impact of excessive food price volatility	374	(59.5%)
Employment	313	(49.8%)
Economic growth	164	(26.1%)
Competitiveness of the EU food sector	185	(29.4%)
Obesity and related chronic diseases prevention	334	(53.1%)
Malnutrition and under-nutrition	365	(58%)
Animal welfare	425	(67.6%)
Fair trade	438	(69.6%)
Other	133	(21.1%)

This pattern was broadly speaking consistent across those groups responding, although professional associations placed competitiveness of the EU food sector much higher in their rankings, only just behind the top environmental issues in terms of importance, and placed health issues as the least relevant.

The *European Public Health Alliance* summed up the argument against considering economic growth and competitiveness in the definition of sustainable food: *"The European Commission's list of items identified to (possibly) fall within the scope of a strategy on the sustainable food system is quite extensive and we do consider all of them to be explored – except for 'competitiveness of the EU food sector' and 'economic growth'. We do not see place for a drive towards greater competition and growth measured in GDP-terms in a strategy for sustainable food system because it is unsustainable, unrealistic and irresponsible to pursue endless growth on a finite planet with finite natural resources. Far too often competitiveness is a substitution practice for 'cheap' food production through externalised long-term social and health costs."*

By contrast the Tesco producer network felt that economic sustainability should be a priority: *"Our producers also say that the focus should lie with economic sustainability and food security: food price stability or the avoidance of price volatility. "*

UNEP offered a simple definition of a sustainable food system as: *"...systems that enable the production of sufficient, nutritious food in an affordable way while conserving the natural resources and ecosystems that food systems depend on and lowering its environmental impacts."*

### **On food waste**

Taking actions to tackle food waste were strongly supported by the public consultation, particularly at EU and national level.

UNEP stated simply that: *"By reducing food loss and waste, the overall availability of safe and nutritious food for human consumption is improved and the pressure on our ecosystems decreased."*

Of the actions presented in the public consultation, some were considered to be more national than EU competence, but in a majority of cases there was support for the EU to take a leading role. The table below shows the actions proposed and the most favoured lead actor/s.

Action	Who should lead action? (most favoured)
a. Develop/disseminate consumer information on avoiding over-purchasing.	EU/national
b. Develop/disseminate consumer information on the meaning of food date labels. ('best-before', 'use-by', 'sell-by').	EU
c. Develop/disseminate consumer information on better storage of food.	National
d. Develop/disseminate consumer information on more sustainable food preparation and use of leftovers.	National
e. Establish new education campaigns on food waste prevention aimed at children.	EU/national
f. Establish new education campaigns on food waste prevention aimed at adults.	EU/national
g. Facilitate the exchange of good practices on food waste prevention and reduction activities at all levels: producers, retailers as well as local, regional and national authorities.	EU
h. Clarify the EU VAT Directive for donation of surplus food to food banks for Member States and businesses.	EU
i. Encourage best-practice in relation to food date labels by food business operators to minimise wastage.	EU
j. Develop EU Food Donation Guidelines for food donors and food banks on how to comply with the EU Food Hygiene legislation.	EU
k. Agree a common EU definition of food waste, classifying products as food, feed or waste etc. as appropriate.	EU
l. Develop a standardised methodology for collecting and reporting data on food waste to ensure data comparability across Member States.	EU
m. Introduce reporting requirements on food waste.	EU
n. Set binding targets for food waste prevention.	EU

Looking at all groups other than 'interested individuals', actions 'a' and 'c-f' (that focus on development and dissemination of information materials and establishment of education campaigns), are overwhelmingly considered as the responsibility of national governments.

For those actions considered to be principally EU competence, (b, g-n) the following results are seen by grouping, in terms of actions were considered to be 'very' or 'fairly' effective:

	<div style="border: 1px solid black; padding: 2px; text-align: center;">% of sector that selected actions as 'very' or 'fairly' effective</div>								
Action	Individual responses (366)	Production and agriculture (40)	Manufacturing (38)	Wholesale and Retail (17)	Consumer organisations (12)	Nature, animal welfare and health (41)	Packaging (4)	Governmental (14)	Redistribution (3)
b. Develop/disseminate consumer information on the meaning of food date labels. ('best-before', 'use-by', 'sell-by').	83	85	95	77	92	73	75	93	100
g. Facilitate the exchange of good practices on food waste prevention and reduction activities at all levels: producers, retailers as well as local, regional and national authorities.	87	93	92	100	92	88	100	100	100
h. Clarify the EU VAT Directive for donation of surplus food to food banks for Member States and businesses.	75	62	74	88	58	66	50	64	100
i. Encourage best-practice in relation to food date labels by food business operators to minimise wastage.	79	74	79	82	92	76	50	93	100
j. Develop EU Food Donation Guidelines for food donors and food banks on how to comply with the EU Food Hygiene legislation.	58	67	67	82	67	56	67	71	100
k. Agree a common EU definition of food waste, classifying products as food, feed or waste etc. as appropriate.	50	69	84	88	67	65	100	86	100
l. Develop a standardised methodology for collecting and reporting data on food waste to ensure data comparability across Member States.	52	61	84	71	83	68	67	86	100
m. Introduce reporting requirements on food waste.	50	41	36	29	83	80	33	79	100
n. Set binding targets for food waste prevention.	55	40	26	24	83	83	0	86	100

From these results the following observations can be made in terms of opinions on EU led actions:



Actions focusing on disseminating information on the mean of food labels, and exchanging good practices, (b. and g.) are very strongly supported by all groups, with the latter being the most favoured option in all but one case.

Proposals for actions to introduce reporting requirements and to set binding targets split the groups opinions, with individual responders and food chain industry representatives, in general placing these as their least favoured options, and with consumer organisations, nature, animal welfare and health groups, redistribution and governmental representations being much more in favour of these options.

By group:

**Individual responders** strongly supported actions on providing better information on date labels, promoting exchange of good practices and clarifying VAT rules, but were less convinced on setting definitions, methodologies and targets on food waste, with only around half considering these as fairly or very effective measures.

The **Production and agriculture** sector very strongly supportive of better information on date labels and promoting exchange of good practices, but were much less convinced on the introduction of reporting requirements or binding targets, with only around 40% marking these down as fairly or very effective. 69% of respondents in this sector did, however, feel that agreeing a common EU definition of food waste would be effective.

The **Manufacturing** sector also very strongly supportive of better information on date labels and promoting exchange of good practices, but were even less convinced on the introduction of reporting requirements or binding targets, with only 36% and 26% respectively marking these down as fairly or very effective. They were very supportive, however of the option of agreeing a common EU definition of food waste and developing a standard measurement methodology.

**Wholesale and Retail** strongly supported all actions other than the introduction of reporting requirements or binding targets, for which only 29% and 24% respectively of respondents considered these as fairly or very effective.

The **packaging** sector respondents were very strongly supportive of better information on date labels, promoting exchange of good practices and on setting a standard definition, but only 33% and 0% supporting a common EU definition of food waste and developing a standard measurement methodology.

**Consumer organisations** very strongly supported better information on date labels *and* promoting exchange of good practices and development of methodology, introduction of reporting requirements and binding targets, with the latter three actions considered effective by 83 % of those responding.

In a similar way, **nature, animal welfare and health** associations put promoting exchange of good practices, alongside the introduction of reporting requirements and binding targets as their favoured options, with 83% supporting the setting of binding targets and 80% the introduction of reporting requirements.

Those **governmental representations** responding were strongly in favour of almost all options, very strongly favouring better information on date labels, promoting exchange of good practices and also setting definitions, methods and targets, all consider fairly or very effective by 86% of respondents.

The **redistribution** sector, while not represented in the survey in great numbers, was very strongly supportive on actions to prevent food waste across the board.

Below are some of the highlights coming from the consultation:

**The Swedish Environmental Protection Agency** have developed consumer information on how to reduce food waste that summarises well the basic messages that need to form part of a food waste prevention campaign:

- *Plan your food purchases and don't buy more than you need.*

- *Use food before it spoils – keep track of what you have in the refrigerator, including those hard to reach spots way in the back.*

- *Store food properly:*

- *Put fresh meat, fish, dairy products and other chilled goods in the refrigerator as soon as possible. Keep your refrigerator at around 4-5° C.*

- *Most fruits and vegetables last longer in the refrigerator. If you want to keep fruit in a fruit bowl on the coffee table, be sure to use them as soon as possible.*

- *Freeze any items that you want to keep for an extended period of time – set your freezer at around -18° C.*

- *Don't throw food away just because the best-before date has passed; many items are just fine for a long time after that. Look, smell and taste any items that you think might be spoiling, and trust your senses. If you have stored an item according to the instructions, it will still be safe to eat even after the best-before date.*

- *Be creative with leftovers - prepare a smorgasbord, use them in a new recipe or freeze them."*

**Tesco pointed out that:** *"According to the Waste Resource Action Programme confusion around on pack date labels and storage guidance is a major contributing factor to household waste and our own research supported these findings. "*

**The Belgian Government made an important point that:** *"Food donation and food waste prevention should be seen as 2 separate policies : the donation cannot depend on the bad management of food systems." And that on definitions it is "important to set a definition which was understandable for all stakeholders and which contained the distinction between food losses and unavoidable secondary fluxes (like peels and seeds). The cascade of value retention must be taken into account meaning the priority for reuse must go to food and feed, a second lead are materials and chemicals, and energy at an even later stage."*

**The Swedish Environmental Protection Agency stated that** *"Sweden is developing a proposal for national targets for prevention of food waste as a part of the Swedish Environmental Objectives system. The environmental quality objectives describe what quality and state of the environment are sustainable in the long term. As a part of this work we are identifying the most cost effective measures and policy instrument to prevent food waste in the whole value chain. "*

*"One of the environmental targets regarding waste management on a national level in Sweden is to reduce the amount of food waste by 20 percent from 2010 until 2015."*

**Ministry of Economic Affairs Netherlands:** *"Food waste should be a major topic of the Communication. It is vital that we reduce food loss. The Netherlands urges the Commission to investigate whether more products that keep and retain their quality for a long time can be exempted from the requirement to state a date of minimum durability on the label (extension of Annex X of EU Regulation 1169/2011)."*

*A sound interpretation of figures on food waste, uniformity of methodology (as in the FUSIONS project) and transparency throughout the entire food value chain are prerequisites for targeted action. For some time now, the Netherlands has been attempting to identify the scale of food waste. The Commission and the member states must create a climate in which it is a matter of course for companies to reveal their food waste statistics. The Commission could use current research programmes, such as FUSIONS, to encourage companies to monitor food waste throughout the value chain."*

**The NGO Food & Water Europe:** *"The Commission can assist with clarifying or rewriting regulations then ensuring they are enforced. Educational campaigns are probably best placed as locally as possible to ensure they make sense to local recipients and meet local needs and preferences."*

**WWF:** *"Set binding targets for food waste prevention. Food waste or rather the "overproduction" of food waste is a massive problem, which could, if properly addressed, reduce the pressure on the environment significantly. By setting binding targets for all actors along the food chain a reduction of waste would be guaranteed, more than when only opting for voluntary measures."*

*Also, introduce reporting requirements on food waste: It is unclear how much food waste is produced. Reporting requirements would not only allow for a better overview but as well for a better control of the industry sectors. The reporting requirements would as well provide the necessary data to determine binding targets on food waste"*

**The European Organization for Packaging and the Environment:** *"Packaging's positive role in protecting food and thereby preventing food waste should be taken into account in all EU and national waste and packaging-related policies. Simply reducing packaging is not always desirable because the likelihood of food spoilage arising increases as packaging is reduced and/or compromised, and the product is no longer adequately protected. Eventually a point is reached at which the negative environmental impact of food waste outweighs the environmental benefits of using less packaging material."*

**Food Ethics Council:** *"We of course need action across all of these areas, and this action needs to be properly, strategically joined-up. We would especially stress the proven efficacy of binding targets."*

**SLOW FOOD:** *"Agree a common EU definition of food waste and food losses– why? Because all other actions need to be built on a clear definition of food waste and losses. Based on this definition, measures can be determined concerning the re-use of food for human or animal consumption or for energy purposes. The definition should not encourage"*

*increasing market price for food waste, which would create an incentive for further food waste (e.g. for biofuels production).*

*Review/simplify the standardization of products for the EU market– why? It would reduce food loss at the post-harvest stage with immediate results.*

*Actions a.b.c.d.e.f – why? To enable consumers to make informed choices about food purchase and consumption with immediate results."*

**Unilever:** *"First of all those action that are in the remit of the Commission should be prioritised, i.e. formulating definition, defining validated methodologies and European guidelines. All other initiatives should be undertaken by stakeholders, i.e. Industry, Retail, Associations and Organisations with support of the Commission where possible."*

**Merseyside Recycling and Waste Authority:** *"It is important that a consistent approach towards definitions and calculation methods is achieved across the EU before any new EU waste targets, including food waste prevention, are set. Without consistency, there is a risk of setting legal targets based on inconsistent data, loose definitions and a lack of justification in terms of securing value for money environmental benefit."*

**Last Minute Market:** *"All these actions are equally important. It would important to set targets at National and European level (see the European Resolution on Food Waste), but also to involve citizens in the fight against food waste."*

**Copa-Cogeca:** *"A high priority should be given to the development of education programmes well targeted to various groups of consumers in order to achieve long-lasting behavioural changes. They could be backed by an EU wide coordinated education campaign in order to further raise awareness. It is also very important to agree on a common terminology and ensure that this concept once determined can be defined and applied evenly all across Europe. We would like to stress our position against any attempt to reduce the level of food safety standards (food and feed safety, animal health and welfare...) or product quality standards in force: these standards should not be considered as elements of constraint as such but rather as necessary safeguards."*

## Annex 3 - The problem of food system sustainability

### A. Global perspective

The production and consumption of food is essential to life and plays a pivotal role in society and the global economy. Global food production and consumption depends on natural resources (e.g. water, land) and ecosystem services (e.g. biodiversity, climate). However, almost all recent meta-analyses lead to the conclusion the resource management in the food system is currently unsustainable, depleting the natural resources and undermining the ecosystem services on which it depends.

The leading advisory committee on the future of agriculture, made up of experts from EU Member States, (The EU Standing Committee on Agriculture Research (SCAR)) concluded in their latest report that:

***Many of today's food production systems compromise the capacity of Earth to produce food in the future. Globally, and in many regions including Europe, food production is exceeding environmental limits or is close to doing so. Nitrogen synthesis exceeds the planetary boundary by factor of four and phosphorus use has reached the planetary boundary. Land use change and land degradation, and the dependence on fossil energy contribute about one-fourth of Greenhouse Gas emissions. Agriculture, including fisheries, is the single largest driver of biodiversity loss. Regionally, water extracted by irrigation exceeds the replenishment of the resource.***

***Price volatility, access restrictions and the interconnectedness of global commodity markets, as well as the increasing vulnerability of food production systems to climate change and loss of agro-biodiversity, will make food even more inaccessible for the poor in the future.***

In their assessment of the environmental impacts of production and consumption the UNEP International Resource Panel concludes that agriculture and food consumption are among the most important drivers of environmental pressure<sup>1</sup>. The sector is one of the leading causes of land-use change (and subsequent biodiversity loss), climate change, water scarcity/pollution and soil degradation, particularly when indirect impacts are accounted for as well.

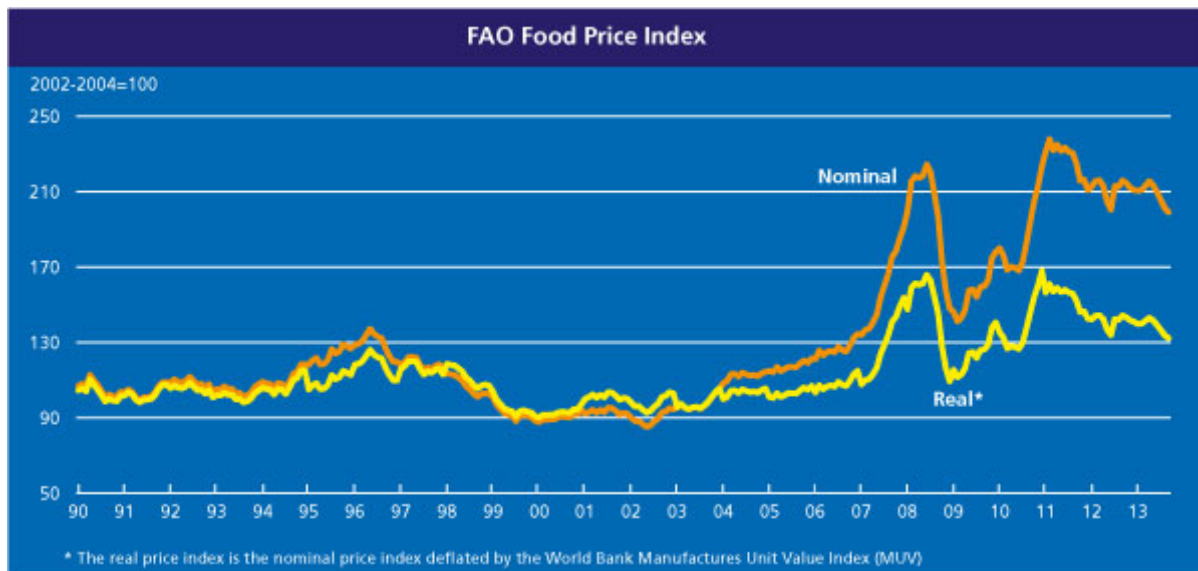
Since food production relies heavily on natural resources and ecosystem services, there is a risk that the lack of sustainability within the food system will have an impact on the functioning of the system itself - such that the supply of affordable, safe food will be affected.

At the same time, global demand for food is predicted to increase, and there is a trend towards more resource intensive and less healthy consumption patterns of food, in terms of both the quantity (more calories) and quality (above recommended levels of sugar, salt, saturated fats, animal protein).

From an economic perspective, recent years have also seen an increase in food price volatility.

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<sup>1</sup> [http://www.rona.unep.org/documents/partnerships/SCP/Assessment\\_of\\_Env.\\_Impact\\_of\\_SCP\\_on\\_Priority\\_Products.pdf](http://www.rona.unep.org/documents/partnerships/SCP/Assessment_of_Env._Impact_of_SCP_on_Priority_Products.pdf)



The FAO states that "International prices have declined this year, but they are still above their historical levels. And prices are expected to remain volatile over the coming next years"<sup>2</sup>. They have classified the current time as a "new era of rising food prices and spreading hunger." stating that "food supplies are tightening everywhere and land is becoming the most sought-after commodity as the world shifts from an age of food abundance to one of scarcity."

The FAO also estimates that each year, approximately one-third of all food produced for human consumption in the world is lost or wasted. This food wastage represents a missed opportunity to improve global food security, but also to mitigate environmental impacts and resources use from food chains.<sup>3</sup> The point out that: "The global volume of food wastage is estimated to be 1.6 G.tonnes of "primary product equivalents", while the total wastage for the edible part of food is 1.3 G.tonnes. This amount can be weighed against total agricultural production (for food and non-food uses), which is about 6 G.tonnes.

Without accounting for GHG emissions from land use change, the carbon footprint of food produced and not eaten is estimated to 3.3 G.tonnes of CO<sub>2</sub> equivalent: as such, food wastage ranks as the third top emitter after USA and China. Globally, the blue water footprint (i.e. the consumption of surface and groundwater resources) of food wastage is about 250 km<sup>3</sup>, which is equivalent to the annual water discharge of the Volga river, or three times the volume of lake Geneva. Produced but uneaten food occupies almost 1.4 billion hectares of land; this represents close to 30% of the world's agricultural land area. While it is difficult to estimate impacts on biodiversity at a global level, food wastage unduly compounds the negative externalities that mono-cropping and agriculture expansion into wild areas create on biodiversity loss, including mammals, birds, fish and amphibians."

## **B. European perspective - key impacts and trends in the food system**

The food sector in the EU has a significant economic value, comprising around 17 million holdings and enterprises (of which 82% are agricultural holdings), providing jobs to over 48 million Europeans. The European food and drink industry has a turn-over of about €1 trillion and provides employment to 4.4 million people, predominantly in SMEs.

It has been estimated that food consumption is responsible for 20-30% of all EU environmental impacts.<sup>4</sup> Environmental impacts are caused during all stages along the food

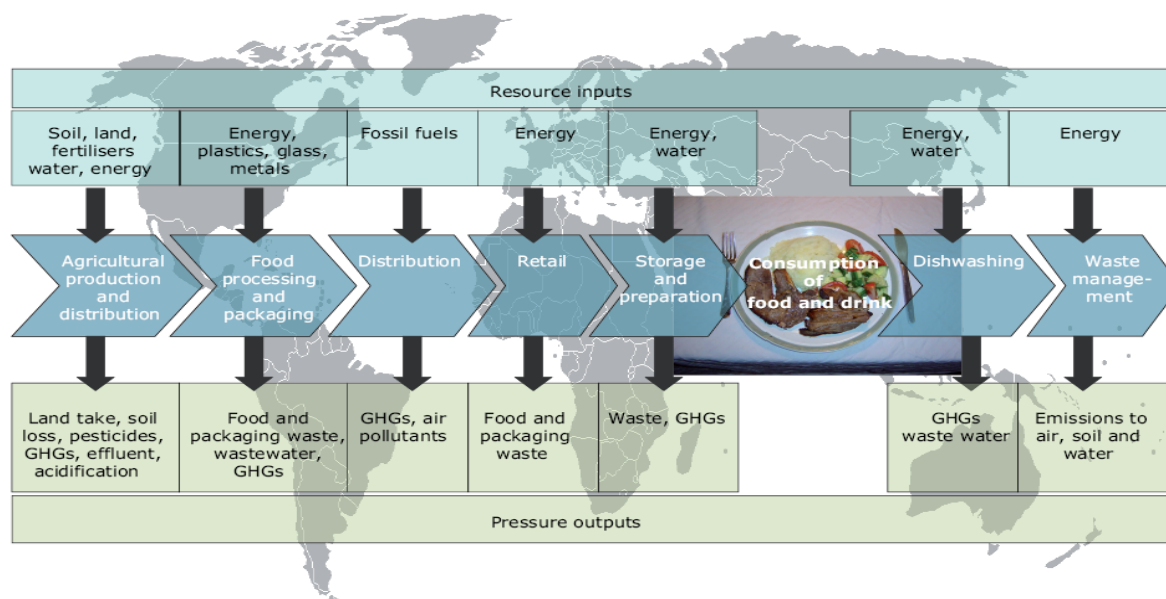
<sup>2</sup> <http://www.fao.org/news/story/en/item/201818/icode/>

<sup>3</sup> <http://www.fao.org/docrep/018/i3347e/i3347e.pdf>

<sup>4</sup> EIPRO, 2006

chain (see diagram below), but agricultural production, and to a lesser extent industrial processing are responsible for the most significant impacts (EEA, 2005; ETC/SCP, 2009; Foster et al., 2006).

### How the food and drink value chain impacts the environment



Source: Compiled by EEA-ETC/SCP.

The environmental impacts of the production and consumption of food in the EU are not restricted to Europe but also occur in third countries, as many products and inputs for the food system come from outside the EU. In fact, the EU is the largest exporter and importer of agricultural and food products on the global stage, with around 19% of global market share (Biointelligence, 2012). The EEA (2012) has observed a dramatic increase in quantities of imported food the past decade: meat imports to the EU-15 increased by 120 % between 1990 and 2007, cereal imports increased by 83 %, frozen vegetables by 174 %, and bananas by 92 % over the same period (FAO, 2010). The import of food products not only lead to increased energy use and emissions from long distance food transport, but also causes depletion of natural resources and environmental damage abroad. (Biointelligence, 2012).

Unsustainable production and consumption have far-reaching environmental, social and economic impacts.

#### Some quantified trend predictions are as follows:

- i. **Biodiversity loss:** intensification of production has resulted in a dramatic reduction in agro-biodiversity as food production systems have increasingly been based on a few high productive plant varieties or animal breeds, leading to genetic erosion (Wiskerke, 2012). In addition, the modernisation of farms and the countryside has also resulted in the loss of non-agricultural biodiversity. Biodiversity loss has accelerated to an unprecedented level, both in Europe and worldwide (EEA). It has been estimated that the current global extinction rate is 1000 to 10000 times higher than the natural background extinction rate. In Europe some 42% of European mammals are endangered, together with 15% of birds and 45% of butterflies and reptiles.
- ii. **Water scarcity:** currently about 35% of water abstracted in the EU is used for agriculture (globally it is 70%). There are some areas in Europe (especially in the

South) that may face seasonal water shortages in the (near) future, spurred by climate change. Desalination is now used to supply irrigation water in Mediterranean countries which is an energy-demanding process leading indirectly to greenhouse gas emissions. Globally, in 2008, 1.4 billion people lived in "closed basins" - regions where existing water cannot meet the agricultural, municipal, and environmental needs for all. This number is expected to grow to 1.8 billion by 2025.

- iii. **Depleting fish stocks:** fishery is considered the single largest driver of biodiversity loss (SCAR, 2012). According to the EEA, the status of commercial fish stocks shows that overfishing in Europe's Seas continues to be a problem - at present, 30% of the stocks for which information exists are fished outside safe biological limits. Of the assessed commercial stocks in the NE Atlantic, almost all demersal stocks have declined and are currently not sustainably.
- iv. **Greenhouse gases:** The global food system, from fertilizer manufacture to food storage and packaging, is responsible for up to one-third of all human-caused greenhouse-gas emissions, (Consultative Group on International Agricultural Research (CGIAR))<sup>5</sup> The EIPRO study (2006) found similar results for the EU, estimating that 31% of the EU's GHG emissions were associated with the food system, and almost a third of direct GHG emissions is generated by livestock.
- v. **Eutrophication:** Aquatic ecosystems in Europe suffer from eutrophication caused by excessive input of nutrients, namely nitrogen and phosphorous, from various anthropogenic sources. The most recently updated information shows that agriculture is the leading source of nitrogen pollution and that in some EU countries it is becoming the main source of phosphorous too. (EEA)<sup>6</sup>
- vi. **Phosphorus:** Phosphorus is one of the key inputs used to boost agricultural production, that cannot be substituted. Demand is predicted to increase by 50–100 % by 2050, yet security of supply of uncontaminated phosphate rock is highly uncertain. EU is more than 90 % dependent on imports. The fertiliser industry recognises that the quality of reserves is declining and the cost of extraction, processing and shipping is increasing. In 2008, prices of phosphorus rock went up by 700% in little over a year.
- vii. **Land use change and soil degradation:** Domestic land use for food production (excluding industrial crops) is 172 million ha<sup>7</sup> (approximately 40% of EU land)<sup>8</sup>. The European livestock sector is responsible for the use of approximately 79 million ha of arable land, 67 million ha of which within Europe (hence the area of arable land used to feed livestock is greater than the area used for crops directly consumed) and 12 million ha outside Europe.<sup>9</sup>

Importation of agricultural commodities into the EU also causes land use and land cover changes abroad. Over the past decade there has been declining EU land use for agricultural commodity exports and an increasing land use outside of EU borders ('global land use') for imports.<sup>10</sup> The EU imports of raw agricultural products (not including processed food and meat) result in global land use of 14.1 million ha<sup>11</sup>. A

<sup>5</sup> <http://www.nature.com/news/one-third-of-our-greenhouse-gas-emissions-come-from-agriculture-1.11708#b1>

<sup>6</sup> <http://ec.europa.eu/environment/integration/research/newsalert/pdf/6na3.pdf>

<sup>7</sup> Eurostat, 2007 – See Appendix A

<sup>8</sup> Overall, relatively little new land has been brought into agriculture in recent decades. Although global crop yields grew by 115% between 1967 and 2007, the area of land in agriculture increased by only 8% and the total currently stands at approximately 4,600 million hectares.

<sup>9</sup> Westhoek, H., et al. (2011). The Protein Puzzle. Netherland Environmental Assessment Agency

<sup>10</sup> Von Witzke, H., Noleppa, S. (2009) EU agricultural production and trade: Can more efficiency prevent increasing 'land-grabbing' outside of Europe?. Note: Report for Agripol network at Humboldt University Berlin for policy advice and OPERA (stakeholders in the agri food sector).

<sup>11</sup> Van der Sleen, M (2009) Trends in EU virtual land flows: EU agricultural land use through international trade between 1995-2005, In cooperation with Rijksuniversiteit Groningen & the European Environment Agency. A Report to the European Environment Agency

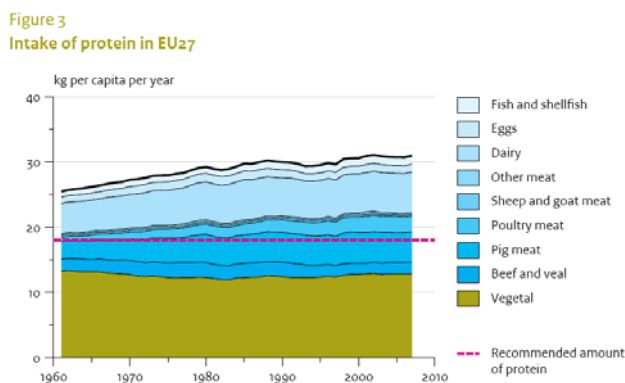


recent report by the Sustainable Europe Research Institute (SERI) finds that: "nearly 60% of the land used to meet Europe's demand for agricultural and forestry products comes from outside the continent"<sup>12</sup>. A limited number of raw agricultural products are responsible for a large amount of EU virtual land use: wheat, coffee, soy and cocoa beans.

There are strong environmental grounds for limiting any significant expansion of agricultural land in the future (although restoration of derelict, degraded or degrading land will be important). In particular, further conversion of rainforest to agricultural land should be avoided as it will increase greenhouse gas emissions very significantly and accelerate the loss of biodiversity (UK Foresight, 2011).

- viii. **Unhealthy, unsustainable diets:** According to the EU platform for action on diet, physical activity and health, "European Union citizens are moving too little and consuming too much: too much energy, too many calories, too much fat and sugar, and salt"<sup>13</sup>. The main consequence is a sustained, acute EU-wide increase in overweight and obesity. The increase is particularly severe for children and adolescents. This trend is increasing ill health and shortening lives." Obesity rates in Europe range from 10% to 38% of the population. Obesity costs society tens to hundreds of Euros per person per year (Van Baal, 2006) and is responsible for approx. 25% of the annual increase in medical spending (Thorpe, 2004).

This food pattern has a negative impact on people's health (e.g. obesity and cardiovascular disease) but is also associated with a larger ecological footprint. The consumption of meat and dairy products is responsible for the bulk of a number of key impacts. It contributes 24 % of the overall environmental impacts caused by total consumption in the EU-27, but accounts for only 6 % of total expenditure (JRC/IPTS, 2008). The four main product groups (dairy, beef, pork and poultry products) contribute respectively 33-41 %, 16-39 %, 19-44 %, and 5-10 % to the impact of meat and dairy products consumption in EU-27 on the different environmental impact categories.



Source: PBL analysis, based on FAO (2010); Gezondheidsraad (2001); NEVO (2010); Schmidhuber (2007); Voedingscentrum (2008); WHO (2003b, 2007)  
The increased consumption of animal products means that the total protein intake has increased over the last 50 years. The consumption of proteins per person is around 70% higher than recommended.

- ix. **Food waste**<sup>14</sup>: A study conducted for the European Commission<sup>15</sup>, based on data from Eurostat and national data, it has been estimated that around 89 million tonnes or 179

<sup>12</sup> [http://seri.at/wp-content/uploads/2011/10/Europe\\_Global\\_Land\\_Demand\\_Oct11.pdf](http://seri.at/wp-content/uploads/2011/10/Europe_Global_Land_Demand_Oct11.pdf)

<sup>13</sup> In some cases this may be caused by so-called 'food deserts' (Cummins and Macintyre, 2006) i.e. impoverished urban neighbourhoods that lack supermarkets and grocery stores, but boasts dozens of fast food and snack shops.

<sup>14</sup> Food waste is composed of raw or cooked food materials and includes food loss before, during or after meal preparation in the household, as well as food discarded in the process of manufacturing, distribution, retail and food service activities. It comprises materials such as

kg per person of food waste was generated in the EU-27 in 2006, of which 42 % was from households, 39 % from manufacturing and the rest from other sources including retailers, wholesale and the food service sector, but excluding agricultural waste. According to UK estimates, over a quarter of avoidable food waste thrown away is still in its original packaging<sup>16</sup> and the total annual financial loss per household is approximately £480 or 565 Euros.<sup>17</sup>

Without additional prevention policies food waste could be expected to rise in Europe to about 126 million tonnes by 2020, representing an additional 40% to current figures. (These figures cover both avoidable food wastage (which could have been consumed) and 'unavoidable' wastage (such as vegetable peel, bones, etc.). Food waste can be treated in various ways: composting, anaerobic digestion, landfilling, incineration, or mechanical and biological treatment. There is significant differentiation between MS in terms of treatment approaches:<sup>18</sup> for example, less than 20% of bio-waste is landfilled in Austria, the Netherlands and Denmark, while more than 80% is landfilled in Ireland, Spain and the UK.

Any reduction in avoidable food waste should lead to equivalent reductions in impacts upstream from agricultural production.

- x. **Price volatility:** In the EU, over the recent years, the increase in price volatility for agricultural inputs, agricultural commodities and foodstuffs has raised concerns from many stakeholders in the food supply chain – from farmers to consumers. Price volatility is a normal feature of agricultural markets which originates in the combination of elastic supply (resulting from, for example, multi-annual climatic variations) and a relatively price-inelastic demand. The level of prices as such should not be regarded as the main area of concern: for instance, high food prices put food security at risk in the short term but they also boost agricultural production on the medium term. However, the increase in price volatility creates economic risks which put at stake the viability of a number of small farmers and small businesses along the food supply chain. In the medium to long run, there are potential issues with the availability and accessibility of agricultural raw materials in Europe (quantity, quality, and price) would damage the competitiveness of the EU food processing industry.

### **C. System drivers**

Unsustainable resource use and inefficiency in the food system can be traced back to two types of drivers:

- *Global, macro-economic drivers* such as a rising population<sup>19</sup> and increasing GDP which respectively raise the overall demand for food and trigger lifestyle changes which are proving less healthy and sustainable;
- *Institutional failures* related to the set-up of the market, the landscape of policies/regulations and the level of information and knowledge about the food system.

Global, macro-economic drivers are difficult to influence and are outside the scope of this initiative, (although they may need to be discussed at international forums) but the

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vegetable peelings, meat trimmings, and spoiled or excess ingredients or prepared food as well as bones, carcasses and organs (BIO Intelligence, 2010).

<sup>15</sup> <http://ec.europa.eu/environment/eussd/reports.htm>

<sup>16</sup> WRAP (2008) The Food We Waste

<sup>17</sup> WRAP (2009) Household Food and Drink Waste in the UK. Report prepared by WRAP.

<sup>18</sup> European Commission (2010) Commission communication on future steps in bio-waste management in the European Union

<sup>19</sup> By 2050 the world's population is predicted to reach 9.1 billion (34% higher than today).

institutional drivers do offer opportunities of intervention. These institutional drivers can be broken down as follows:

### Market failures

*A. Inequity in the supply chain:* In recent decades, the mainstream system of food provision has changed from a supply to a demand driven food supply chain. At the same time, a shift in power has occurred within the food supply chain from primary production to the retail sector and price competition between and within food supply chains has become vigorous (Wiskerke, 2012). This has led to: 1) cost price squeeze on agriculture, and 2) the subordinate economic position of primary producers in the food supply chain, illustrated by the uneven distribution of value added in the supply chain. This has accumulated into a treadmill effect (Morgan and Murdoch, 2000): i.e. farmers feeling compelled to continue along the path of increasing production levels and enlarging the scale of operation in order to reduce the costs of production per unit of product and/or unit of labour (Wiskerke, 2012).

*B. Price signals:* On the supply side, natural capital and resource inputs into the system are currently not appropriately valued and are treated as if they were unlimited in supply. The true 'external' costs of use of natural capital are not 'internalised' in the price of resources, making resource-intensive and environmentally-harmful practices widespread in the agricultural sector. This may be partly due to environmentally harmful subsidies which distort prices (e.g. in the case of energy prices). On the demand side, this translates into an economic incentive for consumers to manage food in a non-resource-efficient way.

### Regulatory failures

*C. Policy gaps and incoherence:* The current multitude of sectoral policies related to the food system and their complexity have led to the possibility of conflicting objectives and policy gaps. There is currently no integrated policy framework or vision to ensure consistency of policy objectives and measures in relation to the food system as a whole. There is no consistent resource-efficient thinking in policy making, health and sustainability goals are not aligned, and there are no clear standards for sustainable sourcing and procurement by public authorities and food services. The diagram below shows a representation of the complex policy landscape for the food system for illustrative purposes. (Note: Red ovals represents possible policy gaps / areas of under-developed policy.)



measuring and comparing environmental impacts. This means it is currently difficult to establish standard criteria for action, such as on the sustainable sourcing, or to make detailed comparisons of similar products.

Indeed food consumption is inherently correlated with diets which include a wide range of different foodstuffs and beverages, prepared and eaten in different contexts (meal cooked at home, foodservice, snack...). As such, it is a challenge to get a full knowledge about the impact one's diet has on one's health, the food supply chain and the environment.

*E. Lack of knowledge and awareness:* Alongside various cultural, socio-economic causes of the overall trend towards less sustainable and less healthy diets, people are poorly informed and aware about combined health and environmental impacts of food products and food waste. Unhealthy, unsustainable diets may thus appear as the easiest choice.

On the supply side, practitioners may not be aware of the need to implement new resource-efficient, agro-ecological methods and techniques or they experience difficulties in assimilating them. This is partly due to a lack of suitable channels for knowledge exchange, the remoteness of scientific research from farming practice and costs.

## **D. Long term food system objectives**

### **Sustainable resource management**

The Roadmap to a Resource Efficient Europe calls for the reduction of resource inputs used for food production, such as water, fossil fuels, nutrients (Nitrogen and Phosphorus), chemicals (e.g. herbicides and pesticides) and materials (e.g. for packaging). At the same time, the challenge is to tackle possible trade-offs between resource-efficiency and sustainability (e.g. less land use and animal welfare). Therefore, it is important to look beyond only efficiency and also consider impacts on overall ecosystem integrity. This can be achieved through a combination of improved resource-efficiency and agro-ecological innovation<sup>20</sup>. Ultimately, farmers not only produce food but also provide ecosystem services for society (e.g. habitat for wild plants and animals, climate regulation).

Furthermore, to lower the overall environmental footprint of food production, companies (particularly manufacturing/processing) should also consider the sustainability aspects of raw materials and agricultural commodities imported from abroad (e.g. soy and maize).

Tackling food is seen as the priority sustainable resource management objective. (see main text and other annexes for information.)

### **Sustainable and healthy consumption patterns**

Food consumption patterns, if pushed towards more sustainable diets<sup>21</sup>, should be seen as a key lever to orient the evolution of food systems towards more resource-efficiency in the long run (FAO, 2012). Basically this would mean a shift from an animal-based diet consisting of mostly processed foods (which tend to be more resource-intensive and often contain high

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<sup>20</sup> Bearing in mind the differences in soil type, farm type, climate, crop selection and other factors across the different regions in the EU, and that the environmental impact of farming is very dependent on such factors, deciding what management practice is the most beneficial for EU production from a sustainability point of view is not straightforward (BIO Intelligence, 2012). Organic farming is certainly not the only possible approach, other types of integrated farming systems may also achieve sustainable resource management.

<sup>21</sup> FAO defines sustainable diets as "those diets with low environmental impacts that contribute to food and nutrition security and to healthy lives for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable, nutritionally adequate, safe and healthy, while optimising natural and human resources (FAO, 2010).

levels of sugar, fat and salt) to a more plant-based diet, containing more whole grain products, legumes, (seasonal) fruits and vegetables, and plant-derived meat substitutes. Such a diet is in line with FAO/WHO nutrition guidelines<sup>22</sup> and reduces the prevalence of diet-related non-communicable diseases (e.g. obesity, micronutrient deficiencies). Furthermore, from an ecological perspective it is also advisable to encourage the consumption of fish species that are not overfished (or from sustainable aquaculture) and to stimulate the purchase of food products that meet a credible certified standard.

Evidence from the health sector shows that changing diets is difficult but not impossible (Foresight, 2011). It requires concerted and long-term actions to raise knowledge and awareness levels on the environmental impact of food. At the same time, healthy and sustainably produced food has to be readily available, affordable and attractive to consumers.

### **E. Approach to take**

Given the existing policy framework, future food system policy should not formulate new policy in areas that are already sufficiently covered. It should aim to add value in areas that show insufficient policy development but are crucial to achieve a sustainable food system through improved efficiency.

At the moment, existing policies mainly relate to farm production, covering various issues such as water, Plant Protection Products, air and soil. As the significant proportion of environmental impacts occur across production and processing stages, improvements at the end of life and consumption stages have the highest potential.

*A. Better data and guidance on the environmental impacts of food products:* scientifically sound data on the actual environmental impacts of food products is necessary to steer the food system in a more sustainable direction. This data should be based on scientific methodologies and indicators that are standardised to enable comparison of food products. Furthermore, to enable sustainable resource management and sourcing, there should be clear sector-specific guidelines and sustainability criteria for key food commodities.

*B. Promoting sustainable consumption patterns:* consumers and food purchasers should be enabled to make informed choices for sustainable diets. This requires a raised level of knowledge and awareness on the environmental impacts by food<sup>23</sup>, but also clear information provision and guidance. Labelling and information is essential for the informed consumer to effect change in the food system by choosing to purchase items that promote sustainability (Foresight, 2011). Shortening supply chains may also stimulate consumers to revalue food. The commitment of retailers and food services in promoting sustainable consumption is essential because of their role in marketing and choice-editing; these actors are able to change the reformulation of mainstream food products (changing the default).

*D. Improved governance:* coherence between various sectoral policies across all levels of governance is a prerequisite for a timely transition to sustainable and equitable food systems (SCAR, 2012). This requires a common understanding of the "sustainable food system", an overarching vision for the food system endorsed by all departments. By creating synergies between biodiversity conservation, sustainable land use, climate change adaptation and health goals, involving various societal actors at different levels, mutual gains can be achieved.

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<sup>22</sup> FAO/WHO dietary recommendations are: <10% of daily energy intake from saturated fatty acids, <1% of daily energy intake from trans fatty acids, <10% of daily energy intake from free sugars, ≥400 g fruits and vegetables a day, <5 g a day of salt (FAO, 2012).

<sup>23</sup> Behavioural change is very complex. A staged approach to awareness-raising will probably be most effective: firstly, people have to realise that food has an environmental impact before they can understand the effects of their purchasing behaviour. The next step is for people to comprehend what constitutes a sustainable diet before they can adjust their behaviour.

A number of possible approaches have been identified, including those related to tackling food waste.

### 1: Better data on environmental impacts of food products

There has to be clarity on the actual environmental impacts of food products to be able to develop guidance for more sustainable production and sourcing.

- Develop a **standardised methodology** for measuring the environmental impacts of food products.
- Make **data** on the environmental impacts of food **more transparent and accessible**.
- Develop **technical guidance** on how to identify more sustainable food products.
- Develop **sustainability criteria** for specific food products.
- **Quantify** in economic terms, the **environmental and social costs associated with food** products or diets (i.e. any hidden costs or 'externalities')

### 2: Stimulating more resource efficient food production

The market place for sustainable food production could be improved by promoting / supporting the following:

- Promoting **regional, wholesale markets**.
- Promoting **seasonally** produced food.
- Promoting **diversification** of cultivated species.
- Promoting productive, **intensive** agriculture.
- Promoting **extensive**, integrated agriculture.
- Promoting **organic** production.
- Develop **sustainability guidelines** to help producers adopt more resource efficient production methods.
- Promoting higher **animal welfare** standards.

### 3: Promoting sustainable consumption patterns

Consumers and food purchasers should be better informed on how to make more sustainable choices. This requires a raised level of knowledge / information and guidance.

- Agreeing a common set of **guiding principles** of what constitutes 'sustainable' diet.

- Develop ideas for food **labelling schemes** and/or **on-package information** highlighting more sustainable choices.
- Run **information campaigns** on the environmental impacts of different food choices.
- Promote more sustainable food choices in retail outlets by **increasing their availability/accessibility**.
- Assess the scope for using **personal technology** for accessing information, e.g. smart phone apps, bar code readers, etc.
- Develop and encourage the use of **Green Public Procurement** guidelines, to help public bodies (or private organisations) purchase food sustainably.

#### 4: Tackling Food Waste and Losses

Actions have to be undertaken to reduce food losses throughout the supply chain.

- Develop/disseminate **consumer information** on avoiding **over-purchasing**.
- Develop/disseminate **consumer information** on the meaning of food **date labels**. ('best-before', 'use-by', 'sell-by')
- Develop/disseminate consumer information on better storage of food.
- Develop/disseminate consumer information on more sustainable food preparation and use of leftovers.
- Establish new education campaigns on food waste prevention aimed at children.
- Establish new education campaigns on food waste prevention aimed at adults.
- Facilitate the exchange of good practices on food waste prevention and reduction activities at all levels: producers, retailers as well as local, regional and national authorities.
- Clarify the EU VAT Directive for donation of surplus food to food banks for Member States and businesses.
- Encourage best-practice in relation to food date labels by food business operators to minimise wastage.
- Develop EU Food Donation Guidelines for food donors and food banks on how to comply with the EU Food Hygiene legislation (types of food suitable for donation, conditions for transport and traceability, legal liability, etc.)
- Agree a common EU definition of food waste, classifying products as food, feed or waste etc. as appropriate.
- Develop a standardised methodology for collecting and reporting data on food waste to ensure data comparability across Member States.
- Introduce reporting requirements on food waste.
- Set binding targets for food waste prevention.

#### 5: Better food system governance:

Establish an integrated policy framework that ensures coherence between sectoral policies to make sure health/sustainability/resource-efficiency goals are aligned and actually delivered through effective measures.

- Perform a comprehensive review of relevant food policies (International/EU/National/local) to check that they are aligned with each other, that they are coherent, and are in line with agreed sustainability goals. (i.e. a 'fitness check')
- Support national and local food system governance by sharing good practices /provide guidance on implementing sustainable food strategies.



- Identify environmentally harmful subsidies (EHS) in the food sector.
- Establish new coordination bodies (or reorganise existing bodies) to provide coherence on in the field of food sustainability.

It is important to note that there are many potential points of intervention at which negative effects of different stages of the food cycle on the environment, resource efficiency and human health could be addressed, as several problems are interlinked – there are “win-wins” for improvements in many cases.

### **Summary of Key background used as input into Impact Assessment Preparation**

<b>Relevant legislative background</b>	<b>Key research / studies to consider</b>	<b>Relevant expert to speak with the Inter-service Group</b>
<ul style="list-style-type: none"> <li>- Common Agricultural Policy</li> <li>- Nitrates Directive</li> <li>- Upcoming Phosphorus Green Paper</li> <li>- Upcoming Land Use Communication</li> <li>- SANCO food safety legislation</li> </ul>	<p>EU SCAR Foresight - Sustainable food consumption and production in a resource constrained world</p> <p>The European Environment – State and Outlook 2010 – European Environment Agency</p> <p>EEA's Indicator report 2012 - Nitrogen emissions and threats to biodiversity</p> <p>The Environmental Food Crisis: <b>The Environment's Role in Averting Future Food Crises</b> (UNEP – 2009)</p>	<p><b>Professor Erik Mathjis</b>, KUL, rapporteur of the Standing Committee on Agricultural Research – Met with ISG <b>29 March 2012</b></p> <p><b>Ybele Hoogeveen</b>, Head of group Natural resources and quality of life, <b>European Environment Agency</b> – Met with ISG, <b>19 June 2012</b></p>
<p>WHO: European Action Plan for Food and Nutrition Policy 2007-2012</p> <p>European Commission: Strategy for Europe on nutrition, overweight and obesity-related health issues (2007)</p>	<p>'The protein puzzle: The consumption and production of meat, dairy and fish in the European Union' - PBL Netherlands Environmental Assessment Agency (2011)</p> <p>IMPRO- Plus "Environmental Impacts of Diet changes in the EU"</p> <p>Evaluation of the livestock sector's contribution to the EU greenhouse gas emissions (GGELS) by JRC (30-11-2010)</p>	<p><b>Henk Westhoek</b> - program manager for Agriculture and Food of the Netherlands Environmental Assessment Agency (PBL). Met <b>10 November 2012</b></p>
	<p>FAO: Global food loss and food waste (2011) (also related to issue 5)</p> <p>European Commission: Preparatory Study on Food Waste across EU 27 (2010) (also related to issue 5)</p> <p>UK WRAP: New estimates for household food and drink waste in the UK (2011)</p> <p>French Ministry of Ecology, Sustainable development, Transport and Housing: Wastage study mid-term report (2012)</p>	<p><b>Ir Toine Timmermans</b> - Wageningen University - Food Waste in a European context – Met with ISG, <b>19 April 2012</b> (also related to issue 5)</p> <p><b>Andrew Parry</b> - Consumer Food Waste Prevention Programme Manager, WRAP, UK – Met <b>27 September 2012</b></p>

<b>World summit on food security</b>	<b>Food Security Assessment, 2008-09</b> (US Department of Agriculture, 2009),	
<b>Declaration of the World summit on food security (2009)</b>	<b>OECD Programme on food, agriculture and fisheries</b>	

[http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/From\\_farm\\_to\\_fork\\_-\\_food\\_chain\\_statistics](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/From_farm_to_fork_-_food_chain_statistics)

## Annex 4 – Causes/drivers of Food waste

Causes of food waste are common to households and businesses, and involve portion size, labelling, packaging and storage issues on the one hand, and awareness, preferences, planning and socio-economic factors on the other. These causes invite two groups of prevention strategies, those that implicate producers and retailers in helping prevent household food waste, by incentivising the creation and promotion of waste resistant products, and those targeting consumers through educational tools and campaigns. The table below lists the key causes of food waste and the sectors they impact.

**Table: Key causes of food waste and impacted sectors**

	Manufacturing & Processing	Wholesale & Retail		Food Service and Restaurants			Households
		Distribution & Wholesale	Retail	Hospitality industry	Schools	Hospitals	
Awareness				●	●	●	●
Knowledge			●	●	●	●	●
Attitudes				●	●		●
Preferences					●	●	●
Portion size			●	●	●	●	●
Planning				●	●	●	●
Storage		●	●				●
Socio-economic factors							●
Labelling			●	●	●		●
Packaging	●	●	●				●
Handling		●	●				
Stock management		●	●				
Logistics	●			●	●	●	
Product quality requirements	●		●				
Technical malfunctions	●						

Sources of food waste exist at all process stages between farm and fork. This study begins when raw materials and fresh produce leave the farm, as agricultural policy is not an area this annex touches upon.<sup>24</sup>

The principle causes by sector are described below.

### **1. Manufacturing & Processing**

Food waste is largely unavoidable (inedible) at this level, according to Danish research<sup>25</sup>, particularly for meat products, involving principally bones, carcasses, and organs that are not commonly eaten.

Technical malfunctions also play a role, including overproduction, inconsistency of manufacturing processes leading to misshapen products or product damage, packaging problems leading to food spoilage, and irregular sized products trimmed to fit or discarded entirely.

At processing level, much waste is generated as a result of legislative restrictions on outside produce. The phasing out of regulations on the size and shape of fruit and vegetables,

<sup>24</sup> While this annex does not cover agricultural food waste prevention, it may be noted that there are occasions where crops have been left in the field unpicked, because the market price of the crop did not justify the expense of harvesting. The Agricultural sector may be an important statistical area for food waste for further research.

<sup>25</sup> Copenhagen Resource Institute (2010) *Study for the Danish Ministry of the Environment*

approved by the European Commission (Commission Regulation (EC) No 1221/2008 of 5 December 2008) should help reduce the quantity of fresh produce needlessly discarded before reaching retail outlets.<sup>26</sup> This odd-shaped produce may be available at a lower cost, increasing the access of low-income families to fresh fruit and vegetables.

## **2. Households**

### **Causes of household food waste which can be addressed by policies targeted at producers:**

#### **Labelling issues**

Misinterpretation or confusion over date labels is widely recognised for its contribution to household food waste. In many MS, there is a lack of consistency in the terms employed (“best before”, “use by”, “sell by”, “display until”), with a tendency among consumers to treat all terms equally, and in some cases to leave a safety margin before the stamped date.

Applying “best before” dates to products that show visible signs of decay may be unnecessary, causing consumers to discard something that does not pose a safety risk. Consumers might be better left to judge the quality and safety of such products autonomously, bread or potatoes for example. The use of “best before” dates, by contrast, on products that are liable to pose microbiological risks after a certain date, is also a concern, eggs or yoghurt for example. In this scenario, consumers may consider the date as a quality indicator, when in fact the product may have become dangerous.

At the point where consumers decide whether to eat or discard a food product in the household, sensory judgements on the quality and safety of the food will interplay with an assessment of the date label on the product. A lack of clarity and consistency in date labels thus results in a greater proportion of discarded food that was in fact still edible.

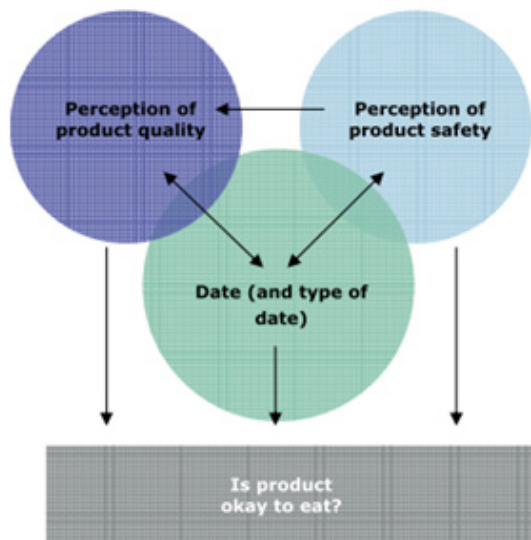
The following diagram shows the interaction of criteria used in assessing product edibility.

### **Figure: ‘Routes’ to deciding whether a product is okay to eat<sup>27</sup>**

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<sup>26</sup>COMMISSION REGULATION (EC) No 1221/2008 of 5 December 2008:  
[eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:336:0001:0080:EN:PDF](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:336:0001:0080:EN:PDF)

<sup>27</sup> WRAP (2008) *Research into consumer behaviour in relation to food dates and portion sizes*



**Source: WRAP (2008) *Research into consumer behaviour in relation to food dates and portion sizes***

### **Storage**

Inappropriate storage conditions leads to food waste throughout the supply chain and is no less important in the household. Lack of consistency in food storage labels can contribute to premature food spoilage, as can the absence of storage guidance and lack of consumer attention to labels where provided. Storage conditions will also vary based on climate and household temperature. WRAP reports that over two million tonnes of food is not being stored correctly in the UK, multiplying food wastage and presenting potential safety concerns.<sup>28</sup> Optimal storage conditions, by contrast, can significantly extend the edible life of products, often beyond expiry dates. Airtight containers, for example, easily maintain the quality of dry foods such as fruits, nuts, rice, pasta, beans and grains over long periods.

### **Packaging issues**

Packaging can also enhance food product longevity. The lifetimes of products with a high water content, cucumbers for example, can be extended fivefold through plastic film wrapping, as it reduces water loss.<sup>29</sup> Packaging also performs a protective function for fragile goods. The trade-off between food and packaging waste must then be considered, based on the environmental impacts of the two waste streams, though this again will be highly product specific. In some instances, lightweight packaging can significantly extend the shelf life of fresh produce; in other cases the benefit can be marginal.

Re-sealable packaging furthermore can easily extend the edible life of many food products.

### **Portion sizes**

<sup>28</sup> Ibid.

<sup>29</sup> Morrisons "Keep it Fresh Test": [www.morrisons.co.uk/Corporate/Press-office/Corporate-releases/Morrisons-launch-Great-Taste-Less-Waste-campaign-to-save-families-up-to-600-per-year/](http://www.morrisons.co.uk/Corporate/Press-office/Corporate-releases/Morrisons-launch-Great-Taste-Less-Waste-campaign-to-save-families-up-to-600-per-year/)

The trade-off between food and packaging waste continues when considering portion sizes. Bulk packaging minimises the ratio of packaging to food product delivered to the consumer, though the quantity may be greater than the consumer can use while the product is fresh.

Individually sized portions can minimise food waste, but create extra waste in another waste stream (plastics, glass etc). Better storage knowledge, freezing and preserving information, and storage equipment in the household can help bulk purchases last longer and minimise reliance on smaller portions.

### **Causes of household food waste that can be addressed through consumer-targeted policies:**

#### **Awareness**

Not everyone thinks about what they throw away. While the last three decades have seen a growing general environmental awareness in the EU, food waste has not been a policy priority since the First World War: abundant food production in the intervening years has induced some complacency in the purchase, consumption and wastage of food resources.

While resource efficiency is gaining in profile, the profusion of environmental behaviour changes called for can be overwhelming. Wasteful behaviours with regard to food can be entirely unconscious. Drawing public attention to the extent of the problem can be highly effective, or awareness campaigns might focus on the practical or attitudinal considerations which are discussed separately below.

#### **Knowledge**

A lack of awareness coupled with a lack of knowledge about prevention measures exacerbates food waste in the household. In practical terms, items such as leftover meat, bread, rice or pasta, which were historically reemployed in many classic European dishes, are now more easily discarded. Stale bread for example was habitually transformed into a range of traditional dishes: *panzanella* in Italy, *pain perdu* in France, bread pudding in the UK, taking advantage of every morsel of food. Information on food waste prevention techniques can thus help households understand how to buy smarter and use what they buy more efficiently.

#### **Planning issues**

A lack of attention in food purchasing can be attributed to the abundant availability of food in Member States and the relatively low cost of food products in relation to household income. “Buying too much” or “lack of shopping planning” are thus frequently cited as causes of food waste in the household, due to goods purchased that perhaps do not combine well to make a meal, were not wanted to by the other members of the household or in the case of highly perishable goods, could not be eaten in time.

Compounding lack of planning on the part of consumer, the promotional sale of several units of food products by retailers (two-for-one deals, for example) has been identified as a further source of household food waste, in terms of buying more than is needed.

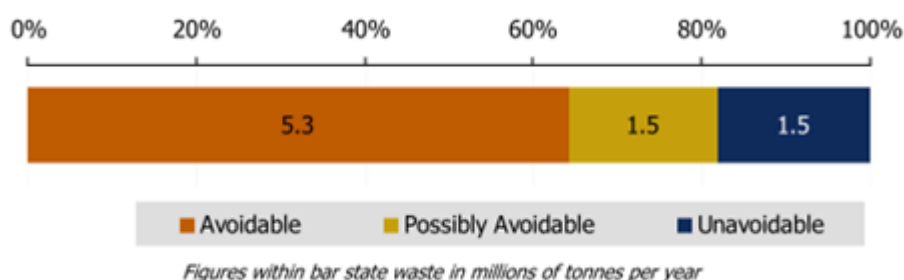
Careful planning does not resolve all issues however. The planning and purchase of very specific food products for a particular recipe or special occasion, which was then not made or did not happen, was identified as a cause of household food waste by a 2001 US study<sup>30</sup>. Many of these non-versatile food products are ultimately discarded after a certain time in the kitchen cupboard or after reaching their expiry date.

### Preferences

Some food waste is generated needlessly, mainly due to a lack of planning and attention. However, other food waste materials are discarded due to personal preference by the consumer, and this area represents 1.5 million tonnes per year in the UK according to WRAP (see below division of household food waste by avoidability). Examples of food items discarded due to preferences include potato skins, apple skins, bread crusts etc. It may be particularly difficult to effect change in this area.

Changes in habits or diets may also play a role in the discard of food products with longer shelf lives (products with a high calorific content may feature strongly here). Causes of food waste in the household waste stream may also include products purchased for the first time that the consumer then “did not like”<sup>31</sup>.

### *Weight of food and drink waste generated by UK households, split by avoidability*<sup>32</sup>



**Source: WRAP (2009) *Household Food and Drink Waste in the UK***

### Attitudes

A problem informally but frequently cited for the generation of food waste is the undervaluing of food resources by consumers based on its low market value. The obesity crisis, furthermore, demonstrates a change of relationship with an attitude towards food in comparison with previous eras.

<sup>30</sup> Wansink, B. (2001) ‘Abandoned Products and Consumer Waste: How did That get into the Pantry?’ *Choices* [foodpsychology.cornell.edu/workcenter/2001-2002\\_dfs/Abandoned-Products-Choices-2001.pdf](http://foodpsychology.cornell.edu/workcenter/2001-2002_dfs/Abandoned-Products-Choices-2001.pdf)

<sup>31</sup> Wansink, B. (2001) ‘Abandoned Products and Consumer Waste: How did That get into the Pantry?’, *Choices* [foodpsychology.cornell.edu/workcenter/2001-2002\\_dfs/Abandoned-Products-Choices-2001.pdf](http://foodpsychology.cornell.edu/workcenter/2001-2002_dfs/Abandoned-Products-Choices-2001.pdf)

<sup>32</sup> WRAP (2009) *Household food and drink waste in the UK*

Life cycle costing of food products with the aim of reflecting their real economic and environmental price might in the long-term change the perceptions of food as rapidly disposable.

Similarly, cultural norms, such as cooking more than the family or group of visitors could possibly eat, remain present in many MS and worldwide. The OECD, in its environmental performance review of Korea, makes an observation that also rings true in the EU:

*“Traditionally, it is considered courteous to prepare more food for a meal than can be eaten, and it is customary to have leftover food.”<sup>33</sup>*

Further attitudinal considerations regard overwhelming the consumer with environmental obligations. This is a recurrent problem with waste prevention affecting many waste streams beyond food: consumers feel that they have ‘done their duty’ by engaging in a highly visible environmental behaviour, such as recycling, but waste prevention is difficult to see and therefore easier to ignore or avoid.

Attitudes that may help counteract food waste include the recent interest in a ‘local impact diet’ and the return of the ‘clean your plate’ ethic, which had been omnipresent in the earlier half of the 20<sup>th</sup> Century. However, this comes at a time when obesity and excessive food consumption have also become a problem.

Household food behaviours are habitual and intuitive<sup>34</sup>, and a wide range of causes can be attributed to actions that the consumer does not think about. Food waste preventing behaviours are thus also multiple, and a suitable response will involve a range of complementary policies.

### **Socio-economic factors**

Certain socio-economic conditions are more conducive to the generation of food waste. Single person households are more wasteful because of the lack of opportunity for sharing food, young people generate more food waste (due to fewer meals being consumed at home, less concern for waste, less experience meal-planning etc.)<sup>35</sup>.

Socio-economic causes are likely to be the least manoeuvrable through policy application, but while the size of the household is unlikely to be influenced, the behaviours within it irrespective of size remain susceptible to general consumer-oriented awareness and informational strategies.

### **3. Distribution and Wholesale**

Limited sources of information on the scale of food waste at this level have been identified; Charlotte Henderson of WRAP’s Retail Grocery Supply Chain Programme noted that the distribution phase was not a key area in WRAP research as not a great deal of food waste is generated during this phase. Areas where food waste may be generated include those

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<sup>33</sup> OECD, (2006) *Environmental Performance Reviews: Korea*, OECD Publishing, Paris, France.

<sup>34</sup> DEFRA, (2009) *Food Synthesis Review 2009*.

<sup>35</sup> WRAP, (2008) *The food we waste*.



common to both the Wholesale/Retail sector and at the Manufacturing/Processing level, namely inaccuracies in stock management and forecasting, and packaging problems.

Excess stock due to “**take-back**” systems and last minute order cancellation<sup>36</sup>, such as contractual obligations for suppliers to accept the return of products with 75% residual shelf life from retailers who have not yet sold them, can result in the discard of safe and edible food products on a large scale. Inaccurate ordering and forecasting of demand also affects the Wholesale/Retail sector.

Stock transportation can lead to both packaging and storage problems. Poor packaging performance resulting in damage to food products will lead to the discard of the product. As noted earlier, damage to the product’s primary or secondary packaging also often means the product will be discarded, while the food itself is unharmed. It is expected generally however that packaging materials have been optimised to minimise waste and hence waste is expected to be limited here.

Furthermore, extreme changes in temperature during shipment can spoil or shorten the shelf life of food products. Meat and fish products are particularly sensitive to temperature conditions during transportation and storage. The degree of degradation of such products can be attributed to cumulated breaks in the cold chain. Research on ‘**time temperature indicators**’ currently underway aims to enable the tracking of temperature changes of food products during the supply chain, facilitating the identification of those areas where food spoilage occurs.<sup>37</sup>

#### **4. The Retail Sector**

Food waste due to inefficiencies in business operations are shared across the supply chain, and in the Retail sector focus on stock management. Difficulties anticipating demand resulting in overstocking affect most product groups; seasonal foods (Christmas cakes or Easter eggs for example) are particularly sensitive to this because of their short shelf life.<sup>38</sup> Storage, handling and packaging also impact food condition and thus wastage.

Charlotte Henderson underlined that food waste in the Retail Sector is highly product specific, leading WRAP to focus on eleven fruit and vegetables in a resource mapping study to be published in 2010. Exposure to light increases in-store wastage of potatoes, for example. Optimised storage conditions for fresh produce in particular in the retail environment will increase the amount sold to consumers, increasing turnover and reducing waste at the same time.

Marketing strategies (two for one deals, for example) often promote food nearing the end of its edible life, addressing overstocking problems. However, this may **shift some of the food waste from Retail level to Households**, where sufficient time to safely consume the product is lacking.

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<sup>36</sup> DEFRA (2007) *Report Food Industry Group on Waste*

<sup>37</sup> FRESHLABEL, Enabling traceability of the Cooling Chain of Fresh and Frozen Meat and Fish Products by means of Taylor-made Time/Temperature Indicators:

[http://cordis.europa.eu/fetch?CALLER=FP6\\_PROJ&ACTION=D&DOC=2900&CAT=PROJ&QUERY=1170700790497&RCN=74777&DOC=1&QUERY=012686305b05:3625:021800bc](http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=2900&CAT=PROJ&QUERY=1170700790497&RCN=74777&DOC=1&QUERY=012686305b05:3625:021800bc)

<sup>38</sup> OECD (2002) *Household Food Consumption: Trends, Environmental Impacts and Policy Responses*

Minimum product quality requirements may increase the quantity of edible food discarded at Retail level, due to packaging defects, product damage or aesthetic issues that do not affect the quality or safety of the food. Promotional strategies could help to reduce this type of waste. Furthermore, the sale of different qualities of fresh produce at different price levels can help maximise their use (Premium, regular and economy level onions for example, based on size and condition).

## **5. Food service and Catering**

### **Hospitality Industry**

The hospitality industry for the purposes of this study refers to hotels, restaurants and for-profit catering services (including workplace cafeterias). This area includes, in principle, catering facilities provided by transport services (rail companies, airlines etc), though this has not been covered by this study due to a lack of evidence at the present time. Phil Williams of WRAP was interviewed regarding this area, discussing the current WRAP hospitality industry food waste study.

Causes of food waste generation strongly resemble those identified in the Household sector and are discussed below.

#### **➤ Portion sizes**

Consumers eat 92% of the food they serve themselves, according to a 2005 study at Cornell University<sup>39</sup>. Where portion sizes are imposed, in cafeterias/canteens for example, food waste is generated that might have been avoided by allowing customers to serve themselves and pay for their serving by weight.

There seems to be scope to optimise set portion sizes of dishes. Where a self-service option is not viable, a choice of portion size may reduce food waste generation by recognising that individuals have different portion needs. Restaurants such as the chain TGI Friday's in the United States are demonstrating that this is viable by offering smaller versions of existing dishes.

Furthermore, the preponderance of single serving items in hotels and many catering facilities, (jams, cereals, juice and milk cartons for example), lead to food waste that could easily be avoided by allowing customers to serve themselves from central containers.

#### **➤ Awareness**

Hospitality industry awareness of food waste is growing in line with overall environmental awareness, but is currently still low, according to Phil Williams, responsible for WRAP's hospitality industry food waste study, which will be published this year. Importantly, WRAP

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<sup>39</sup> Wansink, B., (2005) 'Super bowls : serving bowl size and food consumption', Journal of the American Medical Society [smallplatemovement.org/doc/big\\_bowls\\_spoons.pdf](http://smallplatemovement.org/doc/big_bowls_spoons.pdf)

mentioned anecdotal evidence of significantly higher awareness in businesses that had their food waste collected separately, as workers physically confronted the quantities of food waste they had generated.

➤ **Logistics**

Difficulties in planning in the hospitality industry can be linked to variability in the numbers of customers anticipated. Two key issues stand out here:

- **Reservations:** where reservations are expected, the quantity of food needed, particularly highly perishable products, is much easier to estimate
- **Buffets:** where food is served via a buffet, customers often expect that nothing will run out, particularly in the luxury market, causing businesses to prepare and cook substantially more than will be consumed. Free or all-you-can-eat buffets may furthermore increase the amount of food taken and not consumed by customers.

A final logistical issue in restaurants is cooking, according to the ‘just in time’ principle. Where food is overcooked or not cooked at the same time as the rest of the table’s dishes, it is commonly discarded and the process is restarted.

➤ **Attitudes**

The practice of taking home restaurant leftovers is frowned upon in some parts of Europe, a practice that would enable substantial reduction of restaurant food waste.

➤ **Knowledge**

The lack of clearly defined channels for hospitality industry enterprises to direct edible food towards charitable organisations may strongly impact the diversion of edible food waste from opportunities for reuse.

## **Schools**

Familiar issues arise in school cafeterias and other cost-catering environments. Key causes of food waste in schools include:

➤ **Attitudes**

Food is often not considered valuable to children, as it is plentiful. The question has been raised as to whether free school lunches further undermine the perceived value of food among schoolchildren. This may also contribute to taking more than is needed.

➤ **Preferences**

Limited budgets or lack of motivation to raise quality can aggravate food waste in schools, which have often had difficulty appealing to the

tastes of their customers. Bio-Forum, an association representing the organic agriculture sector in Belgium, has combated these problems by working on food presentation and the choice of spices in its Sustainable Canteens programme, part of which focuses on schoolchildren.

➤ **Portion sizes**

Fixed portion sizes in schools often results in larger waste quantities, because appetites can vary particularly strongly among children.

➤ **Logistics**

Studies in the USA have found that scheduling lunch after breaktime can reduce food waste by 30%<sup>40</sup>, given that children are hungrier, and do not hurry through their lunches to start breaktime.

Mixing of ingredients in large quantities before serving can exacerbate food waste, because mixed products often last less long than products that are stored separately.

## **Hospitals**

Research into food waste generated by hospitals and institutions takes place predominantly at a local level, according to Phil Williams at WRAP. Catering in institutions such as hospitals creates particular food waste problems because individuals fed often have little control over eating times, portion sizes or meal choice. A lack of autonomy, often compounded by low food quality, results in a scenario where patients may opt to eat less than they might otherwise.

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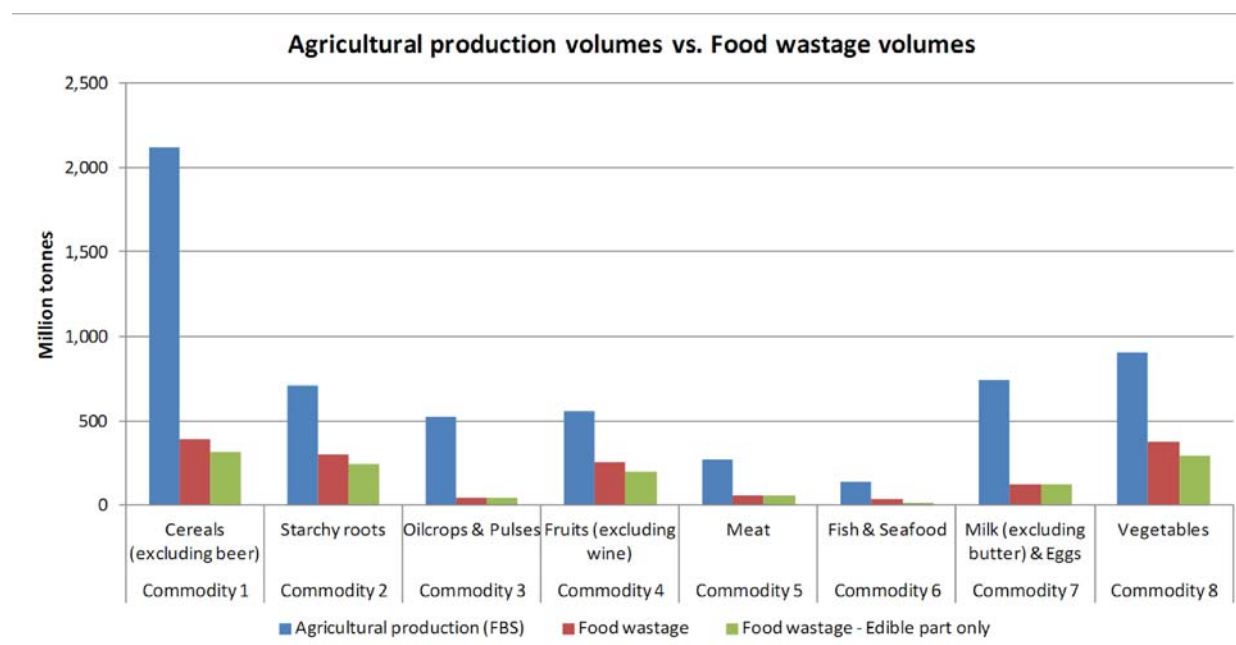
<sup>40</sup> Wasted Food “Lunchlady laments” [www.wastedfood.com/2007/05/22/recess/](http://www.wastedfood.com/2007/05/22/recess/)

## Annex 5 – The global perspective on food waste

The scale of the food wastage problem at global level to a certain extent mirrors that of the EU. The EU's relative part in this wider story has recently been presented in a 2013 FAO study. The FAO report on food waste<sup>41</sup> estimates that each year, approximately one-third of all food produced for human consumption in the world is lost or wasted. They stress that this food wastage represents a missed opportunity to improve global food security, but also to mitigate environmental impacts and resources use from food chains. They point out that: "The global volume of food wastage is estimated to be 1.6 Gtonnes of "primary product equivalents", while the total wastage for the edible part of food is 1.3 Gtonnes. This amount can be weighed against total agricultural production (for food and non-food uses), which is about 6 Gtonnes.

Without accounting for GHG emissions from land use change, the carbon footprint of food produced and not eaten is estimated to 3.3 Gtonnes of CO<sub>2</sub> equivalent: as such, food wastage ranks as the third top emitter after USA and China. Globally, the blue water footprint (i.e. the consumption of surface and groundwater resources) of food wastage is about 250 km<sup>3</sup>, which is equivalent to the annual water discharge of the Volga river, or three times the volume of lake Geneva. Produced but uneaten food occupies almost 1.4 billion hectares of land; this represents close to 30% of the world's agricultural land area. While it is difficult to estimate impacts on biodiversity at a global level, food wastage unduly compounds the negative externalities that mono-cropping and agriculture expansion into wild areas create on biodiversity loss, including mammals, birds, fish and amphibians."

The figure below shows the illustrates the amounts of food wastage along the food supply chain at the global level.



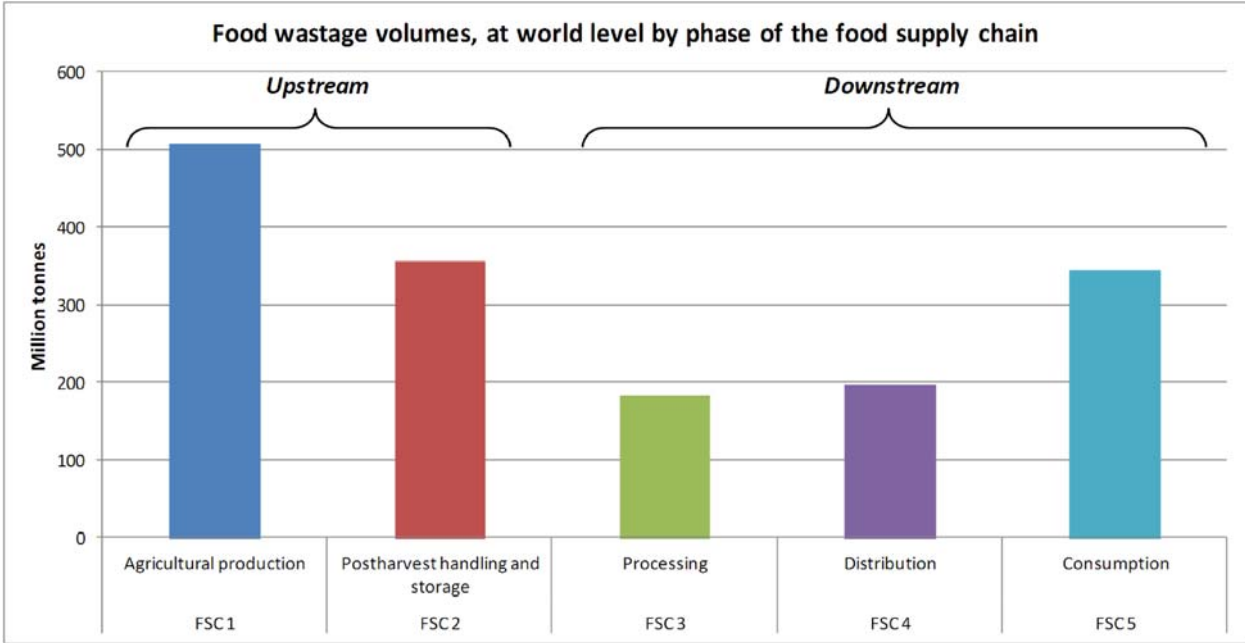
Agricultural production, at 33 percent, is responsible for the greatest amount of total food wastage volumes. Upstream wastage volumes, including production, post-harvest handling and storage, represent 54 percent of total wastage, while downstream wastage volumes, including processing, distribution and consumption, is 46 percent.

<sup>41</sup> <http://www.fao.org/docrep/018/i3347e/i3347e.pdf>

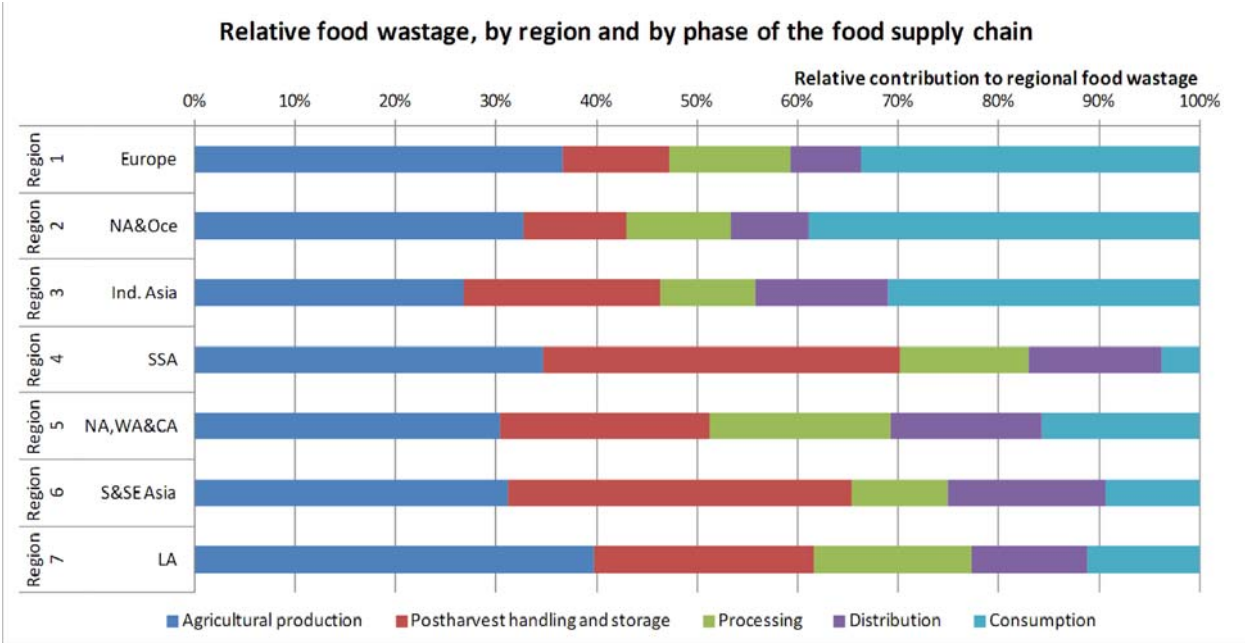
Thus, on average, food waste is balanced between the upstream and downstream of the supply chain. An analysis of the food supply chain phases by regions shows that:

- upstream, losses occurring at agricultural production phase appear homogenous across global regions, representing about one-third of each region’s food wasteage;
- downstream, wastage occurring at consumption level is much more variable, with wastage in middle and high-income regions at 31–39 percent, but much lower in low-income regions, at 4–16 percent.

The figure below shows the total agricultural production (FBS) vs. food wastage volumes (FAO)



Below is the same information broken down by global region.



The table shows that food wastage arises at all stages of the food supply chains for a variety of reasons that are very much dependent on the local conditions within each country.

At global level, a pattern is visible. In high-income regions, volumes of lost and wasted food are higher in downstream phases of the food chain, but just the opposite in low-income regions where more food is lost and wasted in upstream phases.

In developing countries, there are indeed significant post-harvest losses in the early stages of the supply chain, mostly because of the financial and structural limitations in harvest techniques, storage and transport infrastructures, combined with climatic conditions favourable to food spoilage. In the most affluent societies, there is a combination of consumer behaviour and lack of communication in the supply chain. For example, with consumers there can be insufficient purchase planning or exaggerated concern over “best-before dates”. As for actors in the supply chain, quality standards too restrictive, according to size or aesthetics, are responsible for a large amount of the food wasted at the end of the chain.

**Annex 6 - Food waste measures – indicative costs and sectors targeted**

Measure	Causes / drivers addressed (from problem tree)	Estimated cost	Who bears cost	Sector targeted	Examples / Further information on costs	Source											
				<table border="1"> <tr> <td>Agriculture</td> <td></td> </tr> <tr> <td>Manufacturing</td> <td></td> </tr> <tr> <td>Food Service</td> <td>x</td> </tr> <tr> <td>Retail</td> <td></td> </tr> <tr> <td>House holds</td> <td>x</td> </tr> </table>	Agriculture		Manufacturing		Food Service	x	Retail		House holds	x			
Agriculture																	
Manufacturing																	
Food Service	x																
Retail																	
House holds	x																
National awareness raising campaigns	awareness campaigns for consumers (f) -> (k), (3), (4) + food services (b), (c), (f) + (4)	+ / ++	National governments		WRAP's Love Food Hate Waste campaign in the UK had an estimated 700K€ startup cost and annual running costs of 2,350K€, covering advertising, PR, events and web materials	<a href="http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf">http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf</a>											
Retail communication towards consumers	awareness campaigns for consumers (f) -> (k), (3), (4)	+	Retailers	x	Estimates on costs of supermarket communication towards consumers on food waste was not identified, but several effective examples of supermarket campaigns were	<a href="http://www.sainsbury-live-well-for-less.co.uk/meal-planning/makeyourroast-gofurther/">http://www.sainsbury-live-well-for-less.co.uk/meal-planning/makeyourroast-gofurther/</a> ; <a href="http://www.morrisons.co.uk/food-and-drink/GreatTasteLessWasTe/">http://www.morrisons.co.uk/food-and-drink/GreatTasteLessWasTe/</a> ; the Co-operative "Food Lover" messages on till screens in the UK											



Sustainable food education in schools	awareness campaigns for consumers (f) -> (k), (3), (4) + food services (b), (c), (f) + (4)	+	National governments	x	x	x	x	A programme of food waste measurement, implementation of prevention and awareness measures and follow-up in a group of four schools, led by a third party association over a period of six months, costs in the range of 50-60K€ in France, as proposed by the food sustainability focused non-profit De mon assiette à notre planète.	<a href="http://www.assiette-planete.fr">http://www.assiette-planete.fr</a>
Incentives for redistribution	food redistribution programmes (b) + (4)	+ / ++	National governments	x	x	x	x	The cost to governments of providing tax incentives for food donation, specifically reducing or removing tax liability for donated food, is thought to be limited, but no data on this has been identified.	
Reducing barriers to redistribution	food redistribution programmes (b) + (4)	+	National governments	x	x	x	x	Legislation such as the Good Samaritan Law is thought to have a negligible cost. A new study has been commissioned by the European Economic and Social Committee on MS practices and legislation regarding food donation, which should bring further clarification on this in early 2014.	

Packaging innovation	research/development/innovation <b>(c), (h) + possibly (5)</b>	+ / ++	Manufacturers	x	x	x	Costs highly variable depending on the technology involved. A comparative assessment of packaging technologies, their potential to reduce food waste, their relative costs and any barriers to implementation, would support advancement here, on a topic much discussed but significantly lacking comparative data.	
Flexible portion sizes in food service	awareness campaigns for consumers (f) -> (k), (3), (4) + food services (b), (c), (f) + (4)	+	Food Service businesses	x			Sodexo have undertaken several activities testing alternative portion sizes in 2013, and may be able to provide information on the costs of these activities later in the year. Their Better Tomorrow Plan provides guidance for cafeterias on controlling portion size.	<a href="http://blog.sodexoprestige.co.uk/2011/10/28/food-waste-high-on-the-sodexo-sustainability-agenda/">http://blog.sodexoprestige.co.uk/2011/10/28/food-waste-high-on-the-sodexo-sustainability-agenda/</a>
Measurements and targets	waste measurement activity (4) (3), regulatory measure (4)	+ / ++	National governments	x	x	x	Costs will be mainly linked to measuring baseline and subsequent quantification activities.	<a href="http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf">http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf</a>



Landfill bans	regulatory measures (4)	++	All sectors	x	x	x	x	x	According to a 2010 WRAP study, the economic effect of a ban on food waste would depend largely on whether resultant biogas was used for electricity generation or not. Depending on this factor a landfill restriction could mean savings of up to £92 million, or a cost of £290 million, whereas a ban on unsorted food waste could mean savings of £340 million, or a cost of £1.3 billion.	<a href="http://www2.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Reportsearch.71d5b7d6.8796.pdf">http://www2.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Reportsearch.71d5b7d6.8796.pdf</a>
Pay as you throw	regulatory measures (4)	++ / +++	Local governments	x	x	x	x		Costs of implementing PAYT systems variable by MS	The Development of Pay-As-You-Throw Systems in Hellas, Estonia and Cyprus;  Guide for the Implementation of Pay-As-You-Throw Systems link
Separate collection of FW	regulatory measures (4)	++ / +++	Local governments	x	x	x	x	x	Costs highly variable based on system used, but can often be a profitable waste management venture. However, the cost of separate collection of bio-waste followed by anaerobic digestion is estimated at 80 to 125 €/tonne, compared to 55 €/tonne for the landfill of mixed waste.	<a href="http://ec.europa.eu/environment/eussd/pdf/biofoodwaste_report.pdf">http://ec.europa.eu/environment/eussd/pdf/biofoodwaste_report.pdf</a>

## **Annex 7 – Evidence on the extent to which food losses and waste may be reduced**

### ***Introduction***

This Annex is taken from a study commissioned by the European Commission on "Reducing food waste by households and in retail in the EU".<sup>42</sup> It considers by how much food losses and waste in the supply food chain can realistically be reduced.

As indicated by Parfitt (2011), among others, the potential for the reduction of food waste in the developed world lies all along the supply chain, up to and including the consumer at the end point: retailers (supermarkets), food services<sup>43</sup> (or catering industry) and consumers (households).

The figures on quantities of possible food waste reductions are scarce in existing literature, especially at the supply chain level, although there are numerous local initiatives on prevention of food waste in different Member States. The reason for this is that the concept of waste prevention is relatively new and has not yet been implemented into national law by Member States. In addition, food waste prevention initiatives often occur at local level and, given limited budgets, impacts are often not quantified.

Nevertheless, it is possible to review a variety of different strategies to reduce food waste, along with the indicative savings, or market value of the food not wasted, associated with them.

### ***Organisational solutions to reduce food waste***

The Italian food distribution sector throws away 238 thousand tonnes of food per year, worth €881m, which could feed 620,000 people a day (Barilla, 2012). Thus in Italy, several supermarket chains have intervened to reduce this food waste. As an example, the Coop Group set up the project 'Buon Fine o Brutti ma Buoni' (Good End or Ugly but Good) to recover unsold food products (due to defects in the packaging or because they are close to expiration), and donate this food to associations and non-profit organisations. In 2010 Buon Fine coordinated collection at 471 points of food sale (equivalent to 63% of the outlets of the nine large cooperatives of the Coop network), working with 1,009 non-profit organisations to save and redistribute more than 2,990 tonnes of food, worth €18m.

The University of Bologna in Italy founded the Last Minute Market (LMM) action-research activity, which later on became a business campaign aiming at the recovery of unsold (or un-marketable) goods for charitable organisations. LMM's activities address the recovery of food products, collection of surpluses from business and manufacturing activities, vegetables that were not harvested and remained in the field and ready-made meals recovered from the food service sector, such as schools and businesses. The actual results obtained by the Last Minute Market are (Barilla, 2012: p90):

- every day, 30 ready meals for the cafeteria are recovered from a hospital in Bologna, for a value of over €35,000 per year;
- in Verona, eight tonnes per year of cooked products, amounting to 15,000 meals, were recovered from eight school cafeterias;
- between 2010 and 2011, 43,000 meals were redistributed in the provinces of Bologna and Ravenna;
- Esselunga signed an agreement with the Food Bank Foundation for the collection of food and other surplus: food products were recovered for a value of €1m in 2009 (Barilla, 2012: p94).

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<sup>42</sup> <http://edepot.wur.nl/290135>

<sup>43</sup> Food services are businesses and companies responsible for any meal prepared outside the home. This includes restaurants, school and hospital cafeterias, catering operations, etc.

### ***Technological solutions to reduce food waste in retail***

To prevent food losses at the retail level, two UK retailers (Tesco and Marks & Spencer), are both testing the use of an ethylene-absorbing strip to prolong produce life. The strip uses a mixture of high-tech minerals and clay to absorb ethylene, the hormone that causes fruit to ripen and turn moldy, and the product is 100 times more effective than any competing materials. The retailers estimate it could save 1.6m packs of tomatoes, 350,000 packs of avocados, and 40,000 packs of strawberries (Gunders, 2012). Marks & Spencer use the strip inside its strawberry punnets. The strip extends fruit life by two days and makes the fruit taste just as good on day six as on day one. The result is a minimum waste reduction of 4% (Environmental Leader, 2012).

### ***Informational solutions to reduce food waste***

Musgrave Group/United Biscuits in the UK improved forecasting for promotional items and reduced promotional waste by 13%, and Warburtons in the UK removed 'display until' dates from its bread product packaging to reduce consumer confusion (Gunders, 2012).

### ***Reduction of food waste in the food service sector***

Marthinsen et al. (2012), in their study 'Prevention of food waste in hospitality sectors (restaurants, hotels, canteens and catering)', focus on Nordic countries, and conclude that it is difficult to specify a best estimate of the quantities of avoidable food waste from the hospitality sector in the Nordic countries. This is due to the following reasons:

- there are great variations in the estimates (because of differences of sampling and aggregation protocols, as stated previously);
- studies include different parts of the total food waste generated;
- many of the national reports only include data from a specific part of the hospitality sector.

The authors suggest that the estimates with reference to EUROSTAT data are the best available overall statistics. The uncertainty in the estimates is, however, significant and it includes food waste that is avoidable and that is unavoidable. Using the average rate for avoidable food waste for the profit sector of 67% (based on study of WRAP), the authors calculated the total avoidable food waste in Nordic countries in the hospitality sector (Table 2.5).

<b>Country</b>	<b>Total food waste (in tonnes/year)</b>	<b>Avoidable food waste (in tonnes/year)</b>
Denmark	140,000	94,000
Finland	140,000	94,000
Norway	140,000	94,000
Sweden	260,000	174,000
Total	680,000	456,000

Source: Marthinsen et al. (2012): 54 (Table 15).

The figures in Table 2.5 correspond fairly well with the figures in Table 2.2a for the countries involved. When applying that same average rate for avoidable food waste of 67% of total food waste across the EU27, the total avoidable food waste in food service and catering will be 8.2m tonnes. But the applicability of such an average conceals regional and national differences, as is evident from

Tables 2.2a and 2.2b, which may be very important to take into account when formulating corrective waste prevention policies and programmes.

According to SRA (2010) an average restaurant in the UK can reduce its food waste by 20%. The food waste mostly comes from preparation (namely 65%), from customers' plates (30%) and from out-of-date or unusable items (5%). That generates an average annual reduction of over 4 tonnes of food waste per restaurant, more than UKP2,000, from avoided food costs (by from using food that would normally have been thrown away), and between UKP150-1,700 on waste collection costs if food is collected for anaerobic digestion (SRA, 2010).

### ***Reduction of households food waste***

In 2008 the 'Love Food, Hate Waste' campaign<sup>44</sup> was launched in the UK and run by the government-funded Waste and Resources Action Programme (WRAP). In January 2009 the campaign claimed to have helped almost 2m households reduce their food waste, amounting to savings of almost UKP300m and stopping 137,000 tonnes of waste going in the bin, according to WRAP<sup>45</sup> (BIO, 2012b: p121). So the campaign achieved a nearly 3% reduction in avoidable household food waste (or 1.8% of total food waste) throughout the UK over a one-year period (BIO, 2011: p152).

The cost structure for the Love Food Hate Waste campaign consisted of approximately UKP600,000 (€705,000) in initial research to identify sources and causes of food waste, enabling an effective targeting of communication efforts. Ongoing running costs total approximately UKP2m (€2.4m) per year, including advertising, public relations, events, website maintenance and the production of new communication materials (BIO, 2011: p153).

About 45 to 49% of consumers in the UK misunderstand the meaning of the date labels 'best before' and 'use by' on food products. Food waste resulting from date label confusion accounts for up to 1m tonnes of food waste, approximately one fifth of the avoidable food waste produced by households in the UK (BIO, 2011: p142). The financial savings for households from throwing away less food were estimated by WRAP as UKP12bn (€14bn) per year in the UK, or an average UKP199 (€233) per person per year, by calculating the value of the avoidable fraction of food waste. Using the estimated 1m tonnes of food waste triggered by date labelling confusion, representing approximately 20% of avoidable food waste generated in the UK, potential savings to consumers can be estimated at up to UKP39.80 (€46.60) per person (BIO, 2011: p144). Date labelling coherence is anticipated to have the possibility to reduce generation of avoidable food waste in the household sector by up to 20% (BIO, 2011: p159). In comparison, people in the US, on average, throw away 20 pounds of food each month, which amounts to an annual loss of USD1,350 and USD2,275 for the average family of four (Gunders, 2012: p12).

### ***Adaptations to legislation and regulations***

Adaptations to legislation and regulations can significantly reduce food waste in two areas. First, by introducing compulsory best before dates for non-perishable products and by introducing a compulsory long expiration term for long-life products (Waarts et al., 2011: p73). Second, by extending the time that unpackaged food products intended for direct consumption may be exposed to the outside temperature (currently not more than two hours) in the catering sector would directly result in less food being thrown away (Waarts et al., 2011: p9). Adapting legislation in order to reduce food waste has a greater effect when social and economic interests are taken into account (Waarts et al., 2011: p10).

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<sup>44</sup> See <http://www.lovefoodhatewaste.com>.

<sup>45</sup> See also [http://www.edie.net/news/news\\_story.asp?id=15861&channel=0](http://www.edie.net/news/news_story.asp?id=15861&channel=0).

### *Food waste reduction public policy targets*

The Nordic countries and the Netherlands have set reduction targets in the short to medium term at a level that, if replicated in all high-income countries, would make the 50% food waste reduction target possible before 2050 in those countries. In Sweden a 20% food waste reduction target for 2020 was suggested, but this was not accepted by the government. This will be proposed again as part of their National Waste Prevention Programme to be delivered later this year. In the case of the Netherlands an intermediate target of 20% has been set for 2015.

For the UK a medium-term aspiration of a 10 to 15% reduction by 2015 would be quite achievable and give direction to voluntary agreements and have an impact on food waste from consumers (Foresight, 2011: 14).

France already has announced its 50% reduction goal of the volume of food waste by 2025, and furthermore proposes a national pact against food waste, signed by a wide range of leading stakeholders to signal their shared commitment.

In a recent press release, the Austrian Environment Ministry<sup>46</sup> has proposed a 20% food waste reduction target for 2016, but no baseline year has yet been stated.

Sweden's national goal for 2010 was that 35% of the food wastes from households, restaurants, large scale kitchens and shops shall be treated by biological methods such as composting and fermentation. This is not food waste prevention but a way to make better use of the food waste. The goal will probably be updated to 45% in 2015 and with the clarification that the waste should be treated so the plant nutrients are utilised (Stenmarck et al., 2011: p15).

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<sup>46</sup> See: [www.lebensministerium.at](http://www.lebensministerium.at)



## **Annex 8 – Details on food waste initiatives**

A number of different types of initiative exist in terms of tackling food waste. They can be classified by types of instruments as described below:

### ***Reduction at source***

#### **➤ Awareness campaigns**

A first step in engaging all sectors in food waste prevention, awareness-raising is critical to achieving results in this area. Awareness campaigns identified predominantly target households, although there are effective examples of campaigns in schools and involving restaurants.

#### **➤ Informational tools**

Several guides and handbooks have been created by public authorities, industry associations, and NGOs to help specific sectors minimise food waste generation. They describe good practices in the household, the retail environment or even specifically in pubs (public houses) to prevent waste.

#### **➤ Training programmes**

There are significant opportunities for teaching food waste prevention skills, particularly in the hospitality industry. One initiative identified provides consumer workshops on waste-free cooking, but a number of waste measurement initiatives also include provisions for food-service staff awareness-raising and training.

#### **➤ Logistical improvements**

Optimising operations to minimise food waste, logistical improvements in the Retail environment include stock management tools, selling food products near expiry at low cost, or preparing food products near expiry for sale at the deli counter (where most products are for immediate consumption).

In food service venues, logistical improvements may include reservation requirements for meals to help predict food quantities, satisfaction surveys in cafeterias to help food better meet customer preferences, and ordering flexibility in hospitals to avoid serving patients food they do not want.

#### **➤ Waste measurement activities**

Initiatives that engaged participants in waste measurement activities were significant among the study's findings, with eleven initiatives involving households and employees of cafeterias, restaurants and hotels in quantification and composition analysis of the food waste they generate. As noted earlier by WRAP's hospitality industry food waste expert, the act of measurement itself is often enough to stimulate food waste reductions, and because of its hands-on nature, is potentially more effective than information-based awareness-raising.

#### **➤ Research programme**

Research programmes frequently help stakeholders collaborate in developing new prevention methodologies for specific waste streams. Research on Time Temperature Indicators and meat quality assessments, as well as practical research on food waste prevention in hotels, for example, shows the range of possibilities for food efficiency improvements. Packaging also provides great scope for further research, in terms of opportunities for extending the shelf life of products. This may be achieved through testing the effects of certain types of packaging on specific products, as conducted at Morrisons Supermarkets' Packaging Laboratory, or may look at design features such as re-sealable packaging, interactive films, oxygen scavengers and modified atmospheres.<sup>47</sup>

### ➤ **Regulatory measures**

Regulatory measures such as public policies have enormous potential for preventing food waste, but at present very few have been identified. In Ireland, a regulation requiring that food waste from major commercial premises be segregated for separate collection will not only contribute to Ireland's achievement of Landfill Directive requirements, but as frequently discussed, will raise employee awareness of the food waste their business generates on a large scale. Furthermore, Commission Regulation (EC) No 1221/2008 of 5 December 2008, which entered into force on *1<sup>st</sup> July 2009*, and reduces the aesthetic requirements for many fruits and vegetables, should dramatically reduce food waste by allowing consumers to buy odd-shaped produce.<sup>48</sup>

## ***Approaches other than reduction at the source***

### ➤ **Food redistribution activities**

Food redistribution programmes, such as FareShare in the UK, collect food that would otherwise be discarded by retailers, because it is damaged or nearing expiry, and distribute it to a variety of groups in need, including the homeless, the elderly, children and other communities in food poverty. Quantities of edible, whole food items waste in the Wholesale/Retail sector are very large and present enormous opportunities to increase this sort of critical activity.

For-profit enterprises that collect unsellable food from retailers and resell it in other venues, such as discount stores, also effectively minimise food waste and its associated environmental impacts.

### ➤ **Industrial uses**

Several initiatives that converted waste food oil into biofuel were excluded from this study as this is a recycling process rather than waste prevention. However, industrial uses of otherwise inedible food might tentatively be included. An example here would be the Fish Chips created in Denmark, using inedible fish matter to create a marketable Omega 3 fatty acid rich snack; there are potentially many similar examples.

A breakdown of the types of instruments used can be seen below:

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<sup>47</sup> WRAP 'Household Food Waste': [www.wrap.org.uk/retail/food\\_waste/index.html](http://www.wrap.org.uk/retail/food_waste/index.html)

<sup>48</sup> COMMISSION REGULATION (EC) No 1221/2008 of 5 December 2008 : [eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:336:0001:0080:EN:PDF](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:336:0001:0080:EN:PDF)

A range of best practices are presented below in order to highlight the breadth of existing initiatives in food waste prevention. These should be considered in light of the impact assessment option 1 'baseline scenario' in light of the type of actions that are already underway.

### Love Food Hate Waste


#### *Promotion and awareness raising*

Actor responsible for the initiative:	WRAP	
Type of actor responsible for the initiative:	NGO	
Type of initiative:	Awareness campaign	
Main type of stakeholder targeted:	Households	
Country:	United Kingdom	
Geographic level of implementation:	National	
Year of implementation:	2008	

Love Food Hate Waste, an awareness campaign, sponsored by WRAP in the UK, aims at raising awareness on the need to reduce food waste, via the dissemination of information on reducing consumer and household food waste to achieve environmental and economic benefits. The focus of the campaign is on easy practical everyday activities which can lead to waste reduction. Since the campaign launched in 2008, WRAP estimates that 137,000 tonnes of food waste have been prevented.

### New Irish legislation on separate food waste collection (SI 508 of 2009)

#### *Separate collection of food waste*

Actor responsible for the initiative:	Ministry of the Environment	
Type of actor responsible for the initiative:	Public authority	
Type of initiative:	Public policy	
Main type of stakeholder targeted:	Businesses	
Country:	Ireland	
Geographic level of implementation:	National	
Year of implementation:	2009	

Designed to promote the segregation and recovery of food waste arising in the commercial sector, this regulation sets up the source separation of food waste from major commercial premises. The regulation facilitates the achievement of the targets set out in Directive 99/31/EC on the landfilling of waste notably as regards the diversion of biodegradable municipal waste (BMW) from landfill sites to composting and anaerobic digestion plants and to other forms of biological treatment.

## Approved Food


### *Food redistribution programme*

Actor responsible for the initiative:	Approved Food & Drink Company	
Type of actor responsible for the initiative:	Business	
Type of initiative:	Food redistribution programme	
Main type of stakeholder targeted:	Households	
Country:	United Kingdom	
Geographic level of implementation:	National	
Year of implementation:	2009	

Approved Food and Drink Company, a UK-based food redistribution programme, specialises in selling dry food products that are near or past their “best before” date at a discounted rate through their website. While sales and revenue figures are not available, the company has received a large amount of mass media publicity, indicating an impact on consumer awareness. The company represents an innovative private-sector approach to avoiding food waste via resale.

## ‘Buon Samaritano’ (Good Samaritan)

### *Food redistribution*

Actor responsible for the initiative:	Comune di Torino and Azienda Multiservizi Igiene Ambientale Torino SpA (Amiat), Associazione Banco Alimentare del Piemonte e Valle d’Aosta, Auchan, Sorico	
Type of actor responsible for the initiative:	Multi-stakeholder	
Type of initiative:	Food redistribution programme	
Main type of stakeholder targeted:	Schools, retailers	
Country:	Italy	
Geographic level of implementation:	Local	
Year of implementation:	2005	

Comune di Torino and Amiat have implemented the “Good Samaritan” project, which collects uneaten meals from school canteens and products that are still edible from supermarkets and donates them to charity organisations to prevent them from being sent to landfill sites. According to the organisation, every day it is possible to recover 150 kilos of bread and 50 kilos of fruit to prepare approximately a thousand meals. Over the years the amount of food recovered has increased significantly, reaching more than 25,000 kilograms of bread and nearly 13,500 kg of fruit in the school year 2007 to 2008. In total in 2008, the organisation recovered over 81,000 kg of food.

## Cooperative framework for supply chain improvement

### *Voluntary agreements*

Actor responsible for the initiative:	Wageningen University and Research Centre	
Type of actor responsible for the initiative:	Multi-stakeholder	
Type of initiative:	Voluntary agreement, logistical improvement	
Main type of stakeholder targeted:	Manufacturers, retailers	
Country:	Netherlands	
Geographic level of implementation:	National	
Year of implementation:	2006	

In 2006, there was a commitment from industry of 20 million euros to work on food waste issues. To fulfil this commitment, Wageningen University and Research Centre works with government actors and businesses to optimise supply chain processes for private sector companies, using a process of monitoring, modelling, fact finding, scenario analysis and business model integration. Wageningen University, among other research organisations, provides expertise to help businesses to understand the primary opportunities for waste reduction in their supply chains and to incorporate long-term processes for waste reduction in their production activities.

## Eurest restaurant food waste campaign

### *Waste data disclosure*


Actor responsible for the initiative:	Eurest	
Type of actor responsible for the initiative:	Food service	
Type of initiative:	Waste measurement programme, awareness campaign	
Main type of stakeholder targeted:	Business	
Country:	Sweden	
Geographic level of implementation:	National	
Year of implementation:	Not available	

150 units of the Eurest catering organization are participating in efforts to quantify food waste, publicise results to staff and customers, and explain the impacts of food waste and how it can be prevented, including using a spreadsheet to measure waste, with a graph entitled “so much waste we produce every single day” which is available to guests and staff. Through these types of initiatives and by having units measure waste once a month, Eurest has reached 22,055 guests. The initiative, which has been continuing for over half a year, has led to a reduction of 23% in food waste quantities produced.

During the European Week for Waste Reduction, 25 Eurest restaurants and 2 coffee shops in 15 different locations in Sweden weighed and measured the waste resulting from food preparation and made available this information to staff and guests.

## Réduisons nos déchets


### *Awareness campaign*

Actor responsible for the initiative:	ADEME (Environmental Agency)	
Type of actor responsible for the initiative:	National authority	
Type of initiative:	Awareness campaign	
Main type of stakeholder targeted:	Households	
Country:	France	
Geographic level of implementation:	National	
Year of implementation:	2005	

ADEME's national awareness campaign aimed at informing households about waste production and prevention has been in place since 2005 and uses multiple communication channels: online resources, radio broadcasts, etc. The website offers specific practical tips for food waste-related reduction at home and while shopping. No specific results are available but the stated goal is to target the reduction of the 390 kg of waste produced annually in France via individual adoption of simple behavioural changes.

## 'Great Taste, Less Waste'

### *Awareness campaign*

Actor responsible for the initiative:	Morrisons Supermarkets	
Type of actor responsible for the initiative:	Retailer	
Type of initiative:	Awareness campaign	
Main type of stakeholder targeted:	Households	
Country:	United Kingdom	
Geographic level of implementation:	National	
Year of implementation:	2009	

Following on a survey conducted of their customers, Morrisons Supermarkets found that two thirds of UK households are allowing fruit to go to waste by keeping it in the fruit bowl instead of the refrigerator, where it can last up to fourteen days longer. The same survey found that customers wanted to help more to reduce food waste, with 67% of customers stating that supermarkets have a duty to ensure the right packaging so that food stays fresh, but only 12% believing that supermarkets "get packaging right".

The survey led Morrisons Supermarkets, in 2009, to instate a campaign to help customers reduce food-related waste. The initiative has included providing storage advice, offering 'market street' portion choice, providing information on labelling, distributing tips for leftover cooking and 'packaging laboratory: keep it fresh' tests to identify what type of packaging can extend the life of specific fruit and vegetables. Activities are coordinated in-store and information is disseminated in the store as well as through the supermarkets' website and magazine. The campaign has the stated goal of helping customers reduce the on average £600 of food thrown out per household annually.

## Fish Chips

### *Industrial uses*


Actor responsible for the initiative:	Hospitality industry partnership	
Type of actor responsible for the initiative:	Business	
Type of initiative:	Industrial uses	
Main type of stakeholder targeted:	Manufacturers	
Country:	Denmark	
Geographic level of implementation:	National	
Year of implementation:	2009	

Hospitality and restaurant sector players in Denmark formed a partnership, using state and EU fisheries development funds, to develop an Omega 3 rich fish chip product from otherwise inedible fish waste. As of the end of 2009, the team was in the final stages and testing, having already negotiated agreements with manufacturers and buyers. While concrete results are not yet available, given that over 50% of fish is discarded as inedible waste in Denmark, according to a 2010 CRI study, this is an excellent use for a product that would otherwise be food waste.

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## 'Calling Time on Waste'

### *Informational tool*


Actor responsible for the initiative:	National Waste Prevention Programme by EPA	
Type of actor responsible for the initiative:	National authority	
Type of initiative:	Informational tool	
Main type of stakeholder targeted:	Business	
Country:	Ireland	
Geographic level of implementation:	National	
Year of implementation:	No start date identified	

The widely-disseminated brochure titled 'Calling Time on Waste', prepared and published by the National Waste Prevention Programme run by Ireland's EPA, is a guide on resource efficiency in the bar trade. The document, which spans approximately twenty pages, breaks down various waste streams which occur in bar/restaurant settings, explains their impact, provides practical tips for their reduction and prevention, and offers a succinct waste management checklist. The brochure also frames waste prevention in economic terms, offering examples such as "By re-tendering for waste collection, implementing a source segregation scheme and reducing food waste a pub saved €4000 per annum on waste charges".

<sup>49</sup> Danish Environmental Protection Agency (2010) *Feasibility study of food waste in Denmark*

## 'Anti-waste workshops' - Cooking Classes

### *Training program*

Actor responsible for the initiative:	Bruxelles Environnement	
Type of actor responsible for the initiative:	Local authority	
Type of initiative:	Training program	
Main type of stakeholder targeted:	Households	
Country:	Belgium	
Geographic level of implementation:	Local	
Year of implementation:	2009	

Bruxelles Environnement, a local authority in Brussels, has put in place a training program geared at helping households to reduce their food waste production via cooking training. The cooking workshops are offered for free to the local community and highlight techniques for and benefits of reducing food waste. 1000 people were trained in 2009.

## Green Hospitality Award Scheme

### *Waste measurement programme*

Actor responsible for the initiative:	National Waste Prevention Programme by EPA	
Type of actor responsible for the initiative:	National authority	
Type of initiative:	Waste measurement programme	
Main type of stakeholder targeted:	Hospitality	
Country:	Ireland	
Geographic level of implementation:	National	
Year of implementation:	2008	

The Green Hospitality Award (GHA) Scheme, for the hotel and catering sector, organised by the National Waste Prevention Programme, a part of the Irish EPA, involves waste measurement and waste reduction targets, with a specific focus on food waste, with an award for top-performers.

GHA now has a membership of 150 hotels and 10 major catering businesses all working to reduce waste/energy/water use including food waste. 100 of these will achieve award status in 2010. 120 properties were surveyed in 2009 and showed a 6,000 tonne reduction in waste; while no breakdown of this figure is available in relation to food waste, food waste does compose a large percentage of waste produced in this sector.



## Phasing out of EU Commission Regulation (EC) No 1221/2008

### *Public policy*

Actor responsible for the initiative:	European Commission	
Type of actor responsible for the initiative:	Public authority	
Type of initiative:	Public policy	
Main type of stakeholder targeted:	Businesses	
Country:	Europe	
Geographic level of implementation:	European	
Year of implementation:	2009	

With Commission Regulation (EC) No 1221/2008 of 5 December 2008, the European Commission approved the phasing out of regulations on the size and shapes of fruit and vegetables. This legislative change reduces the aesthetic requirements for many fruits and vegetables thereby preventing the unnecessary discard of various types of produce, which are aesthetically imperfect but perfectly edible. This change should lessen the burden of legislation as well as allowing shoppers more choice by ensuring that fruits and vegetables with slight abnormalities will not be thrown away.

The current list of fruit and vegetables impacted are: apricots, artichokes, asparagus, aubergines, avocados, beans, Brussels sprouts, carrots, cauliflowers, cherries, courgettes, cucumbers, cultivated mushrooms, garlic, hazelnuts in shell, headed cabbage, leeks, melons, onions, peas, plums, ribbed celery, spinach, walnuts in shell, water melons, and witloof/chicory. The exception from marketing standards could be extended to another ten products such as apples, citrus fruit, kiwi fruit, lettuces, peaches and nectarines, pears, strawberries, sweet peppers, table grapes and tomatoes to further reduce the production of food waste due to aesthetical concerns.

## FareShare

### *Food redistribution programme*

Actor responsible for the initiative:	FareShare	
Type of actor responsible for the initiative:	NGO	
Type of initiative:	Food redistribution programme	
Main type of stakeholder targeted:	Multi-stakeholder	
Country:	United Kingdom	
Geographic level of implementation:	National	
Year of implementation:	2004	

In place since 2004, the FareShare charity promotes the message that “no food good should be wasted”, diverting edible food and drink products from industry organisations to disadvantaged populations. The organisation also provides warehouse training for the unemployed and helps food industry businesses to track and reduce their greenhouse gas emissions.

The organisation redistributed food contributing to 7.4 million meals in 2008/9, and helped businesses reduce their CO<sub>2</sub> emissions by 13,950 tonnes during the same period. FareShare's future goal is to redistribute 20,000 tonnes of food annually and to support 100,000 vulnerable people every day.

## Tesco ‘Buy One Get One Free Later’


### *Logistical improvements*

Actor responsible for the initiative:	Tesco	
Type of actor responsible for the initiative:	Retailer	
Type of initiative:	Logistical improvements	
Main type of stakeholder targeted:	Business	
Country:	United Kingdom	
Geographic level of implementation:	National	
Year of implementation:	2010	

As part of their pledge to not send any waste to landfill this year and specifically to target food waste reduction, grocery retailer Tesco launched a ‘Buy One Get One Free Later’ initiative to allow customers buying perishable goods to collect their free item the following week. The programme works through a voucher system; products included in the initiative are those which are considered “short-code life-perishable products” with short sell dates such as yoghurts, salads, vegetables and cheese. The initiative does not include products with longer sell dates such as cans of beans and pasta sauce. While specific results are not available, a Tesco spokesperson highlighted the double benefit of food waste reduction for the supermarket and its customers as well as increased customer flexibility.

## 'A la carte' menu

### *Logistical improvements*

Actor responsible for the initiative:	Hvidovre Hospital	
Type of actor responsible for the initiative:	Hospital	
Type of initiative:	Logistical improvements	
Main type of stakeholder targeted:	Hospitals	
Country:	Denmark	
Geographic level of implementation:	Local	
Year of implementation:	2008	

Hvidovre Hospital, in Denmark, led by chef Mogens Pedersen Fonseca, changed how food services are operated to reduce food waste produced via the previously rigid patient catering system. Following on four years of extensive work to modify the kitchen and hospital facilities and rethink the cooking strategy, Mogens Fonseca Pedersen and his one hundred employees were able to offer anytime 'à la carte' order options to patients, while remaining within budget limitations. The programme has helped the hospital avoid 40 tonnes of food waste per year, and the 'à la carte' style encourages portion management; money saved through the initiative has been reinvested to further reduce food waste and improve quality of hospital food services.

## Food and Drink Federation's Five-fold Environmental Ambition

### *Multi-project*

Actor responsible for the initiative:	Food and Drink Federation, WRAP	
Type of actor responsible for the initiative:	Association	
Type of initiative:	Multi-project	
Main type of stakeholder targeted:	Business	
Country:	United Kingdom	
Geographic level of implementation:	National	
Year of implementation:	2007	

The Food and Drink Federation's Five-fold Environmental Ambition started with member commitments to play a role in tackling climate change by reducing CO<sub>2</sub> emissions by 20% by 2010 against a 1990 baseline, sending zero food and packaging waste to landfill from 2015, making significant reductions in levels of packaging reaching households in line with WRAP's Courtauld Commitment, embedding environmental standards into food transport practices and reducing overall transportation and reducing waste use.

The association has already made progress on the waste portion of the Ambition, to send zero food and packaging waste to landfill from 2015. Members established baselines from their 2006 waste volumes and have since this initial reporting prevented more than half a million tonnes of food waste from being created. The project has also included a joint initiative with WRAP to carry out waste prevention reviews at thirteen member company sites across the UK, working closely with FareShare, to encourage member food redistribution and encouraging members to sign up for the original Courtauld Commitment which seeks to reduce domestic food waste by 155,000 tonnes by 2010 as compared to 2008.

## Annex 9 – Food waste targets / related activity in Member States.

The Waste Framework Directive<sup>50</sup> (Article 29) requires Member States to establish waste prevention programmes, including determining “appropriate specific qualitative or quantitative benchmarks for waste prevention measures adopted in order to monitor and assess the progress of the measures and may determine specific qualitative or quantitative targets and indicators”. Based on the best information known on Member State activities / target setting at this time, so far five Member States have set targets for food waste, and one has something in the pipeline. None are currently binding.

The following table summarises the on-going activity currently taking place in Member States at this time:

Member State	National target? If yes, level / date.	Other information relevant for food waste prevention activity.
Austria	20% (2016) non-binding	Government has a 'commitment' to reduce food waste in households by 20% by 2016.  In 2011 the new Austrian Federal Waste Program was published which also included a food waste prevention programme (beside other prevention programs). As one consequence of the programme, this year the Austrian government has committed to a 20% reduction in food waste in residual waste to landfill by 2016 as well as a reduction of food waste along the whole food supply chain. The campaign which was implemented to raise awareness is called: "Lebensmittel sind kostbar". <sup>51</sup>
Belgium	No	Brussels region : Households: Reduce food waste by 5 kg/inhab/yr Business: Reduce food waste by 6 kg/worker/yr Schools: Reduce food wastage by 3 kg/student/yr Analyses of the residual waste bin in Brussels show that 12% is food, some partially eaten and some still perfectly intact. This represents 15 kg of food per person per year, or 15,000 tonnes for the Brussels Region as a whole.  Brussels Environment has carried out pilot projects showing that it is possible to reduce this wastage by almost 80% simply by paying a little attention to our habits in purchasing and preserving food. <sup>52</sup>
Bulgaria	No	While no specific targets set on food waste Bulgaria has transposed the Waste Framework Directive into national law by the Waste Management Act, promulgated in SG 53/ 13 July 2012.  There is a National Strategic Plan that aims for the gradual reduction of the amount of biodegradable waste going to landfill.

<sup>50</sup> <http://ec.europa.eu/environment/waste/legislation/a.htm>

<sup>51</sup> [http://www.lebensministerium.at/lebensmittel/kostbare\\_lebensmittel/lebensmittelkostbar.html](http://www.lebensministerium.at/lebensmittel/kostbare_lebensmittel/lebensmittelkostbar.html)

<sup>52</sup> [http://www.bruxellesenvironnement.be/uploadedFiles/Contenu\\_du\\_site/Professionnels/Formations\\_et\\_s%C3%A9minaires/Conf%C3%A9rence\\_Pre-waste\\_2011\\_\(actes\)/w-bruxellesenvironnement-wasteplanEN.pdf](http://www.bruxellesenvironnement.be/uploadedFiles/Contenu_du_site/Professionnels/Formations_et_s%C3%A9minaires/Conf%C3%A9rence_Pre-waste_2011_(actes)/w-bruxellesenvironnement-wasteplanEN.pdf)

		A waste prevention programme will be part of the new waste management plan for the period 2014-2020 that will be adopted during Dec 2013. It is not clear if this will contain targets relating to food waste. (Municipal Waste Management in Bulgaria– European Environment Agency Feb 2013 ).
Croatia	No	According to Eurostat data, the level of organic recycling is very low, only 1 % or 13 000 tonnes in 2010 and 12 487 tonnes in 2009. The material recycling is also low and was only 3 % or 53 000 tonnes in 2010 (CEA, 2012a). The national waste management strategy sets a target of 18 % for separate collected and recycled municipal waste in 2020 and 25 % in 2025 (EEA, 2010). In addition, it is planned to treat municipal waste by MBT plants and one incineration plant. The aim is to reduce landfilling to only residual waste (EEA, 2010; CEA, 2011a).
Cyprus	No	The total recycled MSW as a percentage of generated MSW doubled in the decade between 2001 and 2010, increasing from around 10 % to 20 %. In 2010, 4 % of MSW was composted. Although Cyprus has transposed all EU legislation, it faces difficulties in its implementation, mainly due to lack of infrastructure, mixing of responsibilities among the authorities and absence of sufficient monitoring of the waste management system. (Municipal Waste Management in Cyprus – European Environment Agency Feb 2013).
Czech Republic	No	Biodegradable and/or compostable waste can be landfilled only as a part of the mixed municipal waste. A bio-waste strategy is in place, but exact requirements still under consideration. Exact reduction targets, schedule, implementation measures, investments, etc. have to be agreed on (being reliable on long term basis) and have to be communicated to investors and stakeholders.
Denmark	No	The Charter of Less Food waste has been prepared by a group of committed companies and organizations who want to avoid unnecessary waste of the planet's resources. Minister for the Environment established in March 2011 "Initiative against food waste", and in June 2011 could be group present Charter. Supports up on the Charter Announcing the Charter was signed by the 19 parties that have been involved in the development of the Charter. <sup>53</sup>
Estonia	No	An objective to reduce waste sent to landfill by 30% by 2030 has been set but there is no specific food waste prevention element to this. <sup>54</sup>
Finland	No	Stabilise the amount of municipal waste at the level of the early years of this century (2.3-2.5 million tonnes annually) and ensure that the trend will be downwards by the year 2016.
France	50% (2025) non-binding	The French government has committed to a 50% reduction in food waste by 2025, as part of the French National Pact against Food Waste, which will be published in June and presented by the Ministry of Agriculture at the Fusions NW Regional Meeting. <sup>55</sup>
Germany	50% (2020) non-binding	This 50% target seems to have been launched as part of a 2012 campaign, so this could be assumed to be the baseline year. <sup>56</sup>

<sup>53</sup> <http://mindremadspild.dk>; <http://www.stopspildafmad.dk/inenglish.html>

<sup>54</sup> [http://www.envir.ee/orb.aw/class=file/action=preview/id=1103821/inglise\\_keeles\\_tegevuskava.pdf](http://www.envir.ee/orb.aw/class=file/action=preview/id=1103821/inglise_keeles_tegevuskava.pdf)

<sup>55</sup> <http://alimentation.gouv.fr/garot-gaspillage-alimentaire>

<sup>56</sup> [http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Anti%20Food%20Waste%20Movement%20Gets%20Government%20Support\\_Berlin\\_Germany\\_3-7-2013.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Anti%20Food%20Waste%20Movement%20Gets%20Government%20Support_Berlin_Germany_3-7-2013.pdf)

Greece	No	<p>However, recycling of MSW in Greece has increased by more than 10 % over the last 10 years. This increase is mainly due to concentrated efforts on material recycling, while organic recycling is still very low. Composting seems to play a minor role in MSW treatment with no more than 2 % of MSW composted, Greece has decided to tackle the issue of landfilling biodegradable MSW by introducing MBT technology in many parts of the country (two plants are operating). (Municipal Waste Management Greece, European Environment Agency – Feb 2013)</p>
Hungary	No	<p>The country's performance in terms of MSW recycling has been improving dramatically over the last decade from close-to-zero (2 % in 2001) to 21 % in 2010. Composting and other biological treatment together accounted for only about 4 percentage point out of the 21 % recycling.</p> <p>The First National Waste Management Plan 2003–2008 sets targets on reducing BMW going to landfill in line with the EU Landfill Directive, and the first two interim targets were met. The Second National Waste Management Plan for 2009-2014 has not been officially approved, thus there is no NWMP in place.</p>
Ireland	No	<p>The Resource Opportunity (2012) policy document promises the introduction of Household Food Waste Regulations ensuring the separate collection of organic waste from households and requiring households to make use of the collection (DECLG, 2012a).</p> <p>National Strategy on Biodegradable Waste (2006) proposes that, by 2016, recycling (principally of paper and cardboard waste which cannot be reused) will divert 875 371 tonnes (38.6 %) from landfill with biological treatment (mainly food and garden waste) contributing 442 129 tonnes (19.5 %) to the overall target. It also established a longer term target of 80 % diversion of biodegradable waste from landfill.</p>
Italy	No	<p>Legislative Decree 36/2003 transposed the Landfill Directive it includes the following target - Before 27 March 2018: landfill of biodegradable municipal waste must be reduced to below 81 kg per inhabitant per year.</p>
Latvia	No	<p>As of Feb 2013 pilot projects on bio-waste treatment (collection and composting) have been introduced. The current waste management plans contain targets for municipal waste management until 2020 (EEA, 2010) and includes a target to decrease the amount of landfilled biodegradable waste in accordance with the Landfill Directive.</p>
Lithuania	No	<p>The vast majority of municipal waste in Lithuania is still landfilled. Since 2004, the recycling rate of MSW has slightly increased, but the overall recycling level is still particularly low (5% in 2010). The requirements for the technical compost and its usage was adopted in 2012 and will enter into force in January 2013.</p>
Luxembourg	No	<p>Achieved 100 % population coverage for the separate collection of organic waste and achieve an organic waste: 75 % recycling rate. They have integration of energy recovery of organic waste (bio-methanisation) in the national energy policy.</p>
Malta	No	<p>The overall treatment of MSW in Malta is characterised by high amounts of landfilling (82 %) and low amounts of recycling (13 %) in 2010; In 2010, a renewed 'Solid Waste Management Strategy' came into force promoting the adoption of 9 policy objectives for improving waste management performance in Malta. Policy objectives include: urging for waste minimisation (setting a target</p>

		of 1.5 % waste generation reduction per annum), the promotion of producer responsibility, and calling for more recycling and separation of biodegradable waste. The consultation paper for the Waste Management Plan 2014 to 2020 does not highlight food waste as an issue or propose any targets
Netherlands	20% by 2015 (non-binding)	Governmental vision on sustainable consumption and production of food. The Ministry of Agriculture, Nature and Food Quality is aiming to achieve a 20% reduction in food waste by 2015, targeting the consumer and agro-chain. <sup>57</sup>
Poland	No	<p>The total recycling increased from 5 % in 2004 to 21 % in 2010. Organic recycling has only increased from 2 % to 7 % in the same period equivalent to an increase from 230 000 tonnes to 790 000 tonnes. This increase in organic recycling has taken place within 2009 and 2010.</p> <p>The current national waste management plan 2014 also suggests that an important measure to increase recycling is to increase the charges for the landfilling of mixed waste, biodegradable waste and waste that can be subject to recovery (Poland, 2010). The significant increases of landfill taxes for MSW in 2008 appear to have already given strong incentives for diverting MSW from landfills.</p>
Portugal	No	One government scenario envisions a 10% reduction in the per capita generated waste levels of 2007 by 2016 - this reduction could be considered as an overall quantitative target. <sup>58</sup>
Romania	No	Recycling of municipal waste has started recently and the recycling rate is still very low (2 %); organic waste is recycled in very small amounts (Municipal Waste Management in Romania, EEA, Feb 2013).
Slovakia	No	<p>The waste management plan of Slovakia for 2011-2015 includes measure to increase reuse and recycling and reduce the landfill of BMW.</p> <p>Separate collection of bio-waste: Since 2006, there is a ban for landfilling and burning, as well as incineration of biodegradable waste from public and private green spaces and gardens. By 2013, Slovakia wants to establish an effective separate collection of kitchen, canteen waste and biodegradable waste from public and private green spaces and gardens (consistent with the Strategy to reduce biodegradable municipal landfilling) [MoE 2011-2015].</p> <p>The total increase of recycling is linked both to material and organic recycling, but the share of organic recycling is higher. Organic recycling has increased from 1 % (17 000 tonnes in absolute amount) in 2001 to 5 % (91 000 tonnes) in 2010. In the same period, material recycling has seen a slightly lower increase – from 1 % in 2001 to 4 % in 2010.</p> <p>The amount of material recovery including composting and energy recovery of municipal waste is very low and did not substantially approach the target set in the WMP until 2010. Slovakia therefore sees a need to extend separate collection as well as improve the level of home composting (EEA, 2010).</p> <p>The Waste Act establishes a deadline for the introduction of separate waste collection for waste paper, plastics, metals, and glass, but not for bio-waste. Separate collection of bio-waste will be introduced by a new amendment of Waste Act which should enter into force on 1 January 2013. (SK, SEA, 2012) (Municipal Waste Management in Slovakia, EEA, Feb 2013)</p>

<sup>57</sup> <http://www.lei.dlo.nl/publicaties/PDF/2011/2011-059.pdf>

<sup>58</sup> [http://scp.eionet.europa.eu/facts/WPP/quantitative\\_targets](http://scp.eionet.europa.eu/facts/WPP/quantitative_targets)



Slovenia	No	Two important documents are in the drafting phase at the moment: the National Waste Management Plan of the Republic of Slovenia as well as the Operative Program for Municipal Waste Management. It is expected that these documents will be a basis for considerable improvements of MSW in Slovenia in years to come. (Municipal Waste Management in Slovakia, EEA, Feb 2013). No waste prevention targets for specific waste streams were specified in the 2009 plan. Some exact targets were set for reuse and recycling for WEEE and batteries and accumulators.
Spain	No	In December 2008, the second National Solid Waste Management Plan 2008-2015 updated and reintroduced some of the concepts of the previous plan and set ambitious targets for the 7-year period. Specifically it set the three 'R's (reduce, re-use, recycle) framework as the main driver of Spanish waste management and set out the guidelines and the main measures to be implemented, which are developed in thirteen specific plans for each type of waste (CIRIEC, 2010).
Sweden	No (but in pipeline)	Sweden is planning a target for food waste in 2014. In the consultation draft from May 2013 <sup>59</sup> it was stated: Food waste in the food chain have to be reduced compared to 2010. The Government have asked the Swedish EPA to propose a quantitative target by January 2014.
United Kingdom	4% by 2012. In England only. Non-binding.	<p>In England, the government has committed to two sector agreements: Courtauld Commitment 2 (2010-12):</p> <ul style="list-style-type: none"> <li>• To reduce UK household food and drink waste by 4%.</li> <li>• To reduce traditional grocery product and packaging waste in the grocery supply chain by 5% - including both solid and liquid wastes.</li> </ul> <p>Measurement of the Courtauld Commitment 2 targets is from January 2010 to December 2012 against a 2009 baseline.</p> <p>The Welsh Government has set ambitious targets to achieve zero waste by 2050. They have committed to reducing their waste arisings by around 1.5% (of the 2007 baseline) each year across all sectors in order to achieve our one planet goal for 2050.<sup>60</sup></p> <p>In Scotland, the Zero Waste Plan (launched 2010) sets two targets that will apply to all waste: 70 per cent target recycled, and maximum 5 per cent sent to landfill, both by 2025. It also proposes the development of a Waste Prevention Programme for all wastes, ensuring the prevention and reuse of waste is central to all our actions and policies.<sup>61</sup></p>

<sup>59</sup> <http://www.naturvardsverket.se/upload/stod-i-miljoarbetet/rattsinformation/remisser/2013/avfallsforebyggande-programmet/avfallsforebyggande-programmet-remiss-forslag-program-20130502.pdf>

<sup>60</sup> <http://wales.gov.uk/docs/desh/publications/100621wastetowardszeroen.pdf>

<sup>61</sup> <http://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Waste-1/wastestrategy>

## **Annex 10 - Detailed analysis of option 1: take no additional action**

This analysis involves the forecasting of future food waste volumes based on the current scenario and taking into account impacting factors such as population growth, disposable income, policy and prevention initiatives as well as environmental impacts. This annex comprises the following sections:

1. Food waste and population growth – the baseline scenario
2. Food waste and disposable income
3. Food waste and policy impact
4. Food waste and prevention initiatives
5. Food waste and environmental impacts
6. Other environmental impacts

### ***Key findings***

Using available EU statistics this analysis shows that food waste quantities overall and on a per capita basis are anticipated to increase significantly due to population growth and increasing affluence. In the baseline year – 2006 - food waste produced in the EU was approximately 89.3 million tonnes; **by 2020 estimates suggest this will increase to 126.2 million tonnes**, presenting an increase of 36.9 million tonnes.

Earlier findings of this study, notably that food waste prevention initiatives are often at a local level and that there is a lack of information regarding the level of impact achieved, result in a serious difficulty in forecasting the impacts resulting from these activities. The majority of initiatives are indeed very recent and very few have measured results. On this basis, no impact due to food waste prevention initiatives has been applied to the data in the forecasting, but some impact should be assumed none-the-less – in the respect the final figures in the 'take-no-action' option should be considered as a worst case scenario.

Accompanying the increasing quantities of food waste will be **positive growth in greenhouse gas emissions, accounting for an additional 70.2 million tonnes of carbon dioxide equivalent gases emitted in 2020**, in comparison with 2006 levels. This brings the total annual food waste related emissions to 240Mt in 2020.

Policies to divert food waste from landfill will not tackle the big issue of food waste generation. The impact of waste policy on food waste generation is neutral in terms of the absolute amounts of waste being generated. Waste policy does however, have a considerable impact on the treatment of food waste once it has been generated. This work predicts that by 2020 the amount of food waste sent to landfill will decrease from 40.4 million tonnes to 4.0 million tonnes in compliance with policy. Based on the forecasts, this leaves an estimated 122.2 million tonnes of food waste across the EU27 by 2020 to manage via other residual

treatment technologies. This is a significant quantity of waste, all of it generating substantial amounts of greenhouse gas emissions. A key issue for the future is thus how to treat this 122.2 million tonnes of food waste via other technologies or whether to expend considerable and sustained efforts to secure the benefits of waste prevention.

### ***Methodology***

In order to consider the future growth and impact of food waste and its economic, environmental and social impacts involved the projection of the levels of food waste in the EU over a 15 year period (2006-2020). In order to make this analysis a Microsoft Excel model was built, based on the available statistics, namely: food waste, social-economic and environmental impact data. The model has been built taking into account the estimated impact of four sets of factors on food waste tonnages:

- Anticipated socio-economic changes (such as disposable income and population growth)
- Potential impacts of existing European policy instruments
- Impacts of food waste prevention activities already in place
- Environmental impacts of anticipated food waste treatment options

### ***Key uncertainties and assumptions***

The forecast is based on 2006 food waste data. This figure was scaled up using EUROSTAT population growth estimates through to 2020, and is used as a baseline scenario for the forecast. As there is no historical food waste data available and estimates are based mainly on 2006 data points, there is inevitably a degree of uncertainty with the estimates.

In all projections, similar estimates and projections for disposable income<sup>62</sup>, policy impacts, etc. have been assumed for EU12 and EU15 countries, i.e. a uniform increase in disposable income for both EU12 and EU15 countries. It is understood that this is an assumption warranting closer scrutiny (as current economic conditions across Europe make accurate economic predictions highly uncertain) and further research would be needed to improve the estimates and to establish the extent and impact of regional variations.

#### **1. Food waste and population growth – the baseline scenario**

The historical population data, as well as annual population projections until 2020, are from the EUROSTAT statistics database. EUROSTAT population projections show that there will be an increase in the EU population of 20.6 million people (4.2%) by 2020, in comparison with 2006. This overall increase masks a projected population decrease for the EU12 (of approximately 1.4 million) and an increase for the EU15 (of approximately 22.0 million).

On this basis, the projections show that the overall increase in food waste tonnages is expected to be 3.7 million tonnes in EU27 by 2020 (4.1%), taking into account the population increase of nearly 21 million. In this scenario the impact of any other factors, such as policies, prevention initiatives or growth in disposable income are not considered. The data assumes

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<sup>62</sup> EUROSTAT: [epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database)

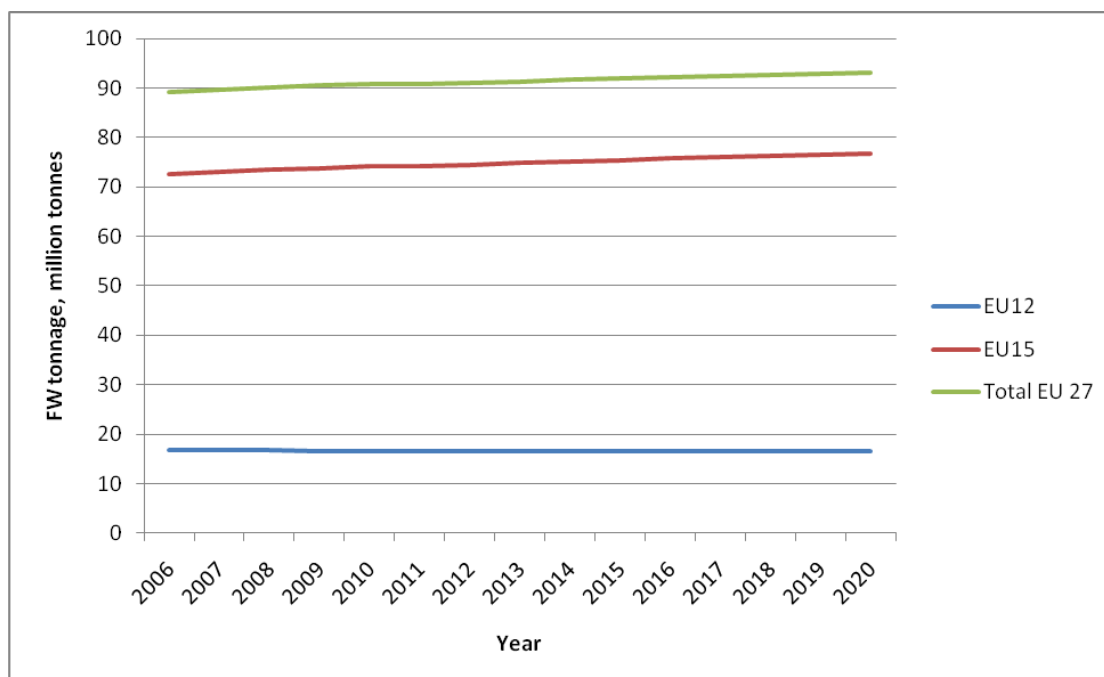
that individuals will continue to generate the same amount of food waste year on year over the period. The table below shows the influence of anticipated population growth on food waste generation in the EU countries over a 15 year period.

***Population projections and food waste forecast for EU27***

<b>Year</b>	<b>Population, million people</b>	<b>Food waste, million tonnes</b>
2006	493.2	89.3
2007	495.3	89.7
2008	497.6	90.1
2009	499.7	90.5
2010	501.2	90.7
2011	501.2	90.7
2012	503.0	91.1
2013	504.6	91.4
2014	506.2	91.6
2015	507.7	91.9
2016	509.1	92.2
2017	510.4	92.4
2018	511.6	92.6
2019	512.8	92.8
2020	513.8	93.0

*Source: EUROSTAT data; AEA*

***Food waste trends in the EU27, 2006-2020***



*Source: EUROSTAT data; AEA*

## 2. Food waste and disposable income

The UNEP Environmental Food Crisis report (UNEP, 2009), highlights, along with rising population, the issue of the increasing incomes of a large fraction of the world’s population, which results in increasing consumption of food per capita as well as changes in diets towards a higher proportion of meat (UNEP, 2009). With growing incomes, consumption – and the quantity of waste or discarded food – also increases substantially (Henningsson et al, 2004). This is confirmed by the EUROSTAT data for 2004 and 2006 which shows that the quantities of food waste generated in the European Union (EU27) increased in 2006 by nearly 23%, in comparison with 2004. This is in step with an increase in the population’s disposable income, by 1.2 trillion Euros or 11.1% (approximately 2,500 Euros per head of population (EU27) in the same time period according to EUROSTAT statistics).

There is, however, some evidence to the contrary - the WRAP study of 2008, *The Food We Waste*, while obtaining variable results, does suggest that those with higher disposable incomes and higher levels of education waste less food per capita. According to the study, professional management people waste 5kg of food a week and semi-skilled and unskilled workers waste 6.1kg a week. The implication is that, beyond a certain point, increased disposable income (as a measure of economic or societal development) may have a depressing effect on food waste but there may be a number of factors at work (for example, eating more meals in restaurants etc) and the extent to which this observation can be extrapolated across the EU is unknown.

### *Assumptions*

Based on the UNEP report (cited above) and on the EUROSTAT statistical trends, together with the WRAP evidence, the **assumption made here is that there is a link between levels of disposable income and food waste generation.**

Disposable income data is taken from the EUROSTAT statistics database where it is provided up to the year 2011. The data for 2012-2020 are forecasts made taking into account historical changes in disposable income data and the current recession. According to the EUROSTAT data, disposable income grew steadily until the year 2009 (see **Error! Reference source not found.**) when it dropped by 4.2% due to the recession. From 2010, disposable income will, according to EUROSTAT, start growing again, albeit slowly. Based on EUROSTAT data and taking into account a slow recovery from the current recession in EU countries, it is assumed that there is an annual increase of 1.5% in disposable income in 2011 and 2012 compared to 2010. This is assumed to gradually increase to 5% by 2015 (2.5% in 2013, 3.5% in 2014, and 5% in 2015) - the maximum pre-2006 increase in disposable income according to the available EUROSTAT data - after which, growth in disposable income is assumed to stay at the same level until 2020 (again, due to the anticipated slow recovery after the current recession).

### ***Forecasting methodology***

Based on the assumptions already mentioned, the projections show with a steady annual growth of disposable income (of between 1.5% to 5%), there will be an increase of 36.9 million tonnes of food waste in EU27 by 2020. Most of this (28.6 million tonnes or 77%) will be due to growth in food waste generation in EU15 countries.

The methodology incorporates growth of food waste for EU12 and EU15 at different rates as each group (EU12 and EU15) has different types of economies: as a result, some will grow more quickly at first and then begin to slow down and stabilise towards 2020 (as they 'mature') whilst others will have a more linear growth.

The EU12 is more likely to show a quick growth to begin with as levels of disposable income increase (in line with the UNEP report) and then begin to stabilise as higher disposable incomes and better education result in less food being wasted (in line with the WRAP study).

The EU15 however, being the more developed economies with higher levels of disposable income, is more likely to show a more steady growth to begin with and also to stabilise as higher levels of disposable income and education influence the behaviour of society and individuals.

In terms of the projections, disposable income is used as an indicator of economic activity and the relationship between food waste generation and disposable income can vary. For this study an important consideration is the relationship between food waste generation and disposable income and the degree to which it can be decoupled. In this context, the concept of decoupling, as defined by the OECD, distinguishes between:

- **No decoupling:** food waste production and the economy grow at the same speed (linear relationship)
- **Negative decoupling:** food waste production grows faster than the economy
- **Relative decoupling:** food waste production grows more slowly than the economy
- **Absolute decoupling:** while the economy is growing, food waste production is diminishing

To show the differences in the relationship between disposable income and food waste generation the following assumptions were applied:

**EU12** - negative decoupling followed by relative decoupling where waste generation grows more quickly than the economy (5.4.2 Scenario 1, Arcadis Bio-waste Final Report, 2009) and then more slowly;

**EU15** - no decoupling has been assumed overall where waste generation grows at the same speed as economic activity. In reality, this is based on a slight decoupling in the first phases and a stabilisation period at the end in which relative decoupling is achieved (5.4.2 Scenario 2, Arcadis Bio-waste Final Report, 2009).

The table below shows the changes in disposable income in EU27 compared to the corresponding growth in food waste using the aforementioned assumptions.

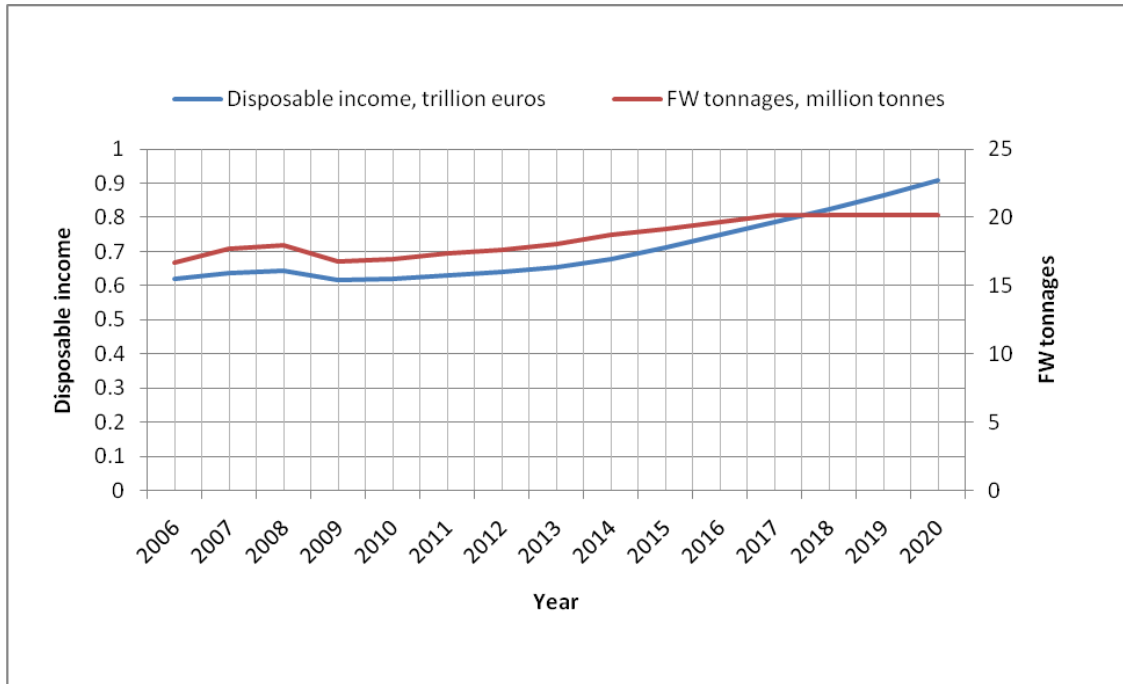
*Changes in disposable income for EU27, trillion Euros*

Year	Disposable income, trillion Euros	Food waste, million tonnes
2006	11.4	89.3
2007	12.0	95.5
2008	12.4	100.1
2009	12.0	95.2
2010	12.1	96.1
2011	12.3	98.1
2012	12.5	99.9
2013	12.7	103.1
2014	13.2	107.6
2015	13.9	111.9
2016	14.6	116.4
2017	15.3	121.1
2018	16.0	122.8
2019	16.8	124.5
2020	17.7	126.2

*Sources: EUROSTAT data; 5.4.2 Scenario 1 and 2, Arcadis Bio-waste Final Report*

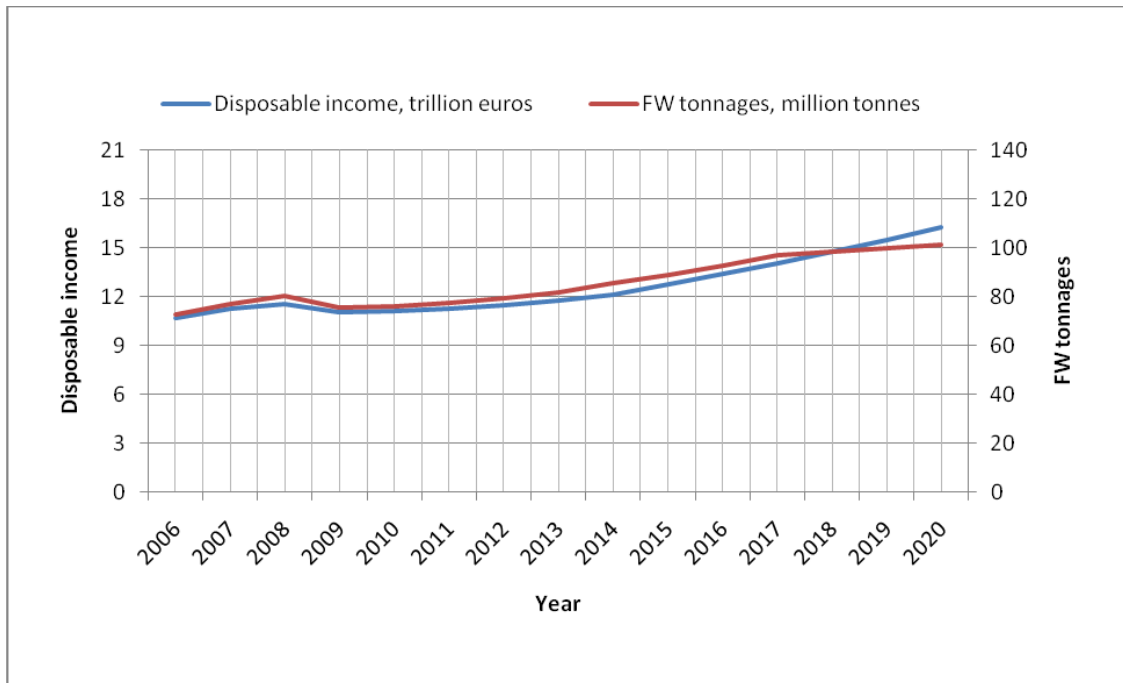
The following charts, for EU12, EU15 and EU27, take into account food waste growth, associated changes in disposable income and the associated decoupling.

**Correlation between food waste generation and change in disposable income, EU12**



Sources: EUROSTAT data; 5.4.2 Scenario 1 and 2, Arcadis Bio-waste Final Report

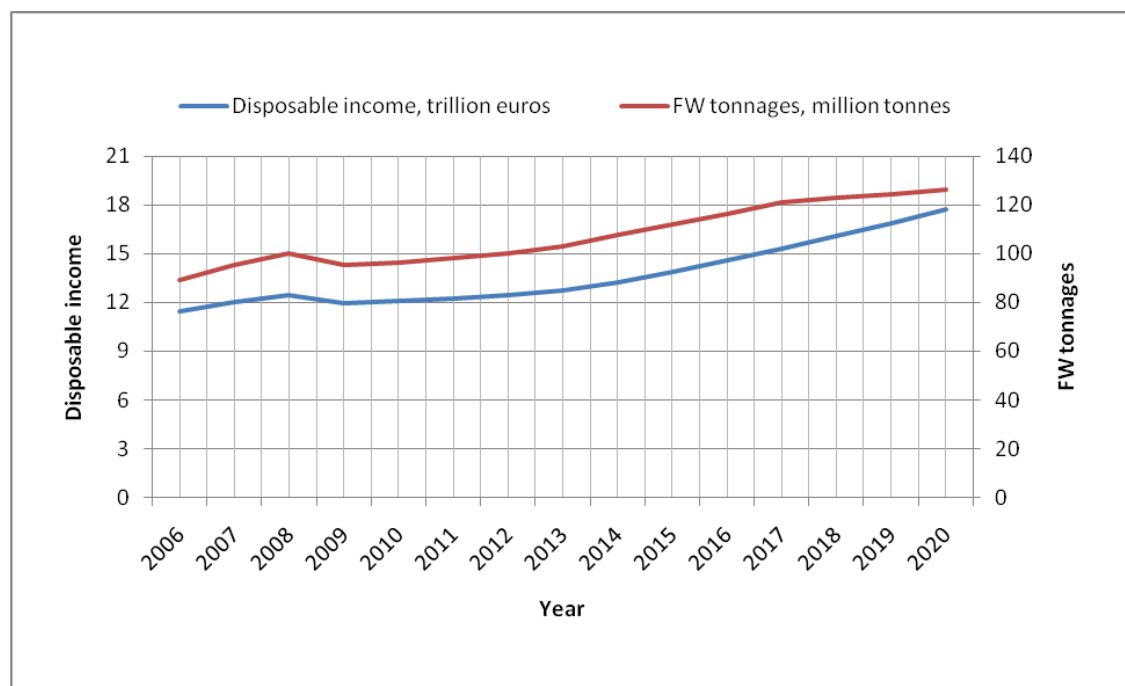
**Correlation between food waste generation and change in disposable income, EU15**



Sources: EUROSTAT data; 5.4.2 Scenario 1 and 2, Arcadis Bio-waste Final Report



## Correlation between food waste generation and change in disposable income, EU27



Sources: EUROSTAT data; 5.4.2 Scenario 1 and 2, Arcadis Bio-waste Final Report

Note: EUROSTAT data for disposable income for EU12 and EU15 does not add up to EU27 which explains slight differences in this graph when compared to the previous two.

### 3. Food waste and policy impact

The overall aim of EU waste management policies is, ultimately, to prevent the generation of waste. The data, however, show that the quantity of food waste is increasing. This, as mentioned above, may be explained by a close link between population growth, economic growth (affluence) and waste generation. The implication therefore, is that **the impact of waste policy on food waste generation is neutral in terms of the absolute amounts of waste generated**. Waste policy does however have a considerable impact on the treatment of food waste once it has been generated.

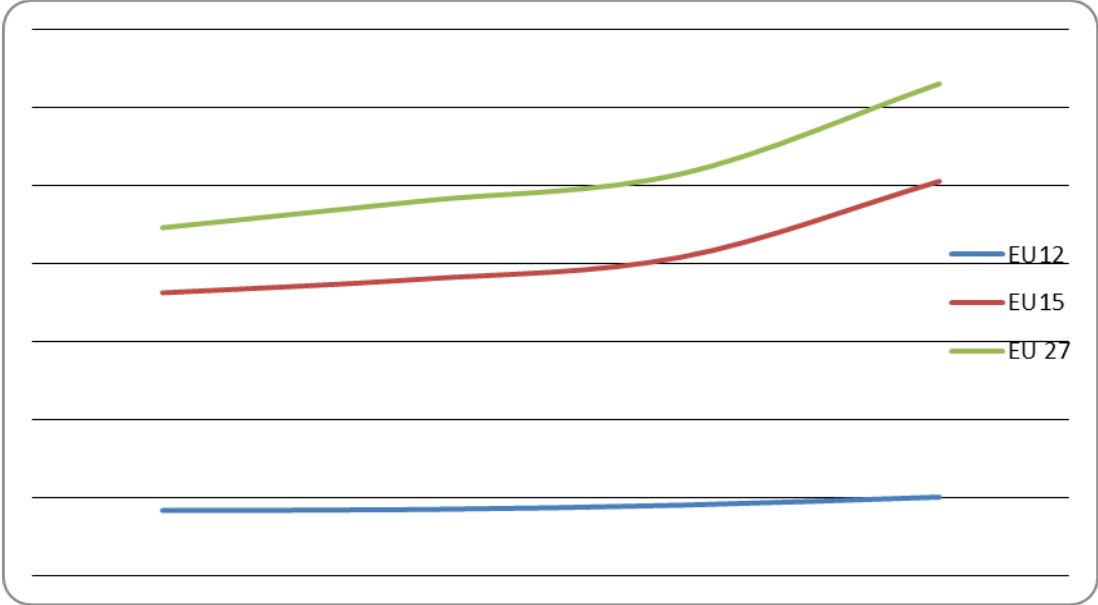
### 4. Food waste and prevention initiatives

The concept of waste prevention, or, rather, embedding waste prevention into legislation is relatively new and has, in many cases, not yet been transposed into national law by MS. The consultation has demonstrated that food waste prevention in particular, is an increasingly important issue for a wide range of stakeholders.

Following the conclusion (that food waste prevention initiatives are often at a local level and that there is a lack of information regarding the level of impact actually achieved), the forecast of impacts due to waste prevention activities is difficult to assert as the vast majority of initiatives are very recent and very few have measured results. On this basis, **no reduction from the current scenario has been applied**.

Again, 2006 food waste data was taken as a baseline and the disposable income scenario was used to produce the forecast. The forecast indicates positive growth in food waste generation, accounting for an additional 36.9 million tonnes of food waste generated across the EU-27 in 2020, compared to 2006 (126.2 million tonnes of food waste generated in 2020 compared to 89.3 in 2006).

*Food waste (FW) taking account of the impact of population growth and disposable income*

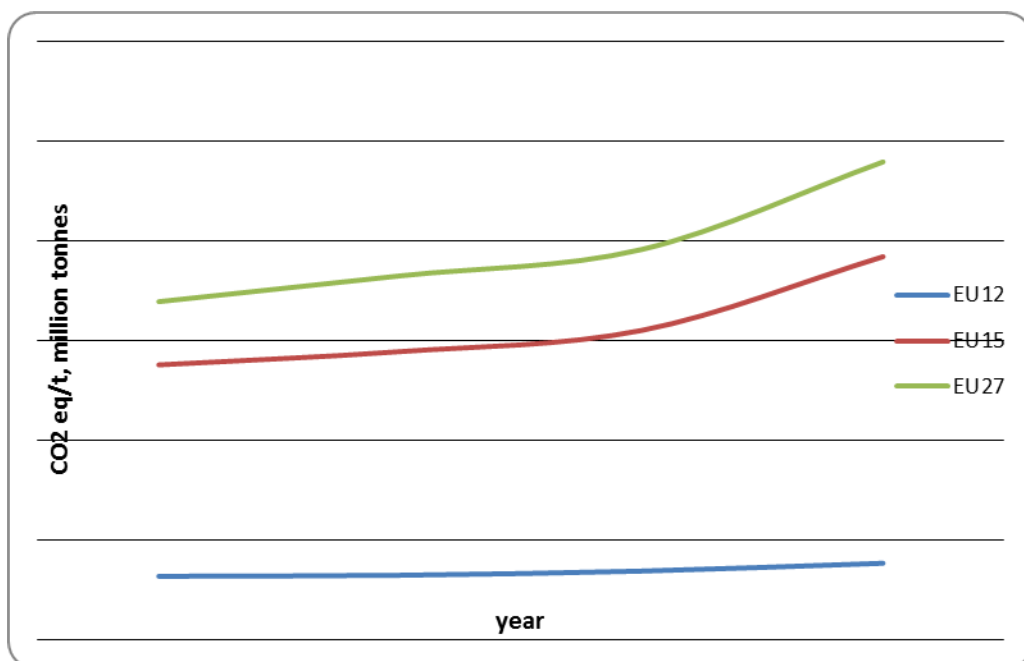


Source: EUROSTAT data

**5. Food waste and environmental impacts**

The main environmental impact considered is emissions of greenhouse gases measured in tonnes of CO<sub>2</sub> equivalent (t CO<sub>2</sub> eq./t). Starting from total impact per tonne of food waste across the sectors studied (**1.9t CO<sub>2</sub> eq./t.**) the projections have then been taken and multiplied by the food waste forecast which includes forecasts for population and disposable income to give an estimate of the likely greenhouse gas emissions through to 2020. The table below takes into account the impact of both population growth and growth in disposable income and shows **there is a positive growth in greenhouse gas emissions, accounting for an additional 70.2 million tonnes of carbon dioxide equivalent gasses emitted in 2020, in comparison with that in 2006.**

*Estimated greenhouse gas emissions from food waste*



Source: EUROSTAT data

## 6. Other environmental impacts

As stated in previously, the impact of waste policy (namely the Landfill Directive and the updated Waste Framework Directive (WFD)) as well as the recommendations contained in the EC communication on future steps in bio-waste management in the European Union on food waste generation is neutral. In other words it has no impact on the actual amount of food waste being generated. Waste policy does however, have a considerable impact on the treatment of food waste once it has been generated and this section looks briefly at the potential impacts of likely treatment scenarios.

For this forecast, the potential effects were investigated and the changes in the mix of treatment options for food waste over 15 years were anticipated based on the Landfill Directive requirements for diversion of biodegradable waste from landfill:

- by 2010 to reduce Biodegradable Municipal Waste (BMW) landfilled to 75% (by weight) of that produced in 1995
- by 2013 to reduce BMW landfilled to 50% (by weight) of that produced in 1995
- by 2020 to reduce BMW landfilled to 35% (by weight) of that produced in 1995

### *Assumptions*

The forecast is based on 2006 food waste data. Despite the fact that the targets of the Landfill Directive are based on the 1995 tonnages of biodegradable food waste, 2006 was taken as a baseline year for two reasons: to ensure a comparability of the data and because there was no EU27 in 1995.

The impacts of policy measures on food waste tonnages are based on the assumption that the targets are fully met and that the impact of prevention activities on food waste growth is neutral.

It has been assumed that 45% of food waste generated in 2006 was disposed of to landfill based on:

the data provided in the Green Paper on bio-waste management in the EU (Green Paper on the Management of Bio-waste in the European Union, Commission of the European Communities, 2008)

OECD reports that estimate approximately 45% of total generated biodegradable waste was being disposed of at landfill in EU27 at the end of the 1990s

The WFD sets no specific targets for biodegradable/food waste per se, but outlines a clear strategy towards the separate collection and treatment of bio-waste. The Directive also has provisions for prevention measures. Article 29 of the WFD requires MS to establish National Waste Prevention Programmes and recommends the use of targets for waste prevention, so modelling should anticipate the potential prevention impact here. As the WFD will not be transposed into national laws before December 2010, its impact is assumed to be 10% reduction in food waste going to landfill by 2013 (in comparison with 2006) and 15% reduction by 2020. These figures have been estimated based on literature reviews and reflect expert judgement on the most likely scenarios.

The impacts of implementing the recommendations in the EC communication on future steps in bio-waste management in the European Union, released May 2010, are even more difficult to predict. Under the WFD, Member States are obliged to develop national waste management plans in line with the waste hierarchy. In addition they have to develop national waste prevention programmes not later than end 2013 with benchmarks that make progress measurable. The inclusion of national bio-waste prevention targets in these programmes could have a significant impact in the future. Therefore, the impact of the Directive on food waste tonnages is assumed to be zero for 2010 and 2013 and to lead to 10% reduction in food waste tonnages going to landfill by 2020. It is further assumed that the targets and their achievement will be cumulative. Again, these assumptions have been derived based on the background reading and desktop research done for this analysis.

Thus, the combined impact of waste diversion policies on the quantity of food waste going to landfill is estimated as:

- **25% reduction in food waste going to landfill by 2010**, in comparison with that produced in 2006 (based on Landfill Directive targets)
- **60% reduction in food waste going to landfill by 2013**, in comparison with that produced in 2006 (based on Landfill Directive (50%) and WFD targets (10%))
- **90% reduction in food waste going to landfill by 2020**, in comparison with that produced in 2006 (based on Landfill Directive (65%), WFD (15%) and future bio-waste legislation following from the EC communication on future steps in bio-waste management in the European Union (10%))

The percentage breakdown of the policy impacts on the food waste tonnages going to landfill is presented in below.

***Percentage (%) impact of EU policies on food waste tonnages going to landfill (x% less waste going to landfill in comparison with that in 2006)***

	2010	2013	2020
<b>Landfill Directive, %</b>			
EU12	25	50	65
EU15	25	50	65
EU27	25	50	65
<b>Waste Framework Directive, %</b>			
EU12	No impact	10	15
EU15	No impact	10	15
EU27	No impact	10	15
<b>Future bio-waste legislation following on the EC communication on future steps in bio-waste management in the European Union, %</b>			
EU12	No impact	No impact	10
EU15	No impact	No impact	10
EU27	No impact	No impact	10
<b>Total combined policy impact. %</b>			
<b>EU12</b>	<b>25</b>	<b>60</b>	<b>90</b>
<b>EU15</b>	<b>25</b>	<b>60</b>	<b>90</b>
<b>EU27</b>	<b>25</b>	<b>60</b>	<b>90</b>

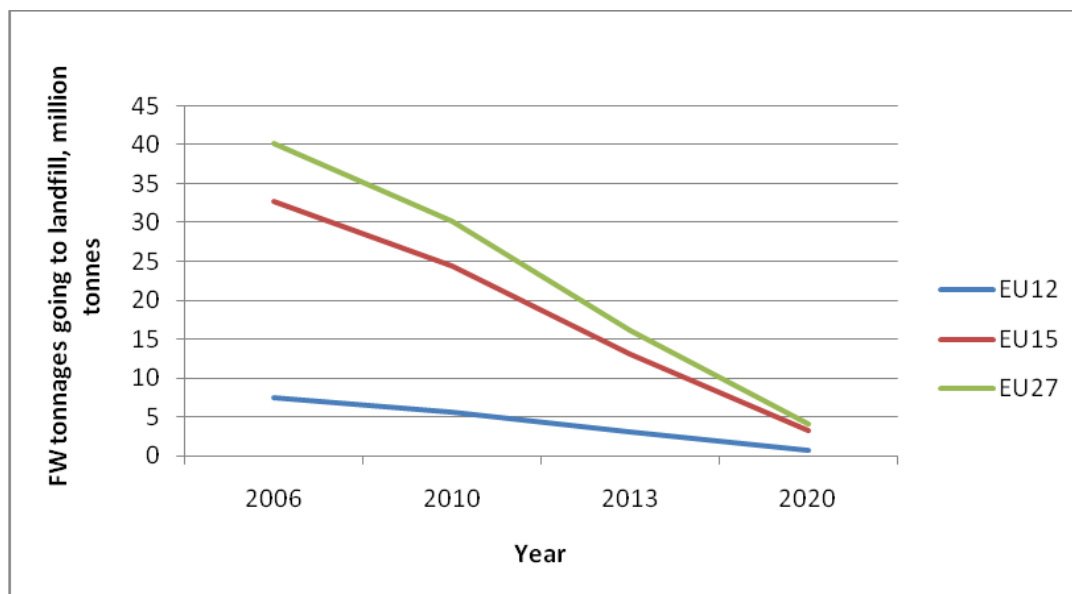
*Source: EUROSTAT data*

***Total impact of policies on food waste tonnages going to landfill, million tonnes (based on 2006 figures, not taking into account socio-economic changes)***

	2006	2010	2013	2020
<b>EU12</b>	7.5	5.6	3.0	0.8
<b>EU15</b>	32.7	24.5	13.1	3.2
<b>EU27</b>	40.2	30.1	16.1	4.0

Source: EUROSTAT data

**Impact of EU policies on food waste tonnage going to landfill (no impact on food waste generation from growth in population and disposable income)**



Source: EUROSTAT data

These figures do not take into account population/economic growth. The reason for this is that the targets in both the Landfill Directive and the WFD are set without considering population/economic growth.

As we can see, as a result of policy measures, there is an estimated 36 million tonne reduction in food waste going to landfill in the EU27 in 2020 compared to 2006, based on the assumption that all targets are met.

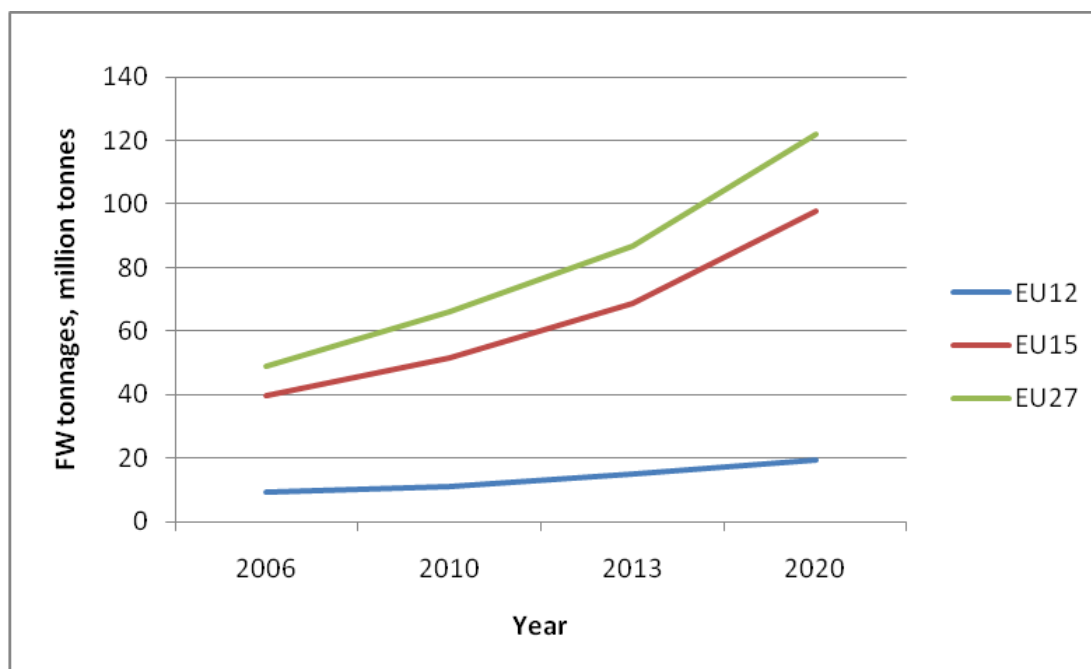
Whilst policy dictates that less food waste is sent to landfill, as reported above, the forecasting suggests the amount of food waste generated is anticipated to increase through to 2020 from 89.3 to 126.2 million tonnes for the EU27. **This means the food waste that cannot be landfilled and need to be treated will reach 122.2 million tonnes in 2020** since the policy forecast states only 4.0Mt can be landfilled.

**Food waste requiring treatment upon achieving expected landfill diversion targets**

	2006	2010	2013	2020
EU12	9.2	11.3	15.1	19.4
EU15	39.9	51.6	68.6	97.9
EU27	49.1	66.0	87.0	122.2

Source: EUROSTAT data

### *Food waste requiring treatment other than landfill*



*Source: EUROSTAT data*

Consequently the plant capacity required to deal with this additional food waste and successfully divert material away from landfill in 2020 will need to more than double unless major prevention initiatives are undertaken. The extent to which this poses issues for planning consent, raising capital, etc. warrants further investigation.

### Annex 11 – Components of meeting a national waste prevention target

(See also Annex 6 - Food waste measures – indicative costs and sectors targeted)

Measure	Causes / drivers addressed (from problem tree)	Estimated cost	Who bears cost	Sector targeted	Examples / Further information on costs	Source
				Agriculture		
				Manufacturing		
				Food Service	x	
				Retail		
				House holds	x	
National awareness raising campaigns	awareness campaigns for consumers (f) -> (k), (3), (4) + food services (b), (c), (f) + (4)	+ / ++	National governments		WRAP's Love Food Hate Waste campaign in the UK had an estimated 700K€ startup cost and annual running costs of 2,350K€, covering advertising, PR, events and web materials	<a href="http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf">http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf</a>
Retail communication towards consumers	awareness campaigns for consumers (f) -> (k), (3), (4)	+	Retailers	x	Estimates on costs of supermarket communication towards consumers on food waste was not identified, but several effective examples of supermarket campaigns were	<a href="http://www.sainsbury-live-well-for-less.co.uk/meal-planning/makeyourroastgofurther/">http://www.sainsbury-live-well-for-less.co.uk/meal-planning/makeyourroastgofurther/</a> ; <a href="http://www.morrisons.co.uk/food-and-drink/GreatTasteLessWaste/">http://www.morrisons.co.uk/food-and-drink/GreatTasteLessWaste/</a> ; the Co-operative "Food Lover" messages on till screens in the UK



Sustainable food education in schools	awareness campaigns for consumers (f) -> (k), (3), (4) + food services (b), (c), (f) + (4)	+	National governments	x	x	x	x	A programme of food waste measurement, implementation of prevention and awareness measures and follow-up in a group of four schools, led by a third party association over a period of six months, costs in the range of 50-60K€ in France, as proposed by the food sustainability focused non-profit De mon assiette à notre planète.	<a href="http://www.assiette-planete.fr">http://www.assiette-planete.fr</a>
Incentives for redistribution	food redistribution programmes (b) + (4)	+ / ++	National governments	x	x	x	x	The cost to governments of providing tax incentives for food donation, specifically reducing or removing tax liability for donated food, is thought to be limited, but no data on this has been identified.	
Reducing barriers to redistribution	food redistribution programmes (b) + (4)	+	National governments	x	x	x	x	Legislation such as the Good Samaritan Law is thought to have a negligible cost. A new study has been commissioned by the European Economic and Social Committee on MS practices and legislation regarding food donation, which should bring further clarification on this in early 2014.	

Packaging innovation	research/development/innovation (c), (h) + possibly (5)	+ / ++	Manufacturers	x	x	x	Costs highly variable depending on the technology involved. A comparative assessment of packaging technologies, their potential to reduce food waste, their relative costs and any barriers to implementation, would support advancement here, on a topic much discussed but significantly lacking comparative data.	
Flexible portion sizes in food service	awareness campaigns for consumers (f) -> (k), (3), (4) + food services (b), (c), (f) + (4)	+	Food Service businesses	x			Sodexo have undertaken several activities testing alternative portion sizes in 2013, and may be able to provide information on the costs of these activities later in the year. Their Better Tomorrow Plan provides guidance for cafeterias on controlling portion size.	<a href="http://blog.sodexoprestige.co.uk/2011/10/28/food-waste-high-on-the-sodexo-sustainability-agenda/">http://blog.sodexoprestige.co.uk/2011/10/28/food-waste-high-on-the-sodexo-sustainability-agenda/</a>
Measurements and targets	waste measurement activity (4) (3), regulatory measure (4)	+ / ++	National governments	x	x	x	Costs will be mainly linked to measuring baseline and subsequent quantification activities.	<a href="http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf">http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf</a>



Landfill bans	regulatory measures (4)	++	All sectors	x	x	x	x	x	According to a 2010 WRAP study, the economic effect of a ban on food waste would depend largely on whether resultant biogas was used for electricity generation or not. Depending on this factor a landfill restriction could mean savings of up to £92 million, or a cost of £290 million, whereas a ban on unsorted food waste could mean savings of £340 million, or a cost of £1.3 billion.	<a href="http://www2.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Reportsearch.71d5b7d6.8796.pdf">http://www2.wrap.org.uk/downloads/FINAL_Landfill_Bans_Feasibility_Reportsearch.71d5b7d6.8796.pdf</a>
Pay as you throw	regulatory measures (4)	++ / +++	Local governments	x	x	x	x		Costs of implementing PAYT systems variable by MS	The Development of Pay-As-You-Throw Systems in Hellas, Estonia and Cyprus;  Guide for the Implementation of Pay-As-You-Throw Systems link
Separate collection of FW	regulatory measures (4)	++ / +++	Local governments	x	x	x	x	x	Costs highly variable based on system used, but can often be a profitable waste management venture. However, the cost of separate collection of bio-waste followed by anaerobic digestion is estimated at 80 to 125 €/tonne, compared to 55 €/tonne for the landfill of mixed waste.	<a href="http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf">http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf</a>

Annex 7 for an introduction of the different types of initiatives that exist for food waste reduction.)

To reach a prevention target, concerted action is needed with both awareness-raising activities and voluntary agreements. Research to understand national food consumption and wastage behaviours and a nationwide or local campaigns adapted to this context would be suitable in addressing consumers in the household, retail and food service settings. The UK campaign Love Food Hate Waste is a good example here. NGOs can also support these activities. Voluntary agreements engaging and supporting industry actors in reaching prevention targets can also be helpful<sup>63</sup>.

Member States may also consider economic instruments to catalyse change, such as separate collection of food waste and pay as you throw schemes for households, bans or significant taxes on the landfilling of food waste for business (as in the Republic of Ireland). Further options aimed at the catering and retail sectors include incentives for redistribution (e.g. tax credits for food donations) and reducing barriers to redistribution (e.g. protecting food donors and food banks from civil and criminal liability for food donated in good faith).

Policymakers can also provide guidance or regulation on contractual clauses that impact food waste in the supply chain, principally quality standards and contractual issues. Quality standards on size, shape, colour etc. imposed by retailers on suppliers can lead to important tonnages of edible produce being discarded. Awareness raising towards consumers on this issue and the provision of evidence that consumers are willing to purchase imperfect products can support this.

As regards supply contracts, retailers have large freedoms in refusing stock due to changes in their supply needs, due to quality standards, and in imposing penalties on suppliers for failure to deliver agreed quantities of fresh fruit and vegetables. This results in a strong impetus for an overproduction buffer<sup>64</sup>, a food waste driver that would benefit from additional government oversight and regulation. Policymakers can also facilitate the transfer of otherwise wasted food to livestock feed, reducing legal barriers or providing incentives depending on the national context.

Innovation in finding commercial uses for foodstuffs that would otherwise become waste is an important lever for retailers (bruised apples for apple juice for example). Retailers can also stimulate packaging innovation by demanding resealable packaging, packs that easy to empty completely, a variety of portion sizes, smart packaging such as ethylene absorbers, which absorb the gas released from produce that stimulates the ageing process. Retailers can also contribute by removing 'sell-by' dates from products, replacing these with codes that are unidentifiable to consumers. Confusion between 'best before' and 'use by' dates continues and can be addressed with a coherent policy approach, which is likely to be product specific. The avoidance of "buy one get one free" schemes, that can encourage customers to buy more than they need, is also helpful. Alternatives include for example Tesco's "Buy One Get One Free LATER" initiative.

Retailers also have an important potential role in customer education and awareness raising. Such actions may focus on storage guidance, how to use leftovers from given products or

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<sup>63</sup> The Courtauld Commitment for example: [www.wrap.org.uk/content/courtauld-commitment-3](http://www.wrap.org.uk/content/courtauld-commitment-3)

<sup>64</sup> IME (2013) *Global food: Waste not, want not*.

ingredients, or how produce, like people, are not identical and thus encouraging the acceptance of natural variation.

In the food service sector, the provision of flexible portion sizes is a major driver for waste prevention, be it by offering two serving sizes as does TGI Friday's or by providing self-service or family-style serving options where customers can adjust their portion to their appetite. Research by the Nordic Choice hotel chain, furthermore, found that smaller plates reduced food waste at buffets by 20 percent.<sup>65</sup>

In order to meet a high target, regulatory action along with some use of economic instruments may be needed, in order to effect such a significant reduction in a short time. Bans or taxes on the landfilling and incineration without energy recovery of food waste might begin to make food waste prevention a more economically viable option. A legal requirement for companies to publicly disclose food waste data would also provide an incentive for businesses to bring attention to the issue and to improve their performance in relation to customer communication. These regulatory approaches would need to be accompanied by the range of softer instruments outlined above, but would not be necessary to reach the proposed 15% reduction. Targets should be applied to Member States within which there should be flexibility to assess where food waste can be reduced most effectively given national circumstances and wastage patterns.

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<sup>65</sup> [http://www.nytimes.com/interactive/2013/01/27/magazine/one-page-magazine.html?\\_r=0](http://www.nytimes.com/interactive/2013/01/27/magazine/one-page-magazine.html?_r=0)