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HALVING FOOD LOSS AND WASTE IN THE EU BY 2030: THE MAJOR STEPS NEEDED TO ACCELERATE PROGRESS

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TABLE OF CONTENTS OF THE REPORT

PREFACE WWF

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We are losing nature at a catastrophic and dangerous rate, putting people, businesses and our economy at risk. This cannot continue. To secure a sustainable future for all, and help stop runaway global warming, the world must commit to zero net loss of nature from 2020, ensure nature is in recovery by 2030, and fully recovered by 2050. This will only be possible if we pursue a New Deal for Nature and People to guide our actions from now and into the future we want. A future in which both people and planet will thrive together. However, the food system, as it is currently structured, stands between us and that future.

In 2019, several scientific reports, from EAT-Lancet,[1] FAO,[2] IPBES[3] and IPCC,[4] provided unambiguous evidence of the strains food puts on nature, climate and people – there has been a breakthrough in recognition of the need to transform how we produce, distribute and consume food. The current public health crisis caused by COVID-19 and the impacts we are seeing on our food system reinforce both the importance and fragility of the current model. In a time of crisis, food remains a necessity, but disruptions to supply chains are creating very real risks of widespread food shortages and hunger. We must work together to unlock the potential for the food system to be part of the long-term solution by sustaining livelihoods and delivering food security to all, and by providing healthy and nutritious foods sourced from healthy ecosystems.

One of the most striking flaws of the current food system is its inefficiency. One third of all food produced is never eaten, representing a huge loss of the natural resources that went into its production; a €850 billion loss to the economy each year; and a total of eight per cent of all greenhouse gas emissions. From farm to fork and bait to plate, we are losing edible, nutritious food or even choosing to throw it away. Today, as movements are restricted due to lockdowns and border controls, we see the flaws of rigid supply chains which mean food cannot be redistributed where it is most needed; instead being left to rot on farms or in storage.

Research has shown significant amounts of food are wasted everywhere, at all points of the supply chain and across all commodities. Losses in production are more dominant in developing regions while waste at the point of consumption is more dominant in developed regions (WRI).[5] Levels of waste by volume and calorie-content vary across food types, but also by environmental impact. To reduce land use, the focus should be on meat and animal-based foods which account for 60 per cent of the land footprint of wasted food; to reduce water scarcity, cereals and pulses,

which account for 70 per cent of wasted bluewater use, as well as fruit and vegetables should be targeted; and to reduce GHG emissions, cereals and pulses should be focused on, as they account for over 60 per cent of food loss and waste associated emissions (FAO).

As a bloc of high-income countries, with low relative levels of food insecurity, the EU must play a global leading role and undertake very ambitious actions to address the environmental impacts of our food system. In the last decade, the EU has made progress in reducing food waste and the conditions are in place for scaling up and accelerating efforts. The next steps are not only to bring together stakeholders to work together on implementing robust measurement frameworks and encouraging further voluntary standards, but also to set binding targets in line with SDG 12.3; to halve food waste and reduce food loss by 2030.

Achieving SDG 12.3 is a key step not just to achieving SDG12 (Responsible Consumption and Production), but also to achieve Zero Hunger (SDG2), Reduced Inequalities (SDG10), Climate Action (SDG13), Life Below Water (SDG14) and Life on Land (SDG15). Fundamental to the health of both nature and people, the reduction of food loss and waste is an imperative in the transition towards a safe, just and truly sustainable food system.

WWF is committed to designing and delivering a New Deal for Nature and People, both eliminating habitat conversion and halving the footprint of our consumption, thus working to help transform the food system – from production to consumption to loss and waste. We are delighted to present this report, identifying a suite of scalable, practical actions that can be applied immediately. We look forward to working in partnership with both the public and private sector to reduce food loss and waste for the benefit of both people and nature.

João Campari
Global Food Practice Leader, WWF International

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PREFACE WRAP

Richard Swannell
Director, WRAP GLOBAL

The ravages of climate change are creeping into every part of our planet – in our oceans, coral reefs, glaciers, ice caps, forests and our weather.

NASA confirmed that the last decade was the hottest ever recorded and ocean temperatures reached a record high in 2019. More extreme weather patterns, rising seas, disappearing glaciers and disruptions to infrastructure could become the new normal. Climate change is here and the science suggests it is going to get a lot worse unless we act and act quickly. It is another global issue that requires a planet-wide response.

We are already in the grip of a monumental struggle. Species which have existed for millions of years are being driven to extinction. And climate change is causing untold human suffering with more flooding, droughts and the loss of resources we rely on to survive. A troubling report in the National Geographic revealed that a six-year-old child will not have spent a day on earth without feeling climate change's influence.

We have the solutions: decarbonising electricity networks, making our buildings more energy efficient, tackling fast fashion, shifting to low carbon transportation and changing our food system.

The global food system is unsustainable, dysfunctional and damaging. It is failing to stave off hunger and obesity and, importantly, fuelling climate change. It is responsible for around 25% of all greenhouse gas emissions; it uses up 70% of freshwater resources and it is destroying habitats, putting thousands of species around the world at risk of extinction. And the climate change it contributes to is provoking extreme weather patterns which are damaging food production in the short and long term.

On top of this, we squander a third of the food we produce every year – over one billion tonnes of it. This is morally indefensible and environmentally reckless. It takes an area the size of China to grow the food that is thrown away every year. If it were a country, food waste would be the third largest emitter of greenhouses gases behind China and the United States.

So, if we reduced food waste dramatically, we could make a significant contribution to tackling climate change. In fact, in the 2020 Drawdown Report,[6] food waste reduction was listed as one of the solutions with significant potential to reduce global carbon emissions.

Some countries are beginning to make progress, with a number of European countries acting at scale. Substantial food waste reductions have been made in the Netherlands, Norway and Denmark. In the UK, food waste has already been reduced by 27% per person, which is over halfway to delivering the UN Sustainable Development Goal (SDG) 12.3 of halving food waste and reducing food loss by 2030.

Around the world though, food waste reduction is a largely unappreciated strategy to help countries meet their Paris Climate Change Agreement commitments. Research conducted by Champions 12.3,[7] shows that whilst governments representing half of the world's population have set an explicit national target in line with the UN's goal to halve food waste by 2030, only those representing 12% of the world's population are measuring how much food is wasted. Moreover, only countries representing 15% of the global population are implementing reduction actions at scale. This must change.

The picture is a little brighter with businesses. More than two-thirds of the 50 largest food companies are setting targets, nearly half are measuring and one third are pursuing action to reduce waste in their own operations. But there is absolutely no room for complacency. Businesses must increase efforts to engage their suppliers and increase public reporting of their food waste, and more businesses need to prioritise food waste reduction.

The UK's Courtauld Commitment, which WRAP runs, and which is being replicated internationally, is testament to what can be achieved when businesses work together to drive rapid, substantial and cost-effective change. Signatories to the commitment have helped save 1.7 million tonnes of food waste/year in the UK, estimated to be worth approximately 5 billion Euro/year.

There is a real opportunity to make food waste reduction one of the key ways we reduce greenhouse gas emissions and put our food system on a trajectory to a more sustainable future. It would also help improve food security, reduce water use, save money and reduce the pressure on precious habitats. Governments will bring benefits to their citizens and their economies by leading this agenda, in Europe and around the world. And critically, we can all play our part today, by simply buying what we need and eating what we buy.

WRAP is working hard to help make this happen, together with our partners at WWF. We are forging powerful partnerships around the world, united in a commitment to halve food waste and deliver SDG 12.3.

Europe is leading that charge. This invaluable report provides important insight into the interventions that work and the gaps which need addressing. It provides the knowledge and tools so we can supercharge efforts in food waste reduction and continue to be a beacon the rest of the world can follow.

2020 has been a year in which time seems to have cleaved in two. We cannot simply bridge back to what was before. And we cannot sleepwalk into the bleak future it has given us a glimpse into. Now is the time for us to find a way to live in harmony with the natural world which sustains us.

Richard Swannell
Director, WRAP GLOBAL

EXECUTIVE SUMMARY

Unsustainable production and consumption of food constitutes one of the biggest environmental threats to our planet. Eliminating food loss and waste to the largest extent possible – at all stages from producer to final consumer – stands out as an urgent and indispensable step towards more sustainable food systems.

The EU's recent adoption of the Circular Economy Package, including the revision of its Waste Framework Directive in 2018 and a new Delegated Act on the measurement of food waste in 2019, opens a limited time period where Member States will have to integrate these policies into their national law. In 2020, the first EU-wide national measurement of food waste will be undertaken. This will be reported back to the EU mid-2022 and will provide comparative baseline measures for all Member States. The publication of this baseline data in 2023 will provide the opportunity to consider the feasibility of establishing Union-wide food waste reduction targets to be met by 2025 and 2030. For this reason, 2020–2023 will provide crucial moments of opportunity for EU Member States' food waste policy and EU-wide food waste reduction.

Indeed, changes in the regulatory framework were necessary but need to be accompanied by further action to effectively accelerate food waste reductions. Through a rapid review of food waste literature and interviews with Member State representatives, this report identifies

and provides case studies of the food waste reduction actions that have the largest evidence bases and largest potential for accelerating progress towards SDG target 12.3 (halving food waste by 2030 and reducing food losses), but which have been insufficiently applied in the EU until now: Food waste measurement; Valorisation; and Voluntary Agreements. Some of these actions are already partly developed in the EU (valorisation), while others have only recently been piloted across several Member States (voluntary agreements) or still need to be deployed coherently (food waste measurement). This report also highlights other interventions that show less evidence of their potential to date, but which are expected to hold high potential for effective food waste reduction: Changes to the Common Agricultural Policy; Stronger Regulation; and National Food Waste Strategies.

Due to the interconnected nature of food waste, and of the EU and Member State policies, all food waste reduction areas proposed are interlinked and related. Together they offer a suite of actions that can be deployed over a range of time scales, from 12 months through to 5 years; and at a range of sizes, from individual companies or specific industry sectors, through to government-led deployment on a national scale. These actions will all benefit from close collaboration between the stakeholders, who can jointly deliver the urgently needed acceleration in food waste reduction.

1. WHY IS FOOD WASTE AN ISSUE?

Unsustainable production and consumption of food constitutes one of the biggest environmental threats to our planet. Eliminating food loss and waste to the largest possible extent – at all stages from producer to final consumer, which in this report will be referred to generically as "food waste" – stands out as an urgent and indispensable step towards more sustainable food systems.

Food waste is a global issue, with approximately one third of all food produced for human consumption lost or wasted.[8] In the EU, an estimated 88 million tonnes of food are lost or wasted every year - equivalent to 20 % of the total food produced or 173 kilogrammes per person.[9] Furthermore, more than half of the total food waste in the EU (47 million tonnes) is generated in households, with 70 % of food waste arising from households, food services and retail.

Food waste is also associated with significant economic costs, estimated to amount to around € 143 billion in the EU.[10] This includes costs to producers, who leave produce un-harvested; processors, who discard edible products that do not adhere to market size and aesthetic standards; retailers, who lose products due to spoilage during transport and throw away unsold products; and households that waste edible food for a variety of reasons including spoilage, lack of knowledge, over-purchase and confusion about best-before/consume-by dates.[11] In addition to the monetary cost of the food wasted, there are also additional financial costs for collecting, managing and treating food waste.

Food waste contributes to climate change and represents a waste of scarce resources such as land, energy and water. It is estimated that approximately 8 % of all global greenhouse gas emissions caused by humans is related to food waste. Furthermore, food waste in Europe accounts for 15 to 16 % of Europe's total emissions impact of the entire food supply chain.[12] Considering that the EU 2030 climate and energy framework commits to at least 40 % cuts in greenhouse gas emissions (from 1990 levels), reduction and prevention of food waste represents a significant and necessary step for the EU to meet this objective.

Food waste highlights the inequity of our food system. While 88 million tonnes of food are wasted yearly in the EU, in 2017, 112 million people in the EU were living in households at risk of poverty or social exclusion (22 % of the population), with 5.8 million people (7.4 % of the population) living in severely materially deprived circumstances, meaning they have limited access to suitable food and healthy diets.[13]

Finally, food waste is also a major indirect cause of biodiversity loss.[14, 15] This is due to uneaten, wasted food compounding unsustainable agriculture practices and agricultural expansion into wild areas (e.g. deforestation), as well as unsustainable fishing and aquaculture.

Sustainable Development Goal 12.3

As a global problem, food waste has moved up the public and political agendas in recent years. At the United Nations General Assembly, the Sustainable Development Goals (SDGs) were adopted in 2015 – as part of the 2030 Agenda for Sustainable Development – with SDG 12 seeking to "ensure sustainable consumption and production patterns", including a specific target on food waste:

> *"By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses." – SDG Target 12.3*

The EU and Member States have committed to meeting the SDGs. As part of this commitment the European Commission operates a multi-stakeholder platform (EU Platform on Food Losses and Food Waste) involving both EU countries and actors in the food chain in order to help define measures needed to achieve SDG 12.3, facilitate inter-sector co-operation and share best practice and results achieved.

In order to measure global progress towards halving food waste and reducing food losses, two indices have been proposed: a Food Waste Index and a Food Loss Index. Building on the Food Loss and Waste Accounting and Reporting Standard,[16] the Food Waste Index is currently in development at UN Environment, with measurement pilots in Mexico and Kenya in 2019.[17] It will measure tonnes of wasted food per capita, considering a mixed stream of products from processing through to consumption. Once approved, data is expected to be collected annually by nations. The Food Loss Index has already been created by the Food and Agriculture Organization of the United Nations (FAO),[18] examining food loss along supply activities such as production, handling & storage and processing. Together these two indices could account for SDG 12.3 in its entirety.

Purpose and methods

This report identifies and describes actions, areas of intervention, approaches, methods and tools that hold large potential for accelerating progress towards SDG target 12.3, but which have been insufficiently applied in the EU until now. It additionally focuses on the role that (environmental) non-governmental organisations (NGOs) and other key stakeholders in Europe can have in accelerating reductions in Food Loss and Waste (FLW).

To identify these FLW reduction actions and areas of intervention, a rapid review of literature was undertaken, followed by interviews with representatives of EU Member States. The rapid review included academic, grey literature, media publications and policy documents, written in English, from 2012 onwards. The main focus of the review was on methods of public policy and private sector engagement with food waste reduction. Additional detail on the review and interviews can be found in Appendix 1.

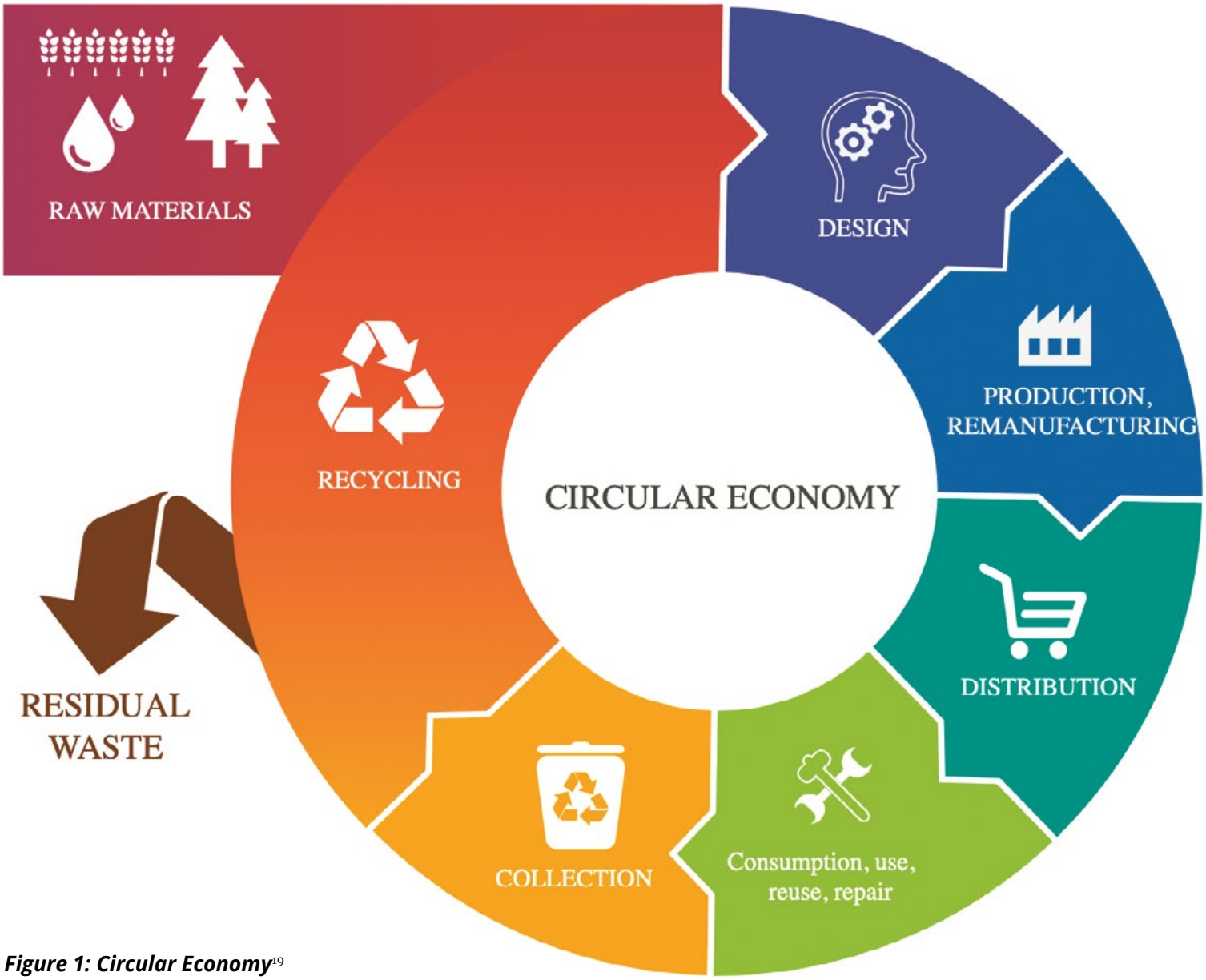

Figure 1: Circular Economy[19]

2. OVERVIEW OF ONGOING EUROPEAN POLICY INITIATIVES ON FOOD WASTE

Circular Economy Package

The Circular Economy Action Plan, proposed by the Juncker Commission in 2015, set out the EU's ambitions to develop a sustainable and competitive economy by minimising waste and maintaining the value of resources for as long as possible. Food waste is one of the five priority areas identified in the Action Plan. It outlined the environmental, social and economic impacts of food waste and the key actions needed to tackle them.

The Circular Economy Package (CEP) comprised four directives that came into force in July 2018. They address the issues set out in the Circular Economy Action Plan and must be transposed into national legislation by the EU Member States within 24 months. Under the revised Landfill Directive, the amount of municipal waste sent to landfill must be cut to 10 % by 2035. Under the revised Waste Framework Directive, Member States will have to ensure they recycle at least 55 % of their municipal waste by 2025, 60 % by 2030 and 65 % by 2035. The revised Waste Framework Directive also contains provisions relating specifically to food waste.

In the CEP, 'Food waste' is defined in line with the definition of 'food' in Article 2 of EU's General Food Law (Regulation 178/2002), whereby "food" (or "foodstuff") means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans'. The entirety of a food product is classed as food, including those parts not intended to be eaten. Importantly, the definition of food excludes pre-harvest produce. However, precisely when 'harvesting' begins is not defined. The definition of 'waste' is given in Article 3 of the Waste Framework Directive 2008/98/EC, whereby "waste" means any substance or object which the holder discards or intends to discard'.

In line with SDG 12.3, Member States have aspirational (non-binding) targets to reduce food waste by 30 % by 2025 and 50 % by 2030. To this end, the revised Waste Framework Directive requires Member States to incorporate food waste prevention into their national waste prevention programmes. These should include consumer awareness campaigns (with specific mention of date labels) and incentives for the collection

and safe redistribution of unsold produce at all stages of the food supply chain (prioritising human consumption over animal feed and processing into non-food products). Member States will also be required to record and report their levels of food waste to the Commission each year in line with the Commission Delegated Decision (EU) 2019/1597.[20]

Indeed, this Delegated Act lays down a common food waste measurement methodology to support Member States in quantifying food waste at each stage of the food supply chain. Based on a common definition of food waste, the methodology should ensure coherent monitoring of food waste levels across the EU. However, the Delegated Act contains two important limitations which have been underlined by stakeholders. Firstly, the reporting is limited to food waste flows destined for waste treatment operations (such as landfilling, composting, biogas, incineration, etc.) and does not require Member States to report food waste separately according to the different food waste hierarchy destinations. Secondly, the Delegated Act does not require the measurement of harvest losses, which is estimated to account for between 11 % (FAO 2011) and 36 % (FUSIONS 2016) of overall food waste across the EU.

Going beyond the aforementioned food waste measurement Delegated Act, the European Commission has also been working with the Technical Adaption Committee to finalise the Implementing Act (EU) 2019/2000, which has established the format for reporting food waste data to the Commission.[21] However, due to the lack of detail around the methods of measurement and reporting of the Food Waste Index (and thus progress towards SDG 12.3) – intended for global use – it is not possible to compare or establish linkages between these and the measurement methods proposed in the EU.

Other EU policies

The interconnected nature of food waste, however, calls for policy action beyond the scope of the CEP, with changes in a suite of EU policies being desirable to deliver further food waste reduction effects.[22]

There are multiple policy areas with interventions that could lead to reductions in food waste, such as in agricultural policy, fisheries policy, food quality, food safety and marketing standards. For example, European legislation currently applies specific marketing (cosmetic) standards to fruit and vegetable products.[23] Some of these standards (required by retail industry or by legislation) have been found to cause farm and supply chain waste for foods with an imperfect shape or appearance. In this regard, an adequate transposition and implementation of the Unfair Trading Practices directive adopted in 2019,[24] could help reduce food waste significantly at farm level (and in the supply chain) in the coming years.[25]

Food waste may also be inadvertently generated through policies and government subsidies that stimulate farmers to oversupply certain commodities.[26, 27] However, as highlighted in Section 5 of this report, reform of the Common Agricultural Policy (CAP) could be used to promote food waste reduction knowledge transfer, stimulate innovative marketing and valorisation activities, and even provide funds to support the collection of data at farm level, and thus fill measurement gaps left in the CEP food waste Delegated Act.

Food waste in the EU could also be reduced through changes to food safety and consumer health policies. Previous reviews have discussed that EU Food hygiene and safety regulations (such as Regulation (EC) No 882/2004, which provides direction on the compliance with feed and food law, animal health and animal welfare rules) are frequently thought by stakeholders to be too strict, often making the recovery or valorisation of wasted food legally or technically impossible.[28] For instance, there are many barriers to using certain types of treated surplus food as pig or other animal feed within the EU;[29] even though such valorisation routes are currently used in other countries from which the EU imports meat, farmed fish and other livestock and aquaculture products.

Complex food labelling[30] can also be a cause of food waste. The use and clarification of "use by" and "best before" dates should be a high priority policy change due to the amount of misunderstanding and resulting waste. A "use by" date on a product is there for food safety reasons. You can eat it right up to the "use by", but not after – even if it looks and smells fine. "Best before", on the other hand, is about quality and food should be safe to eat after the date, but it may no longer be at its best.[31] In this regard, EU food regulation[32] also has links to liability law, with EU food regulation being executed differently in different Member States. If liability law is not applied correctly, this can impede the donation of surplus food (due to the risk of donors being legally pursued if food-related health problems arise, or due to reputational damage). Changes to the operation of liability law could further increase the donation of surplus food.

Changes to waste and taxation policies also have potential to reduce food waste in the EU. Although the food waste hierarchy is mentioned throughout EU policy, there are few fiscal incentives to encourage good waste management practices (waste prevention, followed by disposal to a more desirable hierarchy option).[33] Landfill taxes are used to different ends across the EU,[34] but could have potential to further reduce food waste by increasing the cost of disposal, to include externalities. In addition, the updated Bioeconomy Strategy for Europe[35] has the potential to increase the number of technological valorisation options available to transform food waste into new resources (see case study in Section 4).

Finally, the European Common Fisheries Policy is also related to food waste through regulations on by-catch[36] (discarding unwanted catch due to quota limits, lack of markets and minimum size requirements). The EU aimed to address this issue through the phased implementation of the Landing Obligation, formally completed in early 2019. Through the EU Landing Obligation, the general rule is that no commercial fishing vessel can return any quota species of fish, of any size, to the sea once caught; however, there are numerous exemptions.[37] Furthermore there are also significant concerns that difficulties experienced in monitoring discarded catches may result in compliance problems.[38]

Expected developments

Measurement. All Member States will have to measure their food waste in 2020, and have 18 months from the end of that year to report data back to the Commission. Through the Delegated Act, Member States are required to report estimates of food waste levels by sector, on a yearly basis, using a range of methods (provided in this report in Appendix 2).[39] In addition, Member States are also expected to report more precise data on food waste at each stage of the food supply chain, at least once every four years. Whilst yearly indications may utilise a wide range of methods, assumptions and proxy data, more precise data (reported every four years) is expected to be derived from more robust direct food waste measurement methods.

In relation to the aforementioned limitations of this secondary legislation, such as the quantification of harvest losses and food waste hierarchy destinations, further work could be attempted within the EU Platform on Food Losses and Food Waste and in particular its sub-group on food loss and waste measurement. Indeed, interviews with Member State representatives indicated that multiple Member States are measuring additional food waste data beyond the scope of the Delegated Act.

Member State food waste data collected in 2020 is expected to be published in 2022–2023. This represents an opportunity to consider the feasibility of setting up binding targets, including an EU-wide food waste reduction target to be met by 2030. Interviews with Member State representatives indicated that multiple Member States already have aspirational food waste reduction targets for 2030, with other Member States currently developing their own national and sub-national targets.

Redistribution. In cooperation with stakeholders, it is planned that an updated package of EU food redistribution guidelines will be disseminated in the EU-28 countries in 2020. This will include guidance on national regulation, labelling, hygiene and financial incentives. In the meantime, examples of redistribution practices in the Member States have been gathered and published.[40] For the moment, there is no EU-wide regulation change planned.

Date Labelling. The EU Platform on Food Losses and Food Waste sub-group on date labelling is considering various regulatory and non-regulatory actions relating to date labelling. Non-regulatory actions include: developing scientifically-informed guidance on date marking for food business operators and control authorities, promoting inter-sectoral cooperation (for example, in promoting more consistent storage temperatures throughout the supply chain, or encouraging food business operators to reassess the impact of Minimum Life on Receipt criteria), as well as consumer communication activities. Regulatory actions include improving the format, presentation and terminology of date marking to better differentiate 'use by' from 'best before' concepts and facilitate customer understanding, as well as extending the list of foods which are not required to bear a 'best before' date.

Sharing best practice. The EU Platform on Food Losses and Food Waste subgroup on Action and Implementation is investigating current food waste reduction initiatives throughout the EU. Its key deliverable is a set of recommendations for each stage of the food supply chain, based on an analysis of these initiatives, and published in December 2019.[41]

In addition, in 2021 the Commission plans to launch a new public call for expressions of interest for private sector organisations to participate in the Action and Implementation sub-group of the EU Platform on Food Losses and Food Waste. There will be a possible shift in the mandate, tasks and membership of the Action and Implementation sub-group.

New European Commission. With the elections to the European Parliament in 2019 and the new European Commission taking office in December 2019, further developments are to be expected over the next five years. In her political guidelines, the President of the European Commission announced a "European Green Deal", with a focus on climate but also including a "New Circular Economy Action Plan" and a "Farm to Fork Strategy" on sustainable food, including actions on food waste. Indeed, as regards food waste actions, the Farm to Fork Strategy published in May 2020 confirmed the Commission's intention to revise EU rules on date marking by 2022, and to propose legally binding targets for food waste reduction across the EU in 2023.[42]

The role of non-governmental and civil society organisations

There are multiple non-governmental and civil society organisations (NGOs) currently involved in supporting food waste prevention, reduction and diversion initiatives that are run by European Member State governments. The primary role of the NGOs and civil society organisations – such as WRAP, Feedback, WWF, SAFE and Slow Food – has been to raise awareness around the issue of food waste, while providing a trusted voice on food waste issues.

In addition to the role of awareness raising, environmental NGOs have been effective at advising Member State government departments on food waste issues. The primary objective of promoting the food waste reduction agenda has been the creation of policy and regulatory recommendations. This advice has included campaigning for date labelling reform and changes to redistribution laws, establishing voluntary agreements, food waste measurement and working alongside governments, businesses and universities to pilot food waste reduction initiatives.

Beyond environmental NGOs, development, religious and poverty alleviation NGOs have engaged with Member State government departments on food waste issues mostly around redistribution of food surplus. Other organisations, such as agriculture and farming lobby groups, generally have shown less engagement with Member State government departments on food loss and waste issues.

3. PAST AND FUTURE EU PROJECTS ON FOOD WASTE

Both national and international food waste policies often reflect recommendations highlighted in prior food waste projects. The scale of these projects can range from small scale local initiatives to large scale international collaborations. In the context of Europe, two projects which have been highly influential in EU policy development are FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies) and REFRESH (Resource Efficient Food and dRink for the Entire Supply cHain).

FUSIONS

FUSIONS was a four-year project funded by the European Commission's FP7 programme, which ran from August 2012 to July 2016. The project focused on improving resource efficiency and reducing food waste across Europe; which it aimed to achieve through a comprehensive and experienced European partnership covering all key actors across the food supply chain, including policy makers, business, NGOs and knowledge institutes, all with strong links to consumer organisations. There are four main legacies of the FUSIONS project:[43]

1. Establishing a common framework for food waste definition and identifying its drivers.[44] This has now been expanded upon by both the REFRESH project (see below) and the CEP.
2. Providing an analysis of food waste policies across the 28 EU Member States.[45] This analysis resulted in multiple recommendations concerning policies, practices and effective approaches for food waste prevention and reduction in the EU, at European and individual Member State levels.[46]
3. Establishing reliable data on food waste and harmonising quantification methods.[47] This included a review of existing methods and a "Food Waste Quantification Manual", which has been used to inform EU policy, including the aforementioned Delegated Act. This legacy also includes estimates of food waste arising in the EU for 2012, which have been widely used by policy makers and civil society organisations when campaigning on food waste reduction.
4. Stimulating social innovation on food waste, conducting feasibility studies on multiple actions.[48] In this, over 150 food waste prevention & food waste management activities were inventoried, with policy briefs written. Seven feasibility pilot projects were trialled covering a wide range of food waste reduction innovation. These included

children's education, community music and cooking events, food redistribution, gleaning, pre-ordering of school meals and social supermarkets. While they were mainly demonstrative, a total 44,500 kg food waste was already prevented through these pilots.

REFRESH

REFRESH was an EU food waste project which ran between July 2015 and June 2019. The project was funded through the EU Horizon 2020 programme and consisted of 26 beneficiaries, spanning 19 countries and, similarly to FUSIONS, included a wide range of key actors across the food supply chain. The overall aim of the project was to contribute significantly towards the UN SDG 12.3 (halving food waste by 2030) and maximizing the value of unavoidable food waste and packaging materials.

The Refresh project supported the transformation towards a more sustainable and secure EU food system, benefitting Europe's economy, environment and society, by:

- Developing a 'Framework for Action' model based on strategic agreements across all stages of the supply chain (backed by governments), delivered through collaborative working and supported by evidence-based tools to allow targeted, cost effective interventions. (REFRESH Blueprint)
- Establishing a voluntary agreement to reduce food waste across the Netherlands[49]
- Publishing multiple policy briefs, addressing: reductions in consumer food waste,[50] unfair trading practices in food waste generation[51] and voluntary agreements as a collaborative solution for food waste reduction.[52] Helping formulate EU policy recommendations and supporting the implementation of national strategies
- Publishing guidance documents to evaluate interventions to prevent household food waste[53] and to help measure and manage retail food waste[54]
- Highlighting valorisation opportunities and determining their consumer acceptance[55]

Future EU projects

Research and Innovation. In October 2019, the European Commission published a new Horizon 2020 Rural Renaissance topic, "Reducing food losses and waste along the agri-food value chain" (RUR-07-2020), with a contribution from the EU of up to EUR 12 million. The project will fund two innovation-action projects for demonstrations, pilots and market replication of new innovative approaches to FLW, and to further improve understanding of the root causes. The focus is on preventing avoidable losses and waste of perishable products, fostering collaboration all along the agri-food value chain, from primary production down to final household consumption and disposal.[56]

In addition to RUR-07-2020, several other Horizon 2020 topics are likely to have beneficial FLW reduction effects, these include:

- CE-FNR-17-2020 – "Pilot circular bio-based cities – sustainable production of bio-based products from urban biowaste and wastewater". This topic aims to valorise urban biowaste and wastewater through the production of safe and sustainable bio-based products.[57]
- RUR-06-2020 – "Innovative agri-food value chains: boosting sustainability-oriented competitiveness". This topic aims to pilot innovative systemic approaches to agri-food value chains that unlock their full potential to achieve economic, social and environmental sustainability.[58]
- CE-FNR-07-2020 – "FOOD 2030 – Empowering cities as agents of food system transformation". This topic aims to support cities with the development and implementation of urban food systems and policies delivering on the four FOOD 2030 priorities, including: "Climate-smart and environmentally sustainable food systems" and "Circularity and resource efficient food systems".[59]

4. APPROACHES WITH LARGELY UNTAPPED POTENTIAL TO ACCELERATE FOOD WASTE REDUCTION

Policy and research gaps to build upon

Policy initiatives such as the CEP, the Waste Framework Directive and its Delegated Act on food waste measurement, have provided a groundwork for FLW reduction and prevention across the EU, whilst research projects such as FUSIONS and REFRESH, have helped identify actions necessary to help deliver food waste reductions.[60] However, there are still gaps in the existing policy offering and research base that may not allow FLW reduction to be achieved at the rate needed to meet SDG12.3. Indeed, there are several actions that can be undertaken at different levels to accelerate food waste reduction across the EU.

Food waste measurement, as it will be detailed later in this section, is a first good example of the gaps. Although the Delegated and Implementing Acts will lead to Member States quantifying food waste at each stage of the food supply chain, businesses will require help and significant resources to robustly measure their food waste. Indeed, many businesses currently lack the incentive for accurate measurements. Furthermore, common definitions and approaches have not been established across different contexts, and there remain limitations to current measurement technologies and methods. Therefore, considering evidence that good measurement – by itself – can lead to substantial reductions in food waste, it is important to address these barriers.

Secondly, businesses in the EU often act independently (if at all) on food waste prevention and reduction activities. This individual action is likely to hinder the dissemination of best practice around food waste reduction, as multiple conflicting standards and methodologies may emerge. The REFRESH project has helped highlight the benefits of collaborative action and developed a blueprint with five key steps believed to influence the successful establishment of food waste voluntary agreements (VAs). VAs can offer a cost-effective and flexible approach to tackling food waste, but there are still a very limited number of VAs on food waste deployed across the EU. This may be due to some of the challenges they face, which we have identified.

Thirdly, the recent introduction of the updated EU Bioeconomy Strategy, the renewed Industrial Policy Strategy, the Circular Economy Action Plan and the Communication on Accelerating Clean Energy Innovation have

paved the way for the bioeconomy to expand rapidly in the EU. It is now expected to have a turnover value of EUR 2.3 trillion and account for 8.2 % of the EU's workforce.[61] However, there is still limited engagement between the food industry and the bioeconomy – even though REFRESH mapped priority food waste streams, valorisation methods and outputs.[62] Indeed, the uptake of food waste valorisation opportunities has great untapped potential for reducing food waste quickly. This is due to the scale of industrial and agricultural food waste streams that are currently being disposed of to traditional waste disposal routes that could instead be valorised to create high value products. The promotion of food waste valorisation, associated challenges and potential solutions will be instrumental to diminish food waste along the supply chain.

Finally, there is a range of policies at local, Member State and EU-wide governance levels that can have an impact on food waste generation, reduction, prevention and reuse. Improvements in the policy framework could come from developing new legal regulations, through to alterations to the Common Agricultural Policy (CAP) and establishing comprehensive national food waste prevention strategies for each Member State. While there is a more limited evidence base of their potential, this range of policy-based interventions could result in sustained systemic FLW reduction, particularly if they are well coordinated together.

In the section below we present the main features of these interventions, highlight barriers for their full implementation and provide potential solutions based on expert knowledge and existing best practice. The methodology used to assess the relevance of all these approaches is provided in Appendix 1.

Food loss and waste measurement

Introduction

The measurement of food loss and waste (FLW) along the supply chain – from farm to fork – is an essential requirement in establishing sustainable food systems. Regardless of the lifecycle stage at which it occurs, measurement can help focus strategies and establish targeted actions, leading to significant reductions in FLW.[63] However, the reasons entities measure FLW can vary (Figure 2).

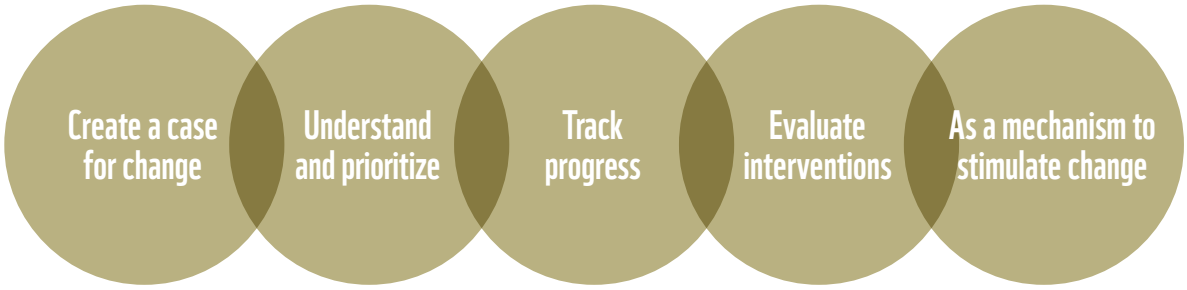

Figure 2: Reasons why entities might measure food loss and waste (Adapted from CEC 2019[64])

One reason entities might measure FLW is to provide information for a case for change (Figure 2). Recent measurement-based studies have highlighted a robust financial case for reducing FLW,[65] in addition to the well-established environmental and social benefits. Furthermore, the measurement of FLW can help entities: understand their current situation, prioritize areas for action, set targets, monitor progress towards targets and help evaluate the effectiveness of different interventions to ensure the right approaches are taken to deliver change.

Multiple approaches can be used to measure FLW. The most common of these tend to be weight-based (e.g. direct weighing or waste composition analysis). Other approaches may focus on the environmental (e.g. GHG emissions, water footprint, land use), social (e.g. jobs) and financial (e.g. market value) impacts of FLW; although these are also often calculated using weight-based measurements and applying a relevant factor (e.g. financial or environmental cost per tonne).

Historically, due to a wide variety of approaches and general disagreement around what constitutes "food loss and waste", it has been difficult for stakeholders to agree on definitions and common measurement

methodologies. Recent years have, however, seen the development of more coherent methods for acquiring national FLW data covering all sectors of the food chain.[66] This led to a multi-stakeholder partnership called "The Food Loss & Waste Protocol" publishing the global food loss and waste Accounting and Reporting Standard (food loss and waste Standard) in 2016. The purpose of the Food Loss and Waste Standard is to facilitate the quantification of FLW and encourage consistency and transparency of the reported data.[67] It is this consistency and consistent definitions of food, food waste and inedible parts that must be adopted by every organisation committed to measuring and reducing food loss and waste.[68] Subsequently, recommendations highlighted in FUSIONS, REFRESH and the Food Loss and Waste Standard were considered in the development of the EU common methodology (see Appendix 2).

Challenges to food loss and waste measurement

The 2010 European Commission Preparatory Study on Food Waste[69] identified a poor understanding of existing levels of FLW across the EU. This finding was replicated by the FUSIONS project, with many Member States lacking robust data on the amounts of food waste generated.[70] More recently the REFRESH project also highlighted several barriers to obtaining FLW data from businesses, including issues concerning: commercial sensitivity, resources required to measure and negative media appearances.[71]

In addition, although finalisation and implementation of the EU common methodology should address some concerns over a lack of prescriptive approaches, there is still significant variation in the potential accuracy of the methods listed. This is important to consider in the effective measurement of progress towards SDG12.3 which will require the use of both accurate and robust approaches. Furthermore, the issue of resourcing, highlights a significant challenge facing the effective implementation of the EU common methodology. Indeed, accurate quantification methods are often more expensive, while more affordable methods tend to be less accurate.[72]

Finally, it is also important to recognise that experience in FLW measurement will vary considerably across the EU: some organisations will be very familiar with approaches, whilst others will require significant help and guidance to measure their FLW.

Potential solutions

In recent years new tools and techniques have been adopted in attempts to improve the quality of FLW data collected, across multiple food supply chain stages, in the EU. Indeed, there are an increasing number of organisations offering advice and support to measure and analyse the causes of FLW (as well as the forecasting and optimisation of production). Services range from providing advice and simple measurement tools, through to ones using innovative technologies, such as artificial intelligence. Thus, those measuring FLW are increasingly able to choose the tools and services appropriate to their needs.

For example, organisations such as Leanpath and Winnow have developed "automated food waste tracking technology",[73] which couples recognition tools (e.g. cameras) with weighing technology, to analyse business food waste. The adoption of their technologies and subsequent change in business behaviour has led to significant savings and reductions in food waste within the year of investment.[74, 75] In addition, apps are also being developed which can analyse the amount of food waste produced by householders. The app compares photos of an eater's plate before and after a meal then sends the images to dedicated servers, where trained researchers can download and analyse them to obtain better estimates of household food waste.[76]

Nowadays, there are new tools for data reporting that can help obtain FLW data from businesses. Firstly, following lessons from the UK's Courtauld Commitment,[77] some voluntary agreements are utilising confidential reporting portals. This stems from the knowledge that some businesses may feel uncomfortable publicly reporting food waste figures. This approach may allay concerns regarding commercial sensitivity and help obtain food waste data in the short term. However, it is unlikely to address increasing demand from consumers regarding the transparency of organisations' sustainability practices.[78] Therefore, in order to ensure widespread public reporting, it is important for external organisations (e.g. other retailers, NGOs and governments) to positively recognise those pioneering organisations who choose to publicly report their data.

Another new online reporting tool that organisations, governments and academics can use to report FLW data is the Food Waste Atlas.[79] The Food Waste Atlas is freely accessible and aims to bring together global FLW data from across the food supply chain. In the future, as the database grows, this Atlas will provide essential insights into the scale and location of FLW.[80] A possible advantage of the Food Waste Atlas

over a national database is the capacity for international comparison of businesses and sectors. This should be an attractive positive for many businesses who wish to have an international platform to broadcast their FLW measurement and reduction activities.

Increased transparency of FLW along the food supply chain corresponds not only to publishing FLW figures but also the methods used to create them. In the first year of mandatory food waste reporting, organisations across the EU will likely adopt a variety of listed measurement approaches (see Appendix 2). However, of the approaches listed, direct measurement represents one of the most accurate and robust methods to measure organisational FLW, yet also potentially requires the largest financial investment. Due to its high cost, public and private resources should be mobilised to use it. Furthermore, there is ongoing research validating and comparing the different measurement approaches.[81] New measurement approaches must continue to be developed, refined and compared to existing approaches.

A continued growth in organisations, ranging from NGOs to consultancies, will be needed to offer up-to-date measurement advice, help and guidance. This can build on 1) the increasing mix of technology solutions to support rapid and cost-effective measurement and reporting, and 2) key reports on the topic (e.g. FUSIONS Manual,[82] Food Loss and Waste Standard,[83] CEC Technical Report[84]). Innovations in these regards may also derive from the upcoming EU projects targeting FLW along the value chain (see section above).

It is also important that FLW stakeholders (e.g. peer business currently measuring FLW, government, environmental NGOs, etc.) communicate the potential financial benefits associated with accurate measurements of FLW, so the mandatory reporting requirement is not viewed solely as a hindrance, but as the starting point for future savings for the businesses.

In conclusion

The collection of accurate and robust FLW measurements across the EU will be an iterative process, regardless of the measurement occurring within, or beyond the scope of the revised Waste Framework Directive and the food waste measurement Delegated Act. Indeed, there are many measurement challenges and opportunities such as:

- introducing FLW measurement approaches and methods to those businesses who are less familiar with them;
- improving FLW reporting methods, combining both anonymous and public reporting;
- further ensuring measurement approaches adopted are those which are both robust and accurate.

Addressing these challenges would be truly instrumental in effectively reducing FLW across the EU and will help determine realistic and ambitious FLW targets. This could be done by:

- effectively disseminating current best practice approaches and stimulating the introduction of new measurement technologies and methods for the provision of advice;
- developing easy-to-use reporting systems and providing additional support and positive recognition for those businesses publicly publishing their FLW data;
- assessing financial incentives[85] and providing additional resources to ensure robust measurement methods are feasible.

Food waste valorisation

Introduction

The term waste valorisation has been defined as the process of converting waste materials into more useful products including food, animal feed, chemicals, materials and fuels.[86] In its essence it's about making better use of resources – or extracting added value from materials – before consigning waste to conventional management options[87] that are at the bottom of the food waste hierarchy (see box below). Reaping the benefits of valorisation requires a mindset change. FLW may be unavoidable, but where it arises it can be an opportunity to recover valuable resources.

When organisations are unable to prevent waste, they often put their environmental focus on the responsible recycling or energy recovery of waste, forgetting (or not knowing) about potential valorisation opportunities. By using food co-products or waste as an ingredient in existing production, or as a feedstock in new processes, these materials remain in the production system. This can help companies: 1) achieve waste reduction targets, 2) reduce waste recycling and disposal costs, and 3) potentially access new income streams.

Furthermore, the fast depletion of natural resources and the need for more circular and cost-efficient waste management processes highlights the importance of valorisation opportunities which could enhance operational efficiency, access access new products and increase profits.

There are multiple valorisation examples across the EU, and these can range from extremely innovative and unusual approaches to those which are incredibly simple. Innovative approaches include – for example – QMILK based in Germany, who has developed a process to produce high-value, organic, textile fibre from waste milk[88] and Shellworks, a UK-based start-up, turning waste lobster shells into bioplastics.[89] In contrast, simpler approaches include the conversion of surplus strawberries into high-value fruit syrups[90] and the extraction of high-value pectin from apple pomace.[91]

However, food waste valorisation still has great untapped potential for rapidly reducing food waste. This is due to the scale of industrial and agricultural food waste streams that are currently being disposed of via traditional waste disposal routes that could instead be valorised to create high-value products. The lack of scaled uptake of valorisation and the development of new European policy priorities[92] means that

the potential for valorisation will continue to grow. Needless to say, any increase in feedstock from industrial and agricultural food waste streams must also be accompanied by an increase in the scale of (and investment in) valorisation infrastructure to accommodate the increased input of feedstock.

The Food Waste Hierarchy

There is clear direction on the prevention, management and treatment of wasted food through the use of a "food waste hierarchy".[93] In the EU this hierarchy is an extension of EU waste hierarchy (from the EU waste framework directive). Although there is currently no EU legislation or specific guidance on how to apply the EU waste hierarchy to food, several EU Member States recognise the use of a hierarchy in the selection of how to prevent and manage food waste (see figure 3 below). Valorisation is an intermediate option between the prevention and waste sections of the hierarchy, enlarging the "sent to animal feed" option to include multiple other alternative valorisation pathways.

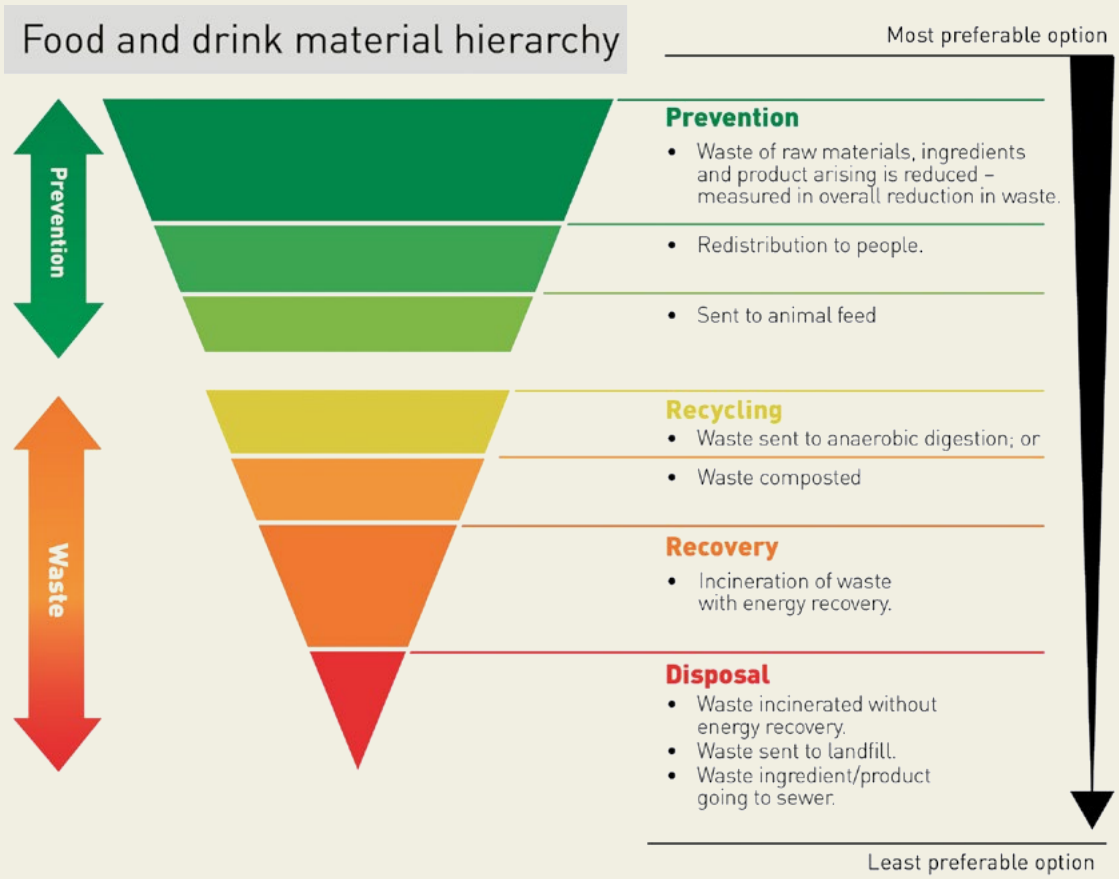

Figure 3: The food waste hierarchy[94]

Examples

GlaxoSmithKline make glucose from bread waste

Working with UK based innovation leaders at the Biorenewables Development Centre (BDC) in York, GlaxoSmithKline (GSK) are seeking new bio-based solutions for their business. Three years ago, GSK embarked on a search for a more sustainable supply of food-grade glucose: a key ingredient for GSK which has highly volatile pricing. Together, BDC and GSK identified new sources of glucose from food manufacturing, using starchy co-products such as bread heels and potato waste as a starting material.[95] BDC are now determining the scalability of these processes at a commercial level.

Piñatex® – an innovative natural textile made from pineapple leaf fibre

Shocked at the environmental impact of mass leather production and chemical tanning, the ground-breaking company Piñatex realised this could not continue and knew that existing PVC alternatives were not a solution either. The company started to use pineapple leaf fibre, an agricultural waste product, to make a new, non-woven textile that could be commercially produced, provide positive social and economic impact and maintain a low environmental footprint throughout its life cycle.[96]

H&M – dresses from orange peel

H&M have recently revealed their Conscious Exclusive's 8th spring collection, which features clothes made from sustainably sourced materials, for example, citrus peel.[97] In Italy alone, it is estimated that more than 700,000 tonnes of citrus waste are produced.[98] Recognising this, Orange Fiber process citrus waste and use the by-products to create a sustainable alternative to conventional textile fabrics.

Challenges and solutions

1. Making a business case

Food waste valorisation as a concept is not new and has been the focus of a very broad range of EU research (e.g. REFRESH,[99] AGRI-MAX,[100] PERCAL,[101] SCALIBUR,[102] VALUEWASTE,[103] etc.). However, the translation of research into business practices can be slow and the true commercialisation of this research into businesses requires support. In most cases, where valorisation approaches have been adopted there is a straight-forward business case for using waste products and diverting them from traditional recovery routes.

In highlighting a case for change, there are now tools[104] which can help businesses of all scales explore valorisation options. Additionally, in the UK, there are several other support mechanisms available for businesses wanting to explore food waste valorisation. These include the BioPilots UK Alliance, which works to "de-risk the commercialisation of bio-based products and processes by trialling new technologies to ensure our partners are investing in the right technologies for their business"[105] and organisations such as the Beacon Bioeconomy Research Centre,[106] IBioIC[107] and BioVale;[108] all of whom offer support to businesses considering valorisation as a waste management option. Facilitating conversations between these organisations and businesses producing food waste is an important step to reducing food waste through valorisation.

Adopting food waste valorisation means disrupting business-as-usual. When considering operational processes, food production is usually quite efficient as it's not in the interest of businesses to waste ingredients unnecessarily. However, experience shows that most – if not all – businesses produce some waste and by-products, and the waste management of these is decided on the basis of economic cost (including capacity of infrastructure), environmental impacts (including availability of alternatives) and regulation. Therefore, adopting valorisation approaches and new techniques or technologies can be disruptive; requiring time, effort, resources and almost certainly some initial financial investment. This highlights that valorisation requires vision to see the potential within a business, but also that adoption of new processes and technology will require a strong economic business case to make the transition from good idea to normal business practice.

Examples

WRAP Valorisation business case toolkit

The 'Value from Food Waste and By-products Business Case Toolkit' is intended to help food and drink manufacturers to explore converting wastes and by-products into potentially lucrative products via valorisation.[109] Primarily designed to assist with comparing different options and to guide thinking for decision-making, the toolkit can help to build the business case for valorisation – from initial evaluation right through to detailed modelling. The toolkit can help businesses see the value in disrupting business as usual.

Pennotec – Functional Fibres

The technology firm Pennotec highlighted a strong business case in the extraction of beneficial fibres from surplus apples, which could then be used to replace fats in certain food types. The surplus food is currently sent for composting or animal feed; however, the apple pomace's beneficial fibres have a far higher, mass market value when added – potentially in the form of a powder or paste – to popular food.[110]

2. Communicating valorisation opportunities

The valorisation research and development landscape is full of great examples of how co-products and waste from the food industry can be used to make widely different products, ingredients and feedstocks. However, the processes and chemical transformations required can be complicated and may seem like a whole new world for food businesses; therefore, communicating potential valorisation opportunities effectively and with technical solvency to food industry stakeholders is a specific challenge that needs to be overcome.

Those organisations looking for new sources of polymers, chemicals, fibres or ingredients need to be aware of the potential and technical feasibility to find those in waste streams and co-products from the food

industry. At the same time, those in the food industry need to be aware of the potential value of the co-products and wastes currently being sent for disposal or used in low value applications, facilitating their valorisation.

However, the situation is starting to change. For example, the UK Biotechnology and Biological Sciences Research Council sponsored the publication of a report which identified the top 10 chemicals that could potentially be made from bio-based rather than fossil-based materials (see UKBioChem10).[111] Bio-based chemicals – chemicals produced from plants rather than crude oil – represent a dynamic area of innovation in the UK, one that can create growth, trade, investment and jobs.[112] Highlighting these substitutes reflects an important element of market push required to shift organisations towards the use of alternative – more sustainable – feedstocks such as food waste. The role of highlighting substitution and valorisation pathways can be carried out by multiple stakeholders on differing regional or national scales. For example, in the UK, BioVale (a not-for-profit company) has fulfilled this role in the Yorkshire and the Humber regions, providing support to stakeholders by facilitating networking, dialogues and partnerships between stakeholders.[113]

3. A better policy environment for valorisation

Current waste management practices may reduce the amount of secondary raw materials[114] available for valorisation purposes. Furthermore, the EU's current political focus on bioenergy and biofuels (promoted through renewable energy targets) may have the unintended consequence of putting other bio-based material uses at a competitive disadvantage.[115] Indeed, as incineration with energy recovery is still usual practice in the EU, the opportunity to extract valuable bioproducts may be lost.

Future EU legislation could address this by encouraging and prioritising the use of bio-waste for value-added products, including chemicals, materials and fuels.[116] In addition, some have suggested that fiscal incentives for companies using local waste as a feedstock[117] may also stimulate more businesses to act in this area.

In conclusion

The valorisation and extraction of added value from FLW can be seen as an emerging disruptive (but proven) technology that often has a faster implementation period than other FLW reduction initiatives (e.g. regulation and voluntary agreements). However, there are some challenges to the further adoption of valorisation. These include:

- the need to communicate to the food industry the potential (and business case) for valorisation for their specific production process;
- the identification, linkage and mapping of waste streams to the places where valorisation can occur;
- the scaling of valorisation infrastructure to accommodate the increased input of feedstock.
- the existing policy disincentives that favour energy recovery over valorisation.

These challenges can be addressed through

- further research and the effective dissemination of beneficial valorisation examples, highlighting the potential environmental and economic benefits associated with these opportunities;
- continued support from external organisations and experts, for businesses considering valorisation options;
- reviewing legislation so that it adequately recognises the currently underutilised element of valorisation (into new products) within the waste hierarchy;
- continued investment in the EU bioeconomy to ensure the development of viable valorisation technologies and methods.

Food waste voluntary agreements

Introduction

Voluntary agreements (VAs), in the context of environmental sustainability, are schemes in which public and private sector organisations make commitments to improve their environmental performance, without the need for legislation or sanctions. They cover arrangements such as public voluntary programmes, negotiated agreements or unilateral commitments.[118]

In recent decades VAs have often been implemented in attempts to help tackle a wide variety of environmental issues: GHG emissions,[119] unsustainable clothing,[120] plastic waste[121] and food waste. Across the EU for example, numerous VAs have been set up to tackle FLW, either covering a wide variety of sectors and stakeholders across the food chain (e.g. the Courtauld Commitment in the UK, ForMat Project in Norway and Taskforce Circular Economy in Food in the Netherlands) or focusing on specific sectors (e.g. Dairy Roadmap and the Hospitality and Food Service Agreement in the UK).

In considering their set up, VAs support the notion that collective action can be more cost-effective and provide greater impact than that experienced when organisations tackle issues in isolation. Furthermore, they have the potential to offer efficient, flexible and effective alternatives to traditional regulatory structures,[122] whilst improving the image of both the regulator and the regulated by signalling the willingness of both sides to engage in a more flexible process of environmental protection.[123] It is this beneficial flexibility which was highlighted in the REFRESH project, which also suggested VAs could help facilitate collaboration between stakeholders and highlight the best practice approaches necessary to deliver change.

Challenges of Voluntary Agreements

There are three main challenges associated with the effective implementation and success of Voluntary Agreements on FLW. Firstly, each VA will have different objectives, depending on the stakeholders involved and the socio-economic and political context under which it operates. It is this variability in context that makes it extremely difficult to take any single VA from one country and replicate it exactly across other countries. In addition, a possible concern for participating large multinational

organisations is that they might feel discouraged (or fatigued) to sign up to multiple VAs across different countries which are in themselves fundamentally different.[124]

Secondly, another concern linked to VAs is the potential for participating and nonparticipating firms to "free-ride" and gain the benefits from a VA without investing resources.[125] VAs which only have aggregated reporting – to encourage participation – may be more susceptible to this issue. While there are some cases reported,[126] published evidence of free riding in VAs remains very limited. Nevertheless, this is important because ultimately the long-term success of VAs will be determined by high levels of participation from all stakeholders involved. Therefore, variability in participation can undermine a VA from achieving substantial impact.

Thirdly, despite some food waste VAs showing promising results, the environmental effectiveness of voluntary approaches is still under question.[127] To date there is limited literature on the effectiveness of such approaches and in most cases impact is poorly measured, so the true attributable impact of VAs is unknown. This is largely associated with the challenges surrounding the collection of both accurate and robust food waste data from organisations across the EU, as well as difficulties establishing a credible counter-factual.[128] However, regardless of whether this lack of data stems from issues with resourcing requirements or commercial sensitivity, or both, it makes evaluating the long-term impact of VAs difficult.

Finally, it is also important to understand the ongoing position of VAs within the overall policy mix of each country, so the right approaches – or combination of approaches – are taken to ensure the most effective and sustainable outcomes.

Figure 4: The five key steps to a voluntary agreement, from the REFRESH VA Blueprint.

Solutions

1. Variation in context

The REFRESH project published a VA Blueprint (Figure 4), based on five key steps believed to influence the successful establishment of voluntary agreements. The project recognised that variations exist in the socio-economic and political contexts under which VAs are set up. However, it observed that the core fundamentals of effective VAs were the same, irrespective of the context in which they were established. These fundamentals include enlisting support, recruiting signatories, identifying ambitious yet realistic targets, identifying funding which is critical to the success of the agreement, determining food waste reduction actions, monitoring and evaluation. Rather than trying to replicate a specific VA directly, it will be a more successful approach for stakeholders to follow the Blueprint and apply the steps and fundamentals proposed. It is expected that following the Blueprint and aligning ambitions with wider international food waste targets (e.g. SDG12.3) could also – to some extent – allay concerns from large multinational organisations regarding the lack of a unified approach across the EU.

2. Ensuring participation

When considering participation, Segerson & Miceli[129] highlighted two basic mechanisms which are thought to motivate participation: positive incentives (e.g. cost-sharing, subsidies and positive brand image) and the threat of legislation. This is supported by further research that suggests VAs which are clearly tied to economic gains can achieve environmental results.[130] Thus, the public sector has a key role to play to secure good participation levels.

However, beyond positive incentives and the threat of legislation, stakeholders and consumers are increasingly demanding more transparent food supply chains, to support decision making and influence buying behaviour.[131] This transparency can be addressed – in part – through regular reports which highlight VA targets and the actions being taken by participating organisations to meet these targets (e.g. UK plastics Pact[132]). These regular progress updates, by signatories, can also help build momentum towards delivering the targets. Furthermore, increased transparency of reporting – which can be driven by VAs – provides external stakeholders with the opportunity to praise highly committed

organisations whilst exerting pressure on those organisations that are less active. In a situation where a participating organisation remains consistently disengaged, the VAs lead organisation (responsible for running the VA) could consider evicting them from the agreement.

High levels of participation also require ambitious yet realistic goals and a core group of "champions" pushing the VA forward. In the case of food waste VAs – throughout the supply chain – a core group may comprise different stakeholders across the food supply chain, e.g. retailers, manufacturers, wholesalers, food service organisations, waste management companies, trade bodies, agricultural businesses, farmers, policymakers, charities and other non-governmental organisations.[133] This core group can further benefit from a strong support network of wider FLW stakeholders (e.g. food waste measurement organisations, government departments responsible for food health and safety, etc.).

When considering the role of governments, research from the REFRESH project highlighted that one of the main success factors for effective VAs is having government backing, including but not limited to financial support.[134] This also allows signatories to raise regulatory barriers to action with government so that solutions can be sought collectively. The government should also recognise and support the lead organisation running the VA, who will be held responsible for the overall success of the VA, including a high level of participation. The lead organisation should be able to work with businesses, government, communities, NGOs and be convinced of the aims of the VA; they need to have a strong representation in the country and a successful track record in the respective area.

Finally, organisations either internal or external to the VA can act as "critical friends". A critical friend is "a trusted person who asks provocative questions, provides data to be examined through another lens and offers critiques of a person's work, as a friend".[135] In the context of VAs this person or organisation is not responsible for monitoring and evaluation but can help ensure participants are highly engaged and progress is made towards targets, as well as identifying issues such as low participation levels.

3. Measuring impact

High levels of engagement can also be demonstrated through involvement with the monitoring and evaluation processes associated with a voluntary agreement. VA evaluation should establish a robust methodology for evaluating against the desired targets and aim to determine the attributable impact of the agreement, although the latter can require significant resource input. Successful VAs are those which monitor their progress, evaluate interventions and adapt when necessary. For instance, a Carrier Bag VA in the UK established a target of 50 % and measured a 48 % reduction thanks to voluntary action.[136] Action taken after this agreement then led to even higher levels of reduction (around 80 %), achieved by a charge on bags. This illustrates how a VA can work well independently and lead the way for stronger regulation.

Data issues (highlighted above) will also be partly addressed following the adoption of the EU common methodology which will go some way towards ensuring the adoption of effective measurement approaches. In addition, where commercial sensitivity remains a significant issue, VAs can also consider the use of confidential reporting portals; however, as mentioned above, it must be noted that this does not satisfy stakeholder demand for increasingly transparent data on food waste within food supply chains.

Examples

Courtauld 2 (UK)

Following on the success of the Courtauld 1 (2005–2009), Courtauld 2 was a VA administered by WRAP that ran for three years (2010–2012), with 53 signatories (including retail, brands and suppliers) in the UK.[137] The main aims of Courtauld 2 were to reduce primary packaging and household food and drink waste. It also included reductions in 1) secondary and tertiary packaging, and supply chain waste, and 2) reducing the carbon impact of packaging. The influence of Courtauld 2 resulted in a 10 % reduction in packaging carbon impact, a 3.7 % reduction in household food and drink waste and 7.4 % less supply chain waste (this represents a total of 1.7 million tonnes of waste). This impact has a monetary value of £3.1 billion and equates to a reduction of 4.8 million tonnes of CO_2. Courtauld 2 was run in conjunction with the consumer facing campaign of Love Food Hate Waste, and part of the effectiveness of Courtauld 2 can be attributed to this joint approach. Overall the VA approach has helped the UK to reduce its total food waste by 19 % (up to 2015).

In January 2020 WRAP reported that edible food waste in the UK had declined by 27 %/person since the baseline year, saving 1.7 Mt food waste/y valued at around 5 billion Euro/y. The activities of the Courtauld Commitments 1, 2, 3 and recently Courtauld 2025, together with the Love Food Hate Waste Campaign have helped deliver these substantial reductions.

ForMat project, Matvett and the Norwegian 'negotiated' agreement

ForMat project is an initiative from the Norwegian food sector. Operated through a private – public partnership ForMat has enabled 1) collaboration and a systematic mapping and monitoring of food waste since 2010 throughout the value chain, and 2) sharing of food waste data between manufacturers, wholesalers and retail. Between 2010 and 2015 it resulted in a 12 % reduction in food waste.[138]

Building upon ForMat, Matvett began in June 2017[139] with 42 companies from the food manufacturing, retail, grocery and catering industries. The objective of Matvett is a 50 % reduction in food

waste by 2030. Matvett is owned by (and represents) the food sector; this includes NHO Mat og Drikke (Food and drink Norway), DLF (Grocery Manufacturers), DMF (Grocery Forum retailers/ environmental), NHO Reiseliv (Norwegian Hospitality Association) and VIRKE (Enterprise Federation of Norway). Both ForMat and Matvett have a unique financial model within the food industry, with financial contributions to the VA coming from signatories as well as via a government packaging levy.[140]

These two actions now also fall under the banner of the wider Norwegian voluntary agreement on food waste. This can be understood to be more of a 'negotiated' agreement. As although it is voluntary, it is also binding for the contracting parties. The aim of this agreement between the Norwegian Government and the food industry is to reduce food waste in Norway by 50 percent by 2030.[141]

In conclusion

As new food waste VAs are set up across the world (e.g. Sweden, Denmark, Germany, South Africa) it is imperative that we address some of the most frequent challenges they face, to ensure desired FLW reduction outcomes are realised by the VAs. Some of the most relevant approaches are:

- ensuring new VAs follow core principles and well-described fundamentals for the establishment of successful VAs
- enlisting government support and ensuring the most appropriate lead organisation is selected
- ensuring VAs are adequately resourced to assist signatories in delivering targets and developing new best practice where needed
- continuously revising the dynamics of the VA and understanding the mechanisms necessary to ensure high levels of engagement (subsequently achieving impact),
- setting ambitious yet realistic goals, and
- further developing appropriate methods to monitor and evaluate progress.

5. COMPLEMENTARY POLICY INTERVENTIONS

This section highlights three additional actions that are related to policy change, and which could lead to further FLW reductions. Although there is little published evidence, we believe that these interventions could hold high potential for effective FLW reduction. The actions are related to the Common Agricultural Policy; Stronger Regulation; and National Food Waste Strategies.

Common Agricultural Policy

The EU's Common Agricultural Policy (CAP) is the policy framework under which most European farms and farmers operate. A review by the REFRESH programme found it to be the most important policy within which to address FLW at the primary production level.[142] Furthermore, a report by the European Court of Auditors found that the CAP can also have an influence on the generation of food waste in production, processing and the retail stages of the food supply chain, through mechanisms such as direct payments, market measures and rural development payments.[143]

Rural development is the most flexible toolbox within the CAP, so it holds the greatest potential to contribute to reducing FLW. To date, however, Member States have not prioritised FLW in their CAP interventions and Rural Development Programmes, so that potential – which could give funding support to investment in infrastructure or physical assets (such as storage), farm advisory services, animal welfare measures, risk management, and community-led social innovation projects – remains mostly unrealised.

However, with the European Commission's proposals on the future of the CAP beyond 2020, the tide may have turned for food loss and waste in this policy area. Indeed, the proposals highlight the policy's "higher ambition on environmental and climate action", and food waste is explicitly mentioned in one of the nine specific objectives the CAP should pursue post 2020.[144] This is in line with the progressive evolution of this policy, whose original objectives (unchanged since the Treaty of Rome, Article 39 of TFEU), are now expanded to cross-cutting EU priorities, such as promoting environmental protection and sustainable development (Article 11 of TFEU).[145]

Once the political agreement is reached, which is likely to happen in 2020 or 2021, Member States will still have to plan interventions in their CAP strategic plans, and food waste should be one of the aspects to be considered. However, given the limited experience and evidence available from within the CAP, external input will certainly be needed and FLW stakeholders should proactively engage in this process. Some of the key elements that could be considered when designing CAP interventions for FLW are:

- The need to perform a critical revision of the existing direct payments and investment support, which could be unwantedly stimulating (either directly or indirectly) overproduction and market saturation, thus constituting a structural barrier to being able to address FLW.
- Sectorial interventions, particularly when targeting producer organisations, could provide funding support for, inter alia: i) technological innovations allowing to transform and valorise sub-products and food waste, or to better match production with demand; ii) developing marketing strategies to minimise on-farm food waste and open new markets which can absorb occasional over-production.
- A few rural development measures should be specifically targeted to FLW, including investment support, knowledge exchange and innovation, or cooperation between actors in the food supply chain.

In the CAP strategic plans revision process, the European Commission will also have a key role to play, making sure that Member States have taken the issue of FLW seriously and have not let the topic be drowned by other competing priorities in the farming policy.

Stronger Regulation

Environmental issues, such as food waste, can also be addressed using stronger regulatory measures, either at EU or national level. Indeed, regulation holds large potential for food waste prevention, reduction and reuse due to the immediate, transformative system-wide effects of regulation coming into force. Regulation can also provide an environment for other actions mentioned in this document to operate with greater effectiveness.

France, for instance, adopted legislation in 2016 to address supermarket food waste, with mixed results (see case study below). At a similar time, in the UK a “private members bill” was being proposed, titled “The

Food Waste (Reduction) Bill 2015-16", which would have required large supermarkets, manufacturers and distributors to reduce their food waste by no less than 30 % by 2025 and enter into formal agreements with food redistribution organisations; to require large supermarkets and food manufacturers to disclose levels of food waste in their supply chain; and for connected purposes.[146] However, the proposed legislation was not taken forward by the UK parliament.[147]

Other regulatory approaches could include establishing mandatory food waste reduction targets, which is an option to be considered by the EU in 2023 as part of the revised Waste Framework Directive; or making food waste measurement/reporting mandatory for all large food businesses, on an individual company basis.[148] These regulatory approaches have potential but, to our knowledge, they have not yet been adopted or tested by any Member State, so evidence of their real effectiveness is still lacking.

One area of regulation and policy that could include FLW commitments would be climate change. Indeed, the 2019 IPCC report on Climate Change and Land[149] has now estimated that global emissions associated with FLW are at 8–10 % of total anthropogenic emissions in CO_2e. (Intended) Nationally Determined Contributions (INDCs) are the main method of listing the carbon emissions of a specific country, alongside national priorities, actions, circumstances and capabilities to reduce carbon emissions to a level that allows the country to meet its goals, set at the UN Framework Convention on Climate Change Conference of the Parties in Paris in December 2015.[150]

Typically, however, INDCs remain at a much higher level and do not refer to categories such as food waste. In contrast, instruments such as the National Energy and Climate Plans, which are being finalised by EU Member States in 2019–2020, contain much more detail of the actions planned to meet the 2030 climate mitigation objectives of the Union, and some of them already refer to FLW.[151] Other climate regulations or laws developed at national level could equally include food waste reduction commitments in line with the climate mitigation ambition, creating an effective lever for enhancing the work on FLW.

Case study:
French regulation against supermarket food waste

On 11 February 2016, France enacted a law on combating food waste (Loi no. 2016-138).[152] The main features of the French law are (a) it clarifies the waste hierarchy in the case of food waste; (b) it forbids the deliberate destruction of food surplus by supermarkets; and (c) it introduces the obligation for supermarkets to sign an agreement with non-profitable organisations to donate food that otherwise would be wasted.

However, in a special report on food waste prevention measures, the European Court of Auditors has expressed concern that the French law is too vague.[153] It does not specify a minimum amount of food that the supermarkets must donate, which means that a retailer who donates only 1% of their surplus will technically be in compliance. Furthermore, the law does not address the root cause of the problem: the large amounts of instore (and supply chain) food waste being caused by multiple factors including supermarkets' instore systems and marketing practices.

The law has also been criticised for increasing supply of food to redistribution charities without properly considering increased strain faced by their redistribution operations (i.e. the lack of infrastructure, transport, storage and logistical resources available to redistribution charities[154, 155]).

It appears there is no publicly available quantification of the impact of Loi no. 2016-138 on food waste. However, this French law is not operating in isolation. There are additional measures including a national pact against food waste,[156] Loi no. 2015-992 that reduces food waste in collective catering, and a quantification of food waste across the supply chain in France.[157] Additional Bills supporting food waste reduction have also been proposed in the Council of Ministers.[158] The Unfair Trading Practices directive adopted by the EU in 2019[159] could also help address some of the root causes of the FLW generated by the supply chain, such as last-minute cancellations of orders.[160, 161, 162]

The example of Loi no. 2016-138, illustrates that no single regulatory solution will be truly effective on FLW.[163] Holistic government intervention and support is needed at all stages of the supply chain and food system.

National food waste strategies

In recent years, certain countries across Europe have started to develop their own national food waste prevention strategies or programmes, such as Spain,[164] Portugal,[165] Germany[166] or Norway.[167] The FUSIONS project defined these strategies as "high level plans/programmes designed as a comprehensive set of policy measures specifically addressing food waste prevention", which can include a number of key sectors, such as local authorities, households, the hospitality industry, the retail supply chain, businesses and institutions (such as schools and hospitals).[168] The strategies can encompass a wide variety of approaches and mechanisms which can be either voluntary, regulatory or a combination of both.

The development of national food waste prevention strategies may be linked to the revised Waste Framework Directive, which in its Article 29 now obliges Member States to adopt specific food waste prevention programmes within their waste prevention programmes. However, we wish to highlight the distinction between a partial (possibly only citizen or industry oriented) food waste prevention programme, and a comprehensive national food waste prevention strategy that has concrete objectives and targets for different actors along the value chain, as well as concrete activities, measures and evaluation activities.

A national food waste strategy can be a game changer, providing momentum to accelerate FLW reduction, prevention and diversion along the value chain at the national level. In addition, a national food waste strategy also offers a pathway for the public (and other stakeholders such as NGOs) to engage, assess and criticise the implementation of activities, methods used and processes chosen. Finally, a national food waste strategy provides an umbrella 'brand' that can enhance the coordination and coherence of different interventions.

One major challenge of a national food waste strategy is the difficulty involved in evaluating the individual and combined impact of such a wide variety of FLW initiatives. Moreover, as national food waste strategies are long term commitments (3–10 years), there is limited scope to revise objectives and targets and redesign activities, measures and evaluation activities, if new evidence comes to light as the strategy progresses. For this reason, an active evaluation of the different interventions and the budget allocated to them, and a regular revision of prioritised activities are required to keep the national food waste strategy relevant, open to innovations and effective.

6. CONCLUSIONS: SEIZING THE OPPORTUNITY TO REDUCE FOOD WASTE IN THE EU

The EU's adoption of the CEP and the revised Waste Framework Directive in 2018 provides a 2-year period where Member States must integrate these policies into their national law. In 2020, the first EU wide national measurement of food waste will be undertaken, following the methodologies provided in the Delegated and Implementing acts. This measurement will be reported in 2022–23 and will deliver comparative baseline measures for all Member States. In 2023, the publication of this baseline data will provide the opportunity for Member States to consider the feasibility of establishing Union-wide food waste reduction targets to be met by 2025 and 2030, which should be aligned with SDG 12.3. Furthermore, the Farm to Fork Strategy presents a great window of opportunity to reduce food waste by accelerating the transition to a sustainable food system and by proposing legally binding targets for food waste reduction across the EU in 2023. For this reason, the next few years will provide crucial moments of opportunity for EU Member States' food waste policy.

Each action highlighted in this report has the potential to drastically reduce food waste across the EU; in addition, three of the actions have robust evidence bases. Indeed, the existing literature has shown that **food waste measurement** is one of the most impactful actions to reduce FLW in the food system. Once FLW has been measured, a case for change can be created, and the reasons for FLW can be understood and prioritised for intervention. Measurement also allows for the tracking of progress and the evaluation of other interventions.

As mentioned above, food waste measurement will occur more consistently across Member States' supply chains and food systems from 2020. However, there is potential for 1) a greater quantity of detailed and robust measurement of food waste than mandated in the Delegated Act; and 2) for the measurement of smaller scales of food waste to be carried out (i.e. sector or company-wide). As food waste measurement is an iterative process, it can evolve as greater volumes of food waste are reported. Indeed, in many Member States the funding available to support measurement (and related support activities) is already changing and will grow with the establishment of more complex measurement programmes across the EU.

The **valorisation** and extraction of added value from food waste is an emerging disruptive technology that has a faster implementation period than voluntary agreements and measurement actions. As shown in the case studies, once identified, valorisation opportunities provide a rapid pathway (possibly within 12 months) for diverting food waste to create high value products. Valorisation actions have links to new European policy priorities in particular; the updated EU Bioeconomy Strategy, the renewed Industrial Policy Strategy, the Circular Economy Action Plan and the Communication on Accelerating Clean Energy Innovation. With these strategies in place, the role of valorisation in reducing food waste - and the wider role of the bioeconomy – will continue to grow. A current challenge for the uptake of valorisation actions in the EU is the lack of knowledge within companies and sectors about potential valorisation opportunities; who can be partnered with to process FLW, and what types of food products can be used for what purpose.

Voluntary agreements provide a longer-term strategy to reduce food waste across an industry sector, a region or a nation. Several Member States are already implementing voluntary agreement approaches within the EU and there is wide scope for further adoption. Reviewing previous voluntary agreements, 5 years can be understood to be a typical timeline for implementing and running a voluntary agreement that delivers significant results. Typically, one year to establish the agreement, three years of operating, and one year to establish a legacy and continuation. Funding for voluntary agreements can come from several sources including contributions from signatories and government sources. Government funding has previously been used as an initial "set up" funding source, which then switches to shared funding between businesses and Government once the VA is in operation. Voluntary Agreements that are not supported by funding, don't have shared targets, so fail to measure and report on progress regularly, and a supporting programme that helps the signatories deliver change rapidly is unlikely to be impactful.[169]

More coherent and integrated policies will be instrumental in accelerating FLW reduction. Modifications to the **Common Agricultural Policy**, and the introduction of **stronger regulation** and/or **National Strategies** must occur over the next few years for the EU to be able to meet SDG12.3. Upcoming Horizon 2020 EU projects will also assist by proposing innovative approaches to FLW reduction, and the experience of experts and researchers in this field will provide fundamental input for the design and assessment of all food waste interventions.

Overall, a high degree of commitment and collaboration from all food waste stakeholders will be needed to deploy all the actions required to accelerate food waste reduction in the EU by 2030. The major challenges and actions highlighted in this report include:

For Industry

- Actively measure, report and ideally also make public their operational FLW data.
- Ensure that the measurement approaches adopted are transparent, robust and accurate.
- Invest in technological solutions and activities for FLW reduction and prevention, with the support of expert organisations offering advice and guidance.
- Encourage supply chain partners to measure (and publish) their FLW and engage in FLW reduction and prevention activities within their own operations.
- Actively participate and invest resources in voluntary agreements, to help ensure their success and the dissemination of best practice FLW reduction and prevention approaches.
- Identify, explore and invest in valorisation opportunities from unavoidable FLW streams to recover valuable resources.
- Engage and collaborate with farmer organisations and cooperatives to diminish on-farm and early supply chain food losses and waste.
- Communicate the importance of FLW reduction and prevention, on the global stage and within their own industry sectors, including the financial benefits expected.

For NGOs

- Provide another voice and pressure group to campaign for parts of the food system (primary producers, processors, retailers, distributors, restaurants and food services, households, governments, etc.) to measure and report FLW data.
- Encourage and publicly recognise businesses who make their FLW data public and engage in reduction and prevention strategies.
- Assist government to communicate the necessity of robust FLW measurement and methods which can be used to measure FLW across various stages of the food supply chain.
- Reframe FLW measurement and reduction as a method to promote action to improve function of the food supply chain, highlighting the environmental, economic and social benefits of measurement.

» Raise awareness of valorisation options and infrastructure available to farmers, manufacturers, processors and retailers, and highlight relevant case studies.
» Advocate for the correct use of the food waste hierarchy, campaigning to make sure food waste prevention rather than treatment is always the highest priority.
» Lead or be a 'critical friend' for a voluntary agreement around food waste, ensuring high levels of participation are maintained and help agreements successfully meet defined targets.
» Ensure industry is transparent in the actions taken towards voluntary agreement targets; and work to ensure businesses provide robust food waste measurements.
» Advocate for an integrated policy environment that diminishes the risks of FLW from farm to fork, providing incentives to adopt corrective measures where they are needed most.

For Governments

» Work with businesses, NGOs and civil society organisations to ensure the most consistent and robust measurement and regulation of FLW across Europe.
» Provide support and seed-funding to establish FLW voluntary agreements and easy-to-use reporting systems.
» If voluntary agreements and measures are not sufficiently effective to achieve the goals of SDG 12.3 due to e.g. a lack of ambitious targets or insufficient participation from industry, national governments should introduce legal and binding requirements for businesses over a certain size to measure and report their company's food waste figures.
» Identify and correct policy disincentives that favour FLW energy recovery over valorisation options.
» Provide funding support for research and innovation in FLW measurement, reporting and valorisation technologies.
» Allocate agricultural policy funding to FLW prevention action, for farmer cooperatives and other stakeholders, while addressing structural barriers like overproduction and market saturation.
» Develop ambitious but realistic FLW prevention programmes and strategies at all relevant levels of government (municipal, regional, national, etc.).
» Adopt innovative policies and commit to binding FLW diversion and prevention targets that align with (or go beyond) SGD12.3.

For the Research Community

» Develop new valorisation research streams to promote whole food utilization.
» Fill data gaps and standardize reporting of FLW data in order to better compare results, create benchmarks and provide clearer direction for governments, industry and NGOs.
» Assess the impact of FLW interventions and solutions to improve the evidence base of what works and the return on investment.
» Develop sector-specific FLW guidance that provides the motivation and technical information needed for industry and government to act.

For All

» Engage with citizens to create society-wide awareness and understanding of the FLW problem.

Appendix 1 Review and interview, methodology and summary results

Rapid Review Methodology

To perform the rapid review, all available English language outputs were reviewed from REFRESH, FUSIONS, the International Platform of Insects for Food and Feed, the EU platform of food losses and food waste (including food waste measurement and action and implementation sub-group meetings) and EU-28 Member States' waste food policy documents. Google Scholar was used to identify additional peer reviewed literature.[170] The Google search engine was also used to identify news and non-peer reviewed actions.

138 items of literature were identified through the rapid review. Scores of robustness of evidence were given to each item (5 point scale). The literature was then clustered and 12 food waste reduction actions were identified. These 12 actions were then scored (5 point scale) based on 1) the actions, place in the waste hierarchy (and the value retained), 2) the evidence of impact on food waste reduction in existing literature (literature and case studies), 3) existing NGO involvement, 4) potential for an NGO to influence the action, 5) evidence of additional benefits in the literature (social, economic, environmental, animal welfare, health etc.). These different metrics were assessed by WWF and WRAP staff, also considering ongoing policy developments. The top 3 actions/areas of intervention to reduce food waste in the EU were identified. We then also identified the top 3 additional approaches that have less evidence but could hold high potential for effective food waste reduction. These 6 actions are reported as detailed Case Studies in Sections 4 and 5.

Interview Methodology

Interviews were conducted with representatives of the European Commission and 3 Member States. The purpose of the interviews was to gain up-to-date knowledge of Member State and EU level policy, as well as to gather Member State opinions on the current and future role of environmental NGOs within EU food waste reduction activities. A list of questions and discussion topics were sent to interviewees in advance, interviews were transcribed and sent back to interviewees to confirm content.

Interview results were used as additional evidence for the effectiveness of food waste reduction actions, and where relevant case studies were found, results were incorporated into Section 4. Results relevant to the deployment and scaling of food waste reduction actions and the role of environmental NGOs were incorporated into the conclusions.

Due to the anonymous nature of the interviews, direct results cannot be shared. However, a summary of the generalised cross cutting findings from the interviews is presented below.

Generalised cross cutting findings from interviews and rapid review

- Measurement/monitoring of FLW is a priority across Member States. However, there are multiple different methods and scales of measurement being used. This variability is dependent on the Member State and the specific industries in which the measurement is being carried out.
- Member States (and sub-industry sectors) have different levels of historic experience with measurement activities. Due to the Delegated and Implementing Acts, it is expected Member States will further develop their measurement capacity.
- The definitions and scope of FLW are different between some Member States and the definition used by the CEP and the Delegated Act. For instance, some Member States are looking at possible measurement of unharvested food and FLW on farms as part of a whole food systems view of FLW.

- Measuring and accounting for cross Member State FLW was raised as an issue by multiple Member States. This is FLW caused in one Member State as part of the trade with and consumption activities in, other Member States.
- Member States have different scopes and capacities for FLW redistribution and rescue activities. This includes different approaches to legislation and policies to reduce obstacles and barriers to donate safe (but unsold) food.
- "Lack of knowledge" was given as a common largest barrier to reducing FLW in each Member State.
- "Social norm and behavioural change" is the most common current solution to reducing citizen and national FLW in each Member State.
- The creation of the EU Platform on Food Losses and Food Waste has had a positive effect. It has allowed greater communication links and coordinated examples of best practice between Member States.
- Member States have different models of work, linkages and interactions with non-governmental and civil society organisations. The role that non-governmental and civil society organisations can play in reducing FLW may be constrained by these linkages.

Appendix 2 List of measurement approaches described by the Delegated Act

1) Methods based on direct access to food waste/direct measurement

The following methods shall be used by an entity with direct (physical) access to food waste in order to measure the food waste or to carry out an approximation:

Direct measurement (weighing or volumetric assessment)
Use of a measuring device to determine the mass of samples of food waste or fractions of total waste, directly or determined on the basis of volume. It includes measurement of separately collected food waste.

Scanning / Counting
Assessment of the number of items that make up food waste and use of the result to determine the mass.

Waste composition analysis
Physical separation of food waste from other fractions in order to determine the mass of the fractions sorted out.

Diaries
An individual or group of individuals keeps a record or log of food waste information on a regular basis.

2) Other methods

The following methods shall be used when there is no direct (physical) access to food waste or when direct measurement is not feasible:

Mass balance
Calculation of the amount of food waste on the basis of the mass of inputs and outputs of food into and out of the measured system, and processing and consumption of food within the system.

Coefficients
Use of previously established food waste coefficients or percentages representative for a food industry sub-sector or for an individual business operator. Such coefficients or percentages shall be established through sampling, data provided by food business operators or by other methods.

REFERENCES

1 EAT-Lancet 2019 : Food in the anthropocene. https://eatforum.org/content/uploads/2019/07/EAT-Lancet_Commission_Summary_Report.pdf

2 FAO 2019: The state of the world's biodiveristy for food and agriculture. http://www.fao.org/3/CA3129EN/CA3129EN.pdf

3 IPBES 2019: Global assessment report on biodiversity and ecosystem services. https://ipbes.net/global-assessment

4 IPCC 2019: Special report on climate change and land. https://www.ipcc.ch/srccl/

5 Flanagan, K., Robertson, K., Hanson, C., & Timmermans, A. J. M. (2019). Reducing food loss and waste: Setting a Global Action Agenda. World Resources Institute (WRI).

6 The Drawdown Review 2020: Climate Solutions for a new decade. https://drawdown.org/

7 https://champions123.org/2019-progress-report/

8 Gustavsson, Jenny, et al. Global food losses and food waste. Rome: FAO, 2011.

9 http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf

10 http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf

11 Quested, Tom E., et al. "Spaghetti soup: The complex world of food waste behaviours." Resources, Conservation and Recycling 79 (2013): 43–51.

12 https://www.sciencedirect.com/science/article/pii/S0956053X18302617

13 https://ec.europa.eu/eurostat/statistics-explained/index.php/People_at_risk_of_poverty_or_social_exclusion

14 FAO. Food wastage footprint: Impacts on natural resources. FAO, 2013.

15 Feldstein, Stephanie. "Wasting biodiversity: why food waste needs to be a conservation priority." Biodiversity 18.2-3 (2017): 75–77.

16 http://flwprotocol.org/

17 https://www.globalinnovationexchange.org/innovation/food-waste-index

18 http://www.fao.org/3/CA2640EN/ca2640en.pdf

19 http://europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits

20 https://eur-lex.europa.eu/eli/dec_del/2019/1597/oj

21 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2019.310.01.0039.01.ENG&toc=OJ:L:2019:310:FULL

22 https://www.mdpi.com/2071-1050/9/1/37

23 https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32011R0543

24 https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/brochure-utp-directive_en.pdf

25 https://eu-refresh.org/regulating-role-unfair-trading-practices-food-waste-generation

26 Porter, Stephen D., et al. "Production-phase greenhouse gas emissions arising from deliberate withdrawal and destruction of fresh fruit and vegetables under the EU's Common Agricultural Policy." Science of The Total Environment 631 (2018): 1544–1552.

27 Khatun, Kaysara. "Reform or reversal: implications of the Common Agricultural Policy (CAP) on land use, land use change and forestry (LULUCF) in developing countries." Conservation Letters 5.2 (2012): 99–106.

28 https://library.wur.nl/WebQuery/wurpubs/fulltext/188798 and https://www.eu-fusions.org/index.php/download?download=161:review-of-eu-legislation-and-policies-with-implications-on-food-waste

29 https://eu-refresh.org/sites/default/files/REFRESH%20animal%20feed%20expert%20seminar%20report%20final%2012.04.18.pdf

30 https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32011R1169

31 https://www.lovefoodhatewaste.com/article/use-or-not-use-question

32 https://www.fsai.ie/legislation/food_legislation/general_principles_of_food_law.html

33 https://www.eea.europa.eu/publications/waste-prevention-in-europe-2017

34 http://www.cewep.eu/wp-content/uploads/2017/12/Landfill-taxes-and-bans-overview.pdf

35 https://www.interregeurope.eu/policylearning/news/4395/important-update-on-the-eu-bioeconomy-strategy/

36 https://ec.europa.eu/fisheries/cfp/fishing_rules/discards_en

37 https://www.seafish.org/media/Publications/Landing_Obligation.pdf

38 http://d2ouvy59p0dg6k.cloudfront.net/downloads/wwfepo_cfpscorecardreport_summary_dec2018.pdf

39 https://op.europa.eu/en/publication-detail/-/publication/241cf6a4-e103-11e9-9c4e-01aa75ed71a1/language-en/format-HTML/source-105917117

40 https://ec.europa.eu/food/sites/food/files/safety/docs/fw_eu-actions_food-donation_ms-practices-food-redis.pdf

41 https://ec.europa.eu/food/sites/food/files/safety/docs/fs_eu-actions_action_implementation_platform_key_recommendations.pdf

42 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590404602495&uri=CELEX%3A52020DC0381

43 https://cordis.europa.eu/project/rcn/104335/reporting/en

44 http://www.eu-fusions.org/index.php/publications/265-establishing-a-common-framework-for-food-waste-definition-and-identifying-its-drivers

45 http://www.eu-fusions.org/index.php/publications/267-analysing-food-waste-policies-across-the-eu-28

46 http://www.eu-fusions.org/index.php/download?download=285:recommendations-and-guidelines-for-a-common-european-food-waste-policy-framework

47 http://www.eu-fusions.org/index.php/publications/266-establishing-reliable-data-on-food-waste-and-harmonising-quantification-methods

48 http://www.eu-fusions.org/index.php/publications/268-stimulating-social-innovation-on-food-waste

49 https://samentegenvoedselverspilling.nl/

50 https://eu-refresh.org/reducing-consumer-food-waste

51 https://eu-refresh.org/regulating-role-unfair-trading-practices-food-waste-generation

52 https://eu-refresh.org/voluntary-agreements-collaborative-solution-food-waste-reduction

53 https://eu-refresh.org/guidance-evaluating-interventions-preventing-household-food-waste

54 https://eu-refresh.org/refresh-webinar-measuring-and-managing-retail-food-waste

55 https://eu-refresh.org/valorisation-food-surpluses-and-side-flows-and-citizens%E2%80%99-understanding

56 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/rur-07-2020;freeTextSearchKeyword=RUR-07-2020;typeCodes=1;statusCodes=31094501,31094502,31094503;programCode=H2020;programDivisionCode=null;focusAreaCode=null;crossCuttingPriorityCode=null;callCode=Default;sortQuery=openingDate;orderBy=asc;onlyTenders=false;topicListKey=topicSearchTablePageState

57 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ce-fnr-17-2020

58 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/rur-06-2020

59 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ce-fnr-07-2020

60 Those not discussed further below include (but are not limited to) introducing market instruments, improving product labelling, introducing and modifying existing legislation around animal feed and food rescue and redistribution, improving crop quality and traits, providing Member State or EU wide communications campaigns, and establishing specific food loss measurement and legislation.

61 https://www.mdpi.com/2071-1050/10/6/1745/htm

62 http://www.refreshcoe.eu/resources/medium-list-waste-streams-appropriate-valorisation/

63 http://flwprotocol.org/case-studies/

64 CEC. 2019. Technical Report: Quantifying Food Loss and Waste and Its Impacts. Montreal, Canada: Commission for Environmental Cooperation. 129 pp.

65 e.g. Hanson and Mitchell, 2017. The business case for reducing food loss and waste, A report on behalf of Champions 12.3

66 Tostivint et al. 2016. Food waste quantification manual to monitor food waste amounts and progression. EU FUSIONS

67 Food Loss and Waste Accounting and Reporting Standard – Executive Summary

68 WRAP, 2018, FOOD WASTE MEASUREMENT PRINCIPLES AND RESOURCES GUIDE

69 http://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf

70 Tostivint et al. 2016. Food waste quantification manual to monitor food waste amounts and progression. EU FUSIONS

71 Boulding, A. and Devine, R., 2019. Evaluation FA Pilots – Final Synthesis Report. REFRESH Deliverable D2.8

72 CEC. 2019. Technical Report: Quantifying Food Loss and Waste and Its Impacts. Montreal, Canada: Commission for Environmental Cooperation. 129 pp.

73 https://www.leanpath.com/about/

74 https://cdn2.hubspot.net/hubfs/650776/IKEA%20Eindhoven%20Case%20Study.pdf

75 https://www.leanpath.com/wp-content/uploads/2018/10/CaseStudyIKEALyssach.New_.v1.pdf

76 National Geographic, 2016. To See Food Waste in a New Way, Start With Your Plate. Online Article

77 http://www.wrap.org.uk/content/what-is-courtauld

78 Wognum et al., 2011: Systems for sustainability and transparency of food supply chains – Current status and challenges

79 https://www.thefoodwasteatlas.org/home

80 https://www.sciencedirect.com/science/article/pii/S0921344919300643?dgcid=author

81 van Herpen, E., van der Lans, I. A., Holthuysen, N., Nijenhuis-de Vries, M., & Quested, T. E. (2019). Comparing wasted apples and oranges: An assessment of methods to measure household food waste. Waste management, 88, 71–84. https://doi.org/10.1016/j.wasman.2019.03.013

82 http://www.eu-fusions.org/phocadownload/Publications/Food%20waste%20quantification%20manual%20to%20monitor%20food%20waste%20amounts%20and%20progression.pdf

83 http://flwprotocol.org/wp-content/uploads/2017/05/FLW_Standard_final_2016.pdf

84 http://www3.cec.org/islandora/en/item/11813-technical-report-quantifying-food-loss-and-waste-and-its-impacts-en.pdf I l

85 For example, in 2019, the Greencore Group with its banking partners launched corporate sustainable revolving credit worth £300 million (€342.5 million). This is tied to sustainability KPIs including food waste reduction. https://www.greencore.com/greencore-secures-innovative-green-refinancing-facility/

86 Arancon, R. A. D., Lin, C. S. K., Chan, K. M., Kwan, T. H., & Luque, R. (2013). Advances on waste valorization: new horizons for a more sustainable society. Energy Science & Engineering, 1(2), 53–71.

87 The waste management options of anaerobic digestion (AD) and co-digestion are often referred to as methods of waste valorisation. However, these destinations are still considered waste destinations whereas food recovered for material use such as bio-based products are not considered food waste (see https://www.eu-fusions.org/index.php/publications/faq, FUSIONS 2014). It is for this reason that this case study will only focus on recovered material used as bio-based products.

88 http://www.wrap.org.uk/sites/files/wrap/QMilk-Fashioning%20waste%20milk%20into%20fibres.pdf?_ga=2.117306822.1170198873.1559405518-1624650628.1559405518

89 https://www.theshellworks.com/

90 http://www.wrapcymru.org.uk/sites/files/wrap/Brooksgrove%20Case%20Study%20v6.pdf

91 http://www.wrapcymru.org.uk/sites/files/wrap/Get%20Wonky%20Case%20Study%20Draft%20v5%20%28reformatted%29.pdf

92 In particular, the updated EU Bio-economy Strategy, the renewed Industrial Policy Strategy, the New Circular Economy Action Plan, the Communication on Accelerating Clean Energy Innovation and the Common Agricultural Policy (via rural development measures focussing on “innovations”).

93 Metcalfe, Peter., Moates, Graham., and Waldron, Keith., “Report of the REFRESH Project, D6.3 Detailed hierarchy of approaches categorised within waste pyramid.” (2017)

94 http://www.wrap.org.uk/content/why-take-action-legalpolicy-case

95 http://www.biorenewables.org/casestudy/pharmaceuticals-food-waste/

96 https://www.ananas-anam.com/about-us/

97 https://www2.hm.com/en_gb/free-form-campaigns/1139-conscious-exclusive-2019.html

98 http://orangefiber.it/en/impact/

99 https://eu-refresh.org/

100 http://agrimax-project.eu/

101 http://www.percal-project.eu/

102 http://www.scalibur.eu/

103 http://www.eubia.org/cms/2018/10/25/new-eu-project-valuewaste/

104 http://www.wrapcymru.org.uk/content/list-resources

105 https://biopilotsuk.com/

106 http://www.bioeconomybeacon.ie/

107 http://www.ibioic.com/

108 https://www.biovale.org/

109 http://www.wrapcymru.org.uk/register-download-valorisation-business-case-toolkit

110 https://www.express.co.uk/finance/city/994077/pennotec-future-foods-project-apples-fruit-technology-fight-obesity

111 https://lb-net.net/wp-content/uploads/2018/05/UKBioChem10_Report.pdf

112 https://lb-net.net/wp-content/uploads/2018/05/UKBioChem10_Report.pdf

113 https://www.biovale.org/about-us/

114 http://ec.europa.eu/environment/green-growth/raw-materials/index_en.htm

115 http://ec.europa.eu/environment/green-growth/raw-materials/index_en.htm

116 https://www.rsc.org/globalassets/04-campaigning-outreach/policy/research-policy/global-challenges/waste-opportunities-response-november-2013.pdf

117 https://www.rsc.org/globalassets/04-campaigning-outreach/policy/research-policy/global-challenges/waste-opportunities-response-november-2013.pdf

118 Boulding, A. and Devine, R., 2019. Evaluation FA Pilots - Final Synthesis Report. REFRESH Deliverable D2.8

119 Bernstein, L., J. Roy, K. C. Delhotal, J. Harnisch, R. Matsuhashi, L. Price, K. Tanaka, E. Worrell, F. Yamba, Z. Fengqi, 2007: Industry. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

120 https://www.textilbuendnis.com/

121 http://www.wrap.org.uk/content/the-uk-plastics-pact

122 Steelman, T., and Jorge Rivera. 2006. "Voluntary Environmental Programs in the United States: Whose Interests Are Served?" Organization & Environment 19 (4): 505–26.

123 Koehler, D. A. (2007). The effectiveness of voluntary environmental programs – A policy at a crossroads?. Policy Studies Journal, 35(4), 689–722.

124 https://publications.internationalrbc.org/garments-textile-2018/international_expansion_and_upscaling

125 Koehler, D. A. (2007). The effectiveness of voluntary environmental programs – A policy at a crossroads?. Policy Studies Journal, 35(4), 689–722.

126 Delmas, Magali., and Maria J. Montes-Sancho. 2007. "Voluntary Agreements to Improve Environmental Quality: Are Late Joiners the Free Riders?" Working paper, Donald Bren School of Environmental Science and Management., University of California, Santa Barbara, CA.

127 OECD (2003), Voluntary Approaches for Environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes, OECD Publishing, Paris, https://doi.org/10.1787/9789264101784-en.

128 There have been some assessments made, see McCarthy, D. & Morling, P. (2015). Using Regulation as a Last Resort: Assessing the Performance of Voluntary Approaches. Royal Society for the Protection of Birds: Sandy, Bedfordshire.

129 Segerson, K., and T. J. Miceli. 1998. "Voluntary Environmental Agreements: Good or Bad News for Environmental Protection?" Journal of Environmental Economics and Management36 (2): 109–30.

130 Koehler, D. A. (2007). The effectiveness of voluntary environmental programs – A policy at a crossroads?. Policy Studies Journal, 35(4), 689–722.

131 Wognum, P. N., Bremmers, H., Trienekens, J. H., van der Vorst, J. G., & Bloemhof, J. M. (2011). Systems for sustainability and transparency of food supply chains – Current status and challenges. Advanced Engineering Informatics, 25(1), 65–76.

132 http://www.wrap.org.uk/sites/files/wrap/The-UK-Plastics-Pact-Member-progress-report-May-2019_0.pdf

133 http://www.wrap.org.uk/sites/files/wrap/WRAP_Global_Voluntary_Approach_to_Cutting_Food_Waste.pdf

134 https://eu-refresh.org/sites/default/files/D2_1_%20Success_Factors_%20FINAL.pdf

135 Costa, Arthur & Kallick, Bena. (1993). Through the Lens of a Critical Friend. Educational Leadership. 51.

136 http://www.wrap.org.uk/content/new-figures-show-single-use-carrier-bags-cut-48

137 http://www.wrap.org.uk/food-drink/business-food-waste/history-courtauld

138 https://ec.europa.eu/food/sites/food/files/safety/docs/fw_eu-platform_20170331_pres-08.pdf, https://www.matvett.no/uploads/documents/ForMat-rapport-2016.-Sluttrapport.pdf

139 https://www.regjeringen.no/en/aktuelt/agreement-to-reduce-food-waste/id2558931/

140 https://eu-refresh.org/sites/default/files/MINUTES_REFRESH-Policy-Working-Group-on-VAs.pdf

141 https://www.regjeringen.no/en/aktuelt/agreement-to-reduce-food-waste/id2558931/

142 https://eu-refresh.org/sites/default/files/REFRESH_D3.3_EU%20policy%20screening_18052018_25072018.pdf

143 https://eca.europa.eu/Lists/ECADocuments/SR16_34/SR_FOOD_WASTE_EN.pdf

144 https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en

145 Massot, Albert. 2017. 'The Common Agricultural Policy (CAP) and the Treaty'. European Parliament. http://www.europarl.europa.eu/factsheets/en/sheet/103/the-common-agricultural-policy-cap-and-the-treaty

146 https://services.parliament.uk/bills/2015-16/foodwastereduction.html

147 However, the momentum of this regulation has been maintained through mechanisms such as 1) a Consultation on annual reporting of food surplus and waste by food businesses, and 2) the Food Waste Reduction Fund, both part of the 2019 Resources and waste strategy for England. https://www.gov.uk/government/publications/resources-and-waste-strategy-for-england

148 This Is Rubbish (2013) Counting What Matters. This Is Rubbish.

149 https://www.ipcc.ch/site/assets/uploads/2019/08/4.-SPM_Approved_Microsite_FINAL.pdf

150 https://unfccc.int/sites/default/files/resource/docs/2016/cop22/eng/02.pdf

151 https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans

152 https://www.legifrance.gouv.fr/eli/loi/2016/2/11/AGRX1531165L/jo/texte

153 https://eca.europa.eu/Lists/ECADocuments/SR16_34/SR_FOOD_WASTE_EN.pdf

154 https://www.repository.law.indiana.edu/cgi/viewcontent.cgi?article=1081&context=ijlse

155 https://www.thegrocer.co.uk/waste-not-want-not/how-france-is-leading-the-way-on-food-waste/536447.article

156 https://agriculture.gouv.fr/pacte-national-de-lutte-contre-le-gaspillage-alimentaire-dossier-de-presse

157 https://www.ademe.fr/etat-lieux-masses-gaspillages-alimentaires-gestion-differentes-etapes-chaine-alimentaire

158 https://agriculture.gouv.fr/egalim-lassemblee-nationale-vote-le-projet-de-loi-en-1re-lecture

159 https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/brochure-utp-directive_en.pdf

160 https://feedbackglobal.org/wp-content/uploads/2018/06/Supermarket-scorecard_136_fv-1.pdf

161 https://thebristolskipchen.wordpress.com/2015/08/05/culture-of-waste-skipchen-response-to-french-supermarket-law/

162 https://eca.europa.eu/Lists/ECADocuments/SR16_34/SR_FOOD_WASTE_EN.pdf

163 https://www.foodnavigator.com/Article/2017/03/24/France-s-food-waste-ban-One-year-on

164 http://www.menosdesperdicio.es/

165 http://www.gpp.pt/images/MaisGPP/Iniciativas/CNCDA/ENCDA.pdf

166 https://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Nationale_Strategie_Lebensmittelverschwendung_2019.pdf?__blob=publicationFile

167 https://www.regjeringen.no/en/aktuelt/agreement-to-reduce-food-waste/id2558931/

168 https://www.eu-fusions.org/phocadownload/Publications/D3.5%20recommendations%20and%20guidelines%20food%20waste%20policy%20FINAL.pdf

169 Due to the long timelines associated with voluntary agreements, a minimum of 4 years of operational funding commitment is recommended to establish an effective voluntary agreement.

170 Search terms included “food waste”, “food waste valorisation” “animal feed law food waste” “EU food waste CAP” “EU food waste donations redistribution” “animal feed food waste insects EU” “food waste valorisation EU policy” “EU food waste valorisation biotechnology”)

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To stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature.

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