Supplementary Material

1 Supplementary Table S1

Legend for Table S1:

Stages along food chain or sectors	
A	primary production: Agricultural production and fisheries
S	Storage, processing and packaging
R	Retail and wholesale
P	Private households
O	Out of home sector
L	Legislation - government

Actors involved in the measure [1]	
x	Main (cooperating) actors
o	Indirectly concerned actors

Supplementary Table S 1. Food waste prevention measures in literature.

	A	S	R	P	O	L	Focus	Measure	Source
1	x						Physical and biological contamination	Good practices in crop and animal production: avoiding damage or physical contamination by extraneous materials, pests, insects or vermin, and biological contamination by mould, pathogenic bacteria or viruses	(HLPE, 2014)
2	x						Fisheries	Fisheries: discard ban	(Teuber and Jensen, 2016)
3	x		x				Imperfect produce	Markets for lower quality fruits and vegetables; alternative marketing channels; shorter chains (eg farmers' markets) to pass by the retail quality standards; discounts for imperfect produce in regular supermarkets	(Gustavvson et al., 2011) (ReFED, 2016a) (Göbel et al., 2012) (Lipinski et al., 2017) (Ribeiro et al., 2018)
4	x	x	x	x		x	Imperfect produce	Revise aesthetic requirements for fruit and vegetables; change marketing standards; sensitise consumers; increase consumer acceptance for imperfect produce; "gleaning" of unharvested produce	(FAO, 2013) (Gustavvson et al., 2011) (Hermsdorf et al., 2017) (Hegnsholt et al., 2018) (Lipinski et al., 2017) (Teuber and Jensen, 2016) (Priefer et al., 2016)

[1] Identification of actors involved is based on what is mentioned in literature; if no (indirect) actors are listed, this does not mean they are not involved, it only means literature did not explicitly list them as being involved

	A	S	R	P	O	L	Focus	Measure	Source
									(FAO, 2013) (HLPE, 2014)
5		x	x			x	Deviant products	Develop markets for 'sub-standard' products such as trimmings, products with deviant size, shape or with production errors (with no effect on safety, taste, nutritional value)	(Gustavvson et al., 2011) (Priefer et al., 2016) (FAO, 2013) (Aschemann-Witzel et al., 2015)
6	x						Technologies - agriculture	Advanced technologies: breeding more robust crop and animal species; develop less damaging cultivation and harvest methods; improve postharvest technologies and storage; early warning systems	(Teuber and Jensen, 2016) (Göbel et al., 2012) (Lipinski et al., 2017)
7	x						Communication & cooperation	Communication and cooperation among farmers; reduce risk of overproduction by allowing surplus crops from one farm to solve a shortage of crops on another	(Gustavvson et al., 2011) (Göbel et al., 2012)
8	x	x	x		x		Communication & cooperation	Integrated supply chain management; improve communication and organization to match demand and supply of food; partnerships to manage seasonal variability (e.g. bumper crops)	(FAO, 2013) (Göbel et al., 2012) (Lipinski et al., 2017) (Teuber and Jensen, 2016) (Priefer et al., 2016)
9	x	x	x				Procurement	Avoid price reductions by suppliers when buying large batches	(Göbel et al., 2014)
10		x	x	x			Procurement – short chains	"localization" of supply chain to reduce the time food spends in transit	(Hegnsholt et al., 2018)
11	x	x	x			x	Infrastructure and transport	Improve infrastructure (storage, cooling, …) and transportation	(Gustavvson et al., 2011) (Lipinski et al., 2017)
12		x					Processing – diversion into other food streams	Valorise by-products, side streams and non-used food; divert preparation losses as input into other food products (e.g. potato leftovers from French fries manufacturing to be used to make croquettes or mashed potatoes)	(HLPE, 2014) (Göbel et al., 2012)
13		x	x				Storage and distribution – cold chain	Lower temperature in the cold chain; proper cold chain management; innovative approaches such as remote container management to continuously monitor container temperature and humidity and intervene where needed; early warning systems; comply with food safety standards	(Teuber and Jensen, 2016) (ReFED, 2016a) (Hegnsholt et al., 2018) (Göbel et al., 2012) (Gustavvson et al., 2011) (HLPE, 2014) (Eriksson et al., 2016)
14		x	x				Process optimisation	Manufacturing line optimization; increase supply chain efficiency	(ReFED, 2016a) (Hegnsholt et al., 2018) (Göbel et al., 2012)
15		x	x				Packaging – optimisation & portions	Packaging adjustments; smaller packages; portion-sized; easy to empty; adapted to target group; offer wrapped biscuits (allowing leftovers to be reused) storage or freezing instructions (directed at consumers) on packaging;	(HLPE, 2014) (ReFED, 2016a, 2016b) (WRAP, 2006) (WRAP, 2007) (WRAP, 2017a) (Lipinski et al., 2017) (Teuber and Jensen,

	A	S	R	P	O	L	Focus	Measure	Source
									2016) (WRAP, 2015) (Schanes et al., 2018) (WRAP, 2010a, 2013a, 2013d) (WRAP, 2014, 2017b) (Aschemann-Witzel et al., 2015)
16		x	x				Packaging - technologies	Minimise packaging in weight but optimise its functionality; smart packaging or spoilage prevention packaging (e.g. breathable polymer films, aseptic technology, modified atmosphere packaging, hermetic seals, re-sealable packaging); ethylene-absorbing strip to increase shelf life of fresh produce	(FAO, 2013) (Gunders, 2012) (HLPE, 2014) (ReFED, 2016a, 2016b) (Stenmarck et al., 2011) (WRAP, 2013c) (WRAP, 2006) (WRAP, 2007) (Hegnsholt et al., 2018) (WRAP, 2015)
17			x				Packaging – no packaging	Sell items loose rather than in fixed portions, so customers only buy the quantity they need; sell fruits and vegetables per weight instead of per piece (create opportunity to sell fruits & vegetables of different size and shape); avoid products being thrown if 1 item within the package is spoiled	(FAO, 2013) (Hafner et al., 2012) (Teuber and Jensen, 2016) (Göbel et al., 2012)
18	x	x	x	x			Excess food	Repurpose excess food through multi-stakeholder collaborations; day-before bakeries selling bakers' wares of the previous day; spontaneous selling actions	(ReFED, 2016a, 2016b) (Hafner et al., 2012) (Göbel et al., 2012)
19		x					Awareness, habits, culture	Promotion of a culture of waste reduction, driving all other activities such as training, performance measurement and incentives	(Teuber and Jensen, 2016)
20		x	x				Storage conditions	Appropriate storage conditions; adapt temperature and humidity to product; doors on fridges in shops (additional benefit: shelves look more full)	(Göbel et al., 2012) (HLPE, 2014) (Stenmarck et al., 2011)
21		x	x				Processing	Fruit and vegetable processing into dried/dehydrated products, juices, concentrates, jams and purees; develop appropriate technologies and infrastructure; investments in infrastructure and knowledge acquisition; find alternatives to disposal when food cannot be sold	(HLPE, 2014) (Aschemann-Witzel et al., 2015)
22		x					Processing - trimming	Improving processing techniques; improved trimming; possibly centralized trimming rather than trimming by end-user (fewer waste + potential to use scrap by-products)	(FAO, 2013)
23			x				Inventory management	Daily control of fresh produce to avoid 1 spoiled item contaminating the entire batch	(Göbel et al., 2014)
24			x				Inventory management	Shorten the period of time between buying and selling; avoid stockpiling; improve inventory management; keep control of stock and sales statistics; store products based on “first in first out” principle	(Göbel et al., 2012) (Koester, 2014) (ReFED, 2016a) (Stenmarck et al., 2011)
25	x	x	x				Improved forecasting	Simplify and optimize product ordering system; avoid incorrect orders and excessive order volumes; develop more accurate supply & demand forecasting models e.g. take into account weather	(Hafner et al., 2012) (Teuber and Jensen, 2016) (Rutten et al., 2013)

	A	S	R	P	O	L	Focus	Measure	Source
								Remark: fine-tuning orders and more frequent deliveries to be balanced with the consequent labour costs and transport impacts	(Hegnsholt et al., 2018) (Göbel et al., 2012) (Lipinski et al., 2017)
26			x				Date labelling	Sell items close to their use-by date rather than throwing them, e.g. at lower price; highlight bargains for products nearing best-before date; expose goods with the shortest shelf life left; donate food that is soon turning "un-saleable" or for which the best-before date has been passed	(FAO, 2013) (Göbel et al., 2014) (Hafner et al., 2012) (Stenmarck et al., 2011) (Göbel et al., 2012) (Schanes et al., 2018)
27			x	x		x	Date labelling - interpretation	Standardize date labelling on 'best-before' and 'use-by' dates; inform consumers on meaning of labels	(FAO, 2013) (Koester, 2014) (ReFED, 2016a) (Hegnsholt et al., 2018) (Lipinski et al., 2017) (Lipinski et al., 2013) (WRAP, 2017a) (Teuber and Jensen, 2016) (Priefer et al., 2016) (Schanes et al., 2018) (Aschemann-Witzel et al., 2015)
28			x				Product line	Good knowledge of the customers; adapt product line/range to customers	(Stenmarck et al., 2011)
29			x				Product line - abundance	Less opulence in retail (quantities and range of products); do not continually replenish supplies; bring down stock at end of the day	(FAO, 2013) (Gustavvson et al., 2011) (Göbel et al., 2012)
30			x				Staff training	Personnel education on impact (environmental and economic) associated with food waste	(Stenmarck et al., 2011)
31		x	x				Staff training	Personnel education on how and when to place orders, and on how to handle and store food; knowledge of the best practice and the routines for treatment of food waste; training on how to process food and minimize cleaning losses	(Stenmarck et al., 2011) (Teuber and Jensen, 2016) (Hegnsholt et al., 2018) (Göbel et al., 2012)
32	x	x	x		x		Education and staff training	Integrate the issue of food waste in education programmes related to the food sector; capacity development along the food chain	(Hafner et al., 2012) (HLPE, 2014)
33			x				Date labelling	Research into dynamic best-before dates based on compliance with the cold chain and quality of foods	(Hafner et al., 2012)
34	x		x	x	x	x	Awareness and information	Provide information and raise awareness; encourage consumers to shift away from products that contribute to waste; educate consumers that not everything needs to be available at all times; increase acceptability of "ugly food" or food nearing expiration date	(Hafner et al., 2012) (FAO, 2013) (Hegnsholt et al., 2018) (Göbel et al., 2012) (Schanes et al., 2018) (Wunder et al., 2019) (Aschemann-Witzel et al., 2015)
35			x	x		x	Awareness raising - attitudes,	Campaigns to raise awareness and educate consumers; change culture of food waste; change consumption habits;	(Hafner et al., 2012) (EPA, 2016) (Kranert et al., 2012b)

	A	S	R	P	O	L	Focus	Measure	Source
							habits and behaviour		(FAO, 2013) (Gustavvson et al., 2011) (ReFED, 2016a) (WRAP, 2015; Hanson and Mitchell, 2017)
36				x			Awareness raising – Self-reflection, social norms	Campaigns to influence social norms; trigger peer influences; bin-cam capturing and sharing images of waste on an online social platform; motivate competition to do better	(Wunder et al., 2019) (Aschemann-Witzel et al., 2015) (Thieme et al., 2012; Comber and Thieme, 2013),
37				x		x	Advice to enable behavioural changes	Advice on how to avoid waste, how to shop, prepare and store food; internet-based platforms; improve food skills and handling	(Hafner et al., 2012) (EPA, 2016) (Kranert et al., 2012b) (Aschemann-Witzel et al., 2015)
38				x			Food purchase	Better planning of purchases; use shopping list; avoid impulsive or advance purchasing of food that is not required immediately; buy appropriate portions; no empty stomach shopping	(HLPE, 2014) (Langen et al., 2015) (BMEL, 2014) (Hebrok and Boks, 2017) (Schanes et al., 2018)
39				x			Food purchase	More frequent shopping (to be balanced with impacts from time spent and transportation); shop smaller quantities	(Britz et al., 2014) (Langen et al., 2015) (Koester, 2014)
40				x			Storage – at home	Appropriate storage and cooling practices at home; lowering refrigerator temperatures; better stock management, use appropriate food containers; intelligent fridges and inventory apps; storage instructions on packaging (provided by retail/packaging industry); freeze food for later consumption	(HLPE, 2014) (BMEL, 2014) (Hebrok and Boks, 2017) (Schanes et al., 2018) (WRAP, 2013b, 2015) (WRAP, 2010a, 2013a, 2013d) (WRAP, 2010b) (Brown et al., 2014b) (Brown et al., 2014a)
41				x			Food preparation –at home	Appropriate portion sizes to prepare; better food preparation techniques (incl. trimming); make full use of fruits and vegetables to extract all the nutritional benefits; use leftovers on other recipes	(Britz et al., 2014) (HLPE, 2014) (BMEL, 2014) (ReFED, 2018) (Lipinski et al., 2017) (Schanes et al., 2018)
42	x	x	x				Monitoring and tracking	Constant collection of data on food waste and losses	(Kranert et al., 2012b) (Hafner et al., 2012)
43					x		Staff - awareness and sensibilisation	Create awareness and show food waste avoidance potential (e.g. through FW tracking devices); show economic value of food gone wasted; staff training; set FW reduction goals	(Kranert et al., 2012b) (Waskow et al., 2016) (Göbel et al., 2014) (iSuN, 2014) (Leanpath, 2016) (SRA, 2017) (WRAP, 2014, 2017b) (Leanpath, 2019) (Futouris, 2019)

	A	S	R	P	O	L	Focus	Measure	Source
44					x		Staff - engagement	Staff training; create incentives (e.g. "FW champion"); ensure staff is familiar with the menu	(Göbel et al., 2014) (WRAP, 2013g) (WRAP, 2018) (Leanpath, 2016) (Clowes et al., 2018a) (Clowes et al., 2018b) (Clowes et al., 2019) (Leanpath, 2019)
45					x		Staff - training	Training on promotion of use of doggy bags/boxes, awareness of surplus food redistribution and correct portioning	(WRAP, 2013c) (Göbel et al., 2014)
46					x		Staff – training food orders & preparation	Train staff for ordering the appropriate amounts of food, preparing the right amounts of food and serving the right portion sizes; train on reducing preparation and trimming losses; train staff on how to best store products	(Göbel et al., 2014) (Betz et al., 2015) (WRAP, 2018) (SRA, 2017) (Winnow, 2019) (Schanes et al., 2018)
47					x		Inventory - stock management	Careful management of stock; "first in first out" principle; review stock rotation and ordering procedures; label all products, incl. expiry date	(WRAP, 2013c) (WRAP, 2013g) (Hrad et al., 2015) (Betz et al., 2015) (WRAP, 2018) (Baldwin et al., 2011) (ReFED, 2018) (Pirani and Arafat, 2014) (Fink et al., 2016) (SRA, 2017) (Hotrec, 2017) (Futouris, 2019)
48					x		Inventory - storage	Proper storage (eg air circulation for fresh produce); keeping fridges and refrigerators clean; check quality of purchased products before storing them; ensure cold chain is not broken (e.g. during transport for outside catering); prevent spoilage; extend shelf life through for example vacuum packing	(Pirani and Arafat, 2014) (Fink et al., 2016) (Winnow, 2019) (Hotrec, 2017) (Futouris, 2019)
49	o	o	o		x		Ordering process - procurement	Review ordering procedures; negotiate deals with suppliers on smaller packs tailored to restaurant needs; ensure that the quality/characteristics of the product fit with your needs; base purchasing needs on standardised recipes and on current stock	(ReFED, 2018) (WRAP, 2018) (Fink et al., 2016) (SRA, 2017) (Hotrec, 2017)
50					x		Forecasting – guest/patient numbers	Monitor consumer numbers and waste; compare estimated number of guests/patients with actual measured number to improve planning parameters; improve information flow on any changes related to expected number of guests or patients; guest RSVP	(WRAP, 2013c) (WRAP, 2013g) (Göbel et al., 2014) (WRAP, 2018) (ReFED, 2018) (WWF, 2017) (Dias-Ferreira et al., 2015) (Futouris, 2019)
51					x		Menu planning – guest preferences	Ask consumers to pre-select meals; take into account seasonal variations and preferences (e.g. salad in summer) or variations related to holidays/weekends vs weekdays; know your clientele (eg dishes targeted at children in schools);	(WRAP, 2013c) (Göbel et al., 2014) (Silvennoinen et al., 2015) (Schmidt et al., 2018)

	A	S	R	P	O	L	Focus	Measure	Source
								take into account guest preferences, age, religious and cultural habits, and occasion (eg wedding vs business meeting)	(ReFED, 2018) (Pirani and Arafat, 2014) (WWF, 2017) (Fink et al., 2016) (Hotrec, 2017) (BMEL, 2015) (Futouris, 2019)
52			o		x		Menu planning – flexibility	Flexibility in menu or "Dish of the day" to use leftover ingredients, items bought spontaneously (as supplier wanted to get rid of products in critical state) or items close to expiry date; be creative with leftovers (soups, sauces…); use kitchen left-overs for a following day's service (e.g. through freezing)	(Göbel et al., 2014) (WRAP, 2013g) (WRAP, 2013c) (Hrad et al., 2015) (Betz et al., 2015) (ReFED, 2018) (Clowes et al., 2018b) (SRA, 2017) (Winnow, 2019) (Hotrec, 2017) (Futouris, 2019)
53					x		Menu planning – maximise ingredient use	Maximise use of any one food item on the menu (waste of one ingredient as input to another meal); use smaller amounts of ingredients that can be used for wide range of dishes; reduce number of menu choices	(WRAP, 2013g) (Göbel et al., 2014) (Hrad et al., 2015) (ReFED, 2018) (Leanpath, 2016) (WWF, 2017) (Winnow, 2019) (Hotrec, 2017) (WRAP, 2014, 2017b) (Futouris, 2019)
54					x		Menu planning - menu engineering and ABC	Menu engineering on profitability and popularity of menu items; assign all purchasing and overhead costs to menu items to obtain appropriate price for each dish (activity-based costing, ABC)	(Pirani and Arafat, 2014)
55					x		Food preparation - planning	Optimize production planning using sophisticated software solutions; use a computer-based programme for recipe-management; optimize production volume (and portion per guest); reduce buffer for overproduction; plan smaller portions	(Göbel et al., 2014) (Schmidt et al., 2018) (Fink et al., 2016) (Winnow, 2019) (WRAP, 2014, 2017b) (Futouris, 2019)
56		o	x		x		Food preparation - convenience grade	Procure part of menu in pre-prepared format to reduce preparation waste and allow for greater responsiveness and flexibility in case of changes in number of guests; use of pre-trimmed produce, meats and fish; purchase of dough pieces to be baked on the spot	(WRAP, 2013c) (ReFED, 2018) (Göbel et al., 2012)
57					x		Food preparation – recipes and serving	Use weight-based and standardized recipes so the right quantity of food is prepared for the number of servings required; use standardised serving spoons or plates; ensure a good mise en place	(WRAP, 2013c) (Göbel et al., 2014) (Hrad et al., 2015) (Fink et al., 2016) (Hotrec, 2017) (Futouris, 2019)
58					x		Food preparation – preparation losses	Reduce preparation losses; reduce trim waste (apply yield testing); choose ingredients based on how much is considered edible (cfr WWF Produce Yield Ranking Tool which rates ingredients based on how much is typically considered edible)	(Baldwin et al., 2011) (Betz et al., 2015) (WWF, 2017) (Winnow, 2019) (Hotrec, 2017)

	A	S	R	P	O	L	Focus	Measure	Source
59	o	o	o		x		Food preparation – imperfect produce	Use imperfect produce (second grade vegetables) - take into account additional working time spent	(Teuber and Jensen, 2016) (Lynnerup, 2016) (ReFED, 2018)
60					x		Food service - buffet	Change practices and quantities served towards end of service (smaller food containers; reduce buffet lines from 2 to 1); cook on demand; enable requirements-oriented refilling of food containers (smaller or separable units); use chafers with adjustable tray heights; no overstocking; individual servings rather than food pans; pre-portion items individually at the buffet; change display of food (eg pastries nicely displayed on a tray rather than piled baskets); reduce continuous availability of food on the buffet	(FAO, 2013) (Göbel et al., 2014) (Hrad et al., 2015) (Betz et al., 2015) (Schmidt et al., 2018) (ReFED, 2018) (Clowes et al., 2018b) (WWF, 2017) (Fink et al., 2016) (Leverenz et al., 2016) (WRAP, 2014, 2017b) (Leanpath, 2019) (Futouris, 2019)
61					x		Food service - Portion sizes and side dishes	Offer refills; smaller portion sizes (at lower prices); offer customers to choose their side dishes; bread, butter or side dishes on demand; use a pictorial representation of a portion as a basis for serving (within sight of where meals are served); adapt portion sizes to target groups (eg small children vs adults); meet consumer expectations; “mobile catering” in hospitals plating food at the room (instead of in the kitchen), allowing clients to choose what and how much to eat	(WRAP, 2013c) (WRAP, 2013g) (Lipinski et al., 2013) (WRAP, 2013f) (WRAP, 2014, 2017b) (Göbel et al., 2014) (Hrad et al., 2015) (Snels and Wassenaar, 2011; Kranert et al., 2012a) (Schmidt et al., 2018) (WRAP, 2018) (Baldwin et al., 2011) (ReFED, 2018) (Leanpath, 2016) (Fink et al., 2016) (Priefer et al., 2016) (SRA, 2017) (Lipinski et al., 2017) (Dias-Ferreira et al., 2015) (Hotrec, 2017) (Dias-Ferreira et al., 2015) (Leanpath, 2019) (Futouris, 2019)
62					x		Food service – presentation	Improved and more attractive meal presentation; make clear which dishes contain meat/fish/… or which ones are vegetarian; label ingredients	(Navarro et al., 2016) (BMEL, 2015) (Leanpath, 2019) (Futouris, 2019)
63					x		Nudges to guests – plates and trays at buffet	Smaller plates; smaller serving utensils at the buffet; tray-less dining; “pay-by-weight” rather than “all-you-can-eat”; use of permanent plates instead of disposable ones	(ReFED, 2016a, 2016b) (Göbel et al., 2014) (Betz et al., 2015) (Lipinski et al., 2013) (ReFED, 2018) (Kallbekken and Sælen, 2013)

	A	S	R	P	O	L	Focus	Measure	Source
									(Pirani and Arafat, 2014) (Fink et al., 2016) (Priefer et al., 2016) (Schanes et al., 2018) (Thiagarajah and Getty, 2013) (Williamson et al., 2016) (Leanpath, 2019) (Wansink and van Ittersum, 2013)
64					x		Monitoring and tracking	Measure amounts of food waste, types of products gone wasted and reasons why; make use of tracking sheets and/or digital tools such as smart scales Focus on both kitchen as well as plate waste	(ReFED, 2016a, 2016b) (WRAP, 2013c) (WRAP, 2014, 2017b) (Silvennoinen et al., 2015) (WRAP, 2018) (Sakaguchi et al., 2018) (ReFED, 2018) (Leanpath, 2016) (Leverenz et al., 2016) (Clowes et al., 2018a) (Clowes et al., 2018b) (Clowes et al., 2019) (Winnow, 2019), (Winnow, 2018a, 2018b) (City of Hillsboro, 2010) (Leanpath, 2019)
65					x		Menu planning - waste monitoring and feedback	Carefully monitor uptake of different menu types and cycles, and link this with waste monitoring data; identify consistently returned food items and seek for feedback on why this was the case; avoid overproduction of less popular dishes; identify most popular dishes	(WRAP, 2013c) (Göbel et al., 2014) (WRAP, 2013g) (Betz et al., 2015) (Leanpath, 2016) (Fink et al., 2016) (Winnow, 2019)
66					x		Internal communication	Communicate with kitchen staff on buffet and plate leftovers, and on feedback from customers on portion sizes, expectations and reasons why food was left behind	(Schmidt et al., 2018) (Göbel et al., 2014) (Hotrec, 2017)
67					x		Food service - leftover take away	Offer take away boxes for leftovers; encourage consumers to take their leftovers with them and consume them at home REMARK: do not encourage customers to request larger portions so they can take it home	(FAO, 2013) (WRAP, 2013c) (Hrad et al., 2015) (WRAP, 2018) (Sakaguchi et al., 2018) (SRA, 2017) (Stöckli et al., 2018) (Hotrec, 2017) (WRAP, 2014, 2017b)
68					x		Food service – catering & take away	At the end of service (or during the last break of a conference), provide for food that can be taken home by participants (fruit, sandwiches,..); inform participants of this possibility and provide for appropriate packaging	(BMEL, 2015)

	A	S	R	P	O	L	Focus	Measure	Source
69					x		Food surplus – staff meals	Use food surplus to prepare staff meals; use food close to expiry date	(SRA, 2017) (Hotrec, 2017)
70					x		Nudges and prompts – signs at buffet	Informational signs "only take what you will eat" or "eat what you take"; "visit our buffet multiple times"; fine customers for leftover plate waste	(Lipinski et al., 2013) (Göbel et al., 2014) (Kallbekken and Sælen, 2013) (Pirani and Arafat, 2014) (Priefer et al., 2016) (Whitehair et al., 2013)
71					x		Customer – sensibilisation	Increase tolerance of customers towards sustainability measures; provide sign "we are fighting food waste - not everything may be available at all times"	(Betz et al., 2015) (Göbel et al., 2014) (Waskow et al., 2016) (WWF, 2017) (Hotrec, 2017)
72					x		Clients – awareness, engagement and sensibilisation	Encourage customers to act more sustainably; in case of school catering: ask teachers, students, … to become "FW champions" or "food savers" and keep an eye on how much food is served and eaten; provide incentives; inform clients on how much food was wasted (eg FW barometer) and what they can do to avoid; communication with clients; inform customers what the restaurant/food service is doing	(Göbel et al., 2014) (Schmidt et al., 2018) (Hotrec, 2017) (Ellison et al., 2017) (Leanpath, 2019) (Futouris, 2019)
73					x		Marketing	Award certificates; initiate a hotel and restaurant industry federation; green tourism map	(Hafner et al., 2012)
74	x	x	x		x	x	Food redistribution and donation	Make partnerships for food donation; facilitate redistribution of overproduced food to charities or to staff; improve food banks' infrastructure to allow for more frequent food collection and sufficient storage facilities; improve on-site storage and refrigeration possibilities for prepared food in restaurants; encourage food donation e.g. through donation tax incentives; educate potential donors on liability laws	(Betz et al., 2015) (Cicatiello et al., 2016) (FAO, 2013) (Göbel et al., 2014) (Hermsdorf et al., 2017) (HLPE, 2014) (Hrad et al., 2015) (Lipinski et al., 2013) (Pirani and Arafat, 2014) (ReFED, 2016a, 2016b) (ReFED, 2018) (Sakaguchi et al., 2018) (Silvennoinen et al., 2015) (SRA, 2017) (Teuber and Jensen, 2016) (WRAP, 2018) (WWF, 2017) (Hegnsholt et al., 2018) (Lipinski et al., 2017) (Hotrec, 2017) (Schanes et al., 2018) (WRAP, 2014, 2017b)
75	x	x					Food donation – process excess food	Extend usable life of donated foods (imperfect produce, unharvested food, overproduction at processing stage…) through processing, e.g. make soups, sauces or other value-added products	(ReFED, 2016a, 2016b)

2 Supplementary Table S2

Supplementary Table S 2. Use of evaluation criteria for food waste prevention measures in literature. A description of the applied methodology is indicated in colour: green for effectiveness (food waste reduction), blue for sustainability assessment (across environmental, economic and social dimensions), and red for efficiency assessments. The results of the assessments as provided for in literature, are given in black. The non-exhaustive table contains both implemented measures with measured outcomes (●) as well as projected outcomes for a (hypothetical) measure or target (○), with a focus on the Out of Home (OoH) sector.

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	Imperfect produce: co-op "Fruta Feia" buys ugly produce from farmers and sells it to consumers through delivery points	(Ribeiro et al., 2018)	Agric.	PT, 1 co-op	Based on tons of ugly produce sold and thus diverted from landfill 171 tonnes in 2015	LCA (ReCiPe Midpoint method). Incl: full life cycle impacts of produce; avoided landfilling; transport from farm to delivery point; production of reusable fabric bags and wooden boxes (consumer baskets). Excl: consumer transport; logistics of delivery point (manual work) Each kg fruit/vegetable sold avoids 0.14 kgCo2eq emissions. Over 5 yrs: 108 tonnes of Co2eq emissions avoided	ECON: incl. variable costs such as purchase of produce from farmers and transport to the delivery points; fixed costs such as personnel costs, webpage, services and investments in logistics and computer hardware; revenues from selling produce to consumers. Thus based on value of food no longer wasted + implementation costs; excl. are the avoided disposal/landfilling costs. SOC: Social-Life Cycle Assessment (S-LCA) ECON: Net present value (after 5 years) is positive; increases with number of delivery points SOC: fair salaries but often variable working hours for those involved in the delivery process; community engagement; creates food waste awareness at consumers; consumers buy produce at low prices, below market price; contribution to local employment and greater awareness as project is being replicated in other regions; increases revenue for local farmers + immediate payment; transparent system
					EFFICIENCY: Investment pay-back period (5 yr time frame; 3,5% discount rate); Social Return on Investment (SROI) method, monetizing the economic, environmental and social value created in order to assess the project's contribution to society. Value of 1t CO2 = € 52.7 (based on literature). Payback period: 4 yrs if only 1 delivery point; 2 yrs if 3 delivery points. SROI always > 1 (for every €1 invested, the social value generation is higher than €1); SROI ranges from 1,11 for 1 delivery point after 1 yr to 1,69 for 3 delivery points after 5 yrs.		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	Reduced storage temperature in cheese, dairy, deli and meat department of supermarket Meat: from 4 ◦C to 2 ◦C Deli: from 8 ◦C to 5–2 ◦C Cheese & dairy: from 8 ◦C to 5 ◦C	(Eriksson et al., 2016)	Retail	SWE, 6 supermarkets	For all products: lower t° lead to less FW with max. FW reduction of 16-30% at lowest storage t° of 2°C	Net effect = embodied GHGs of foods that are no longer wasted - GHG emissions associated with addit. electr. use for lower storage t° Net savings per store per year: Meat: 12 Mg CO2e. Deli: 0.4–0.8 Mg CO2e. Cheese & dairy: net losses. For dairy: net savings possible when using green electr. mix	Net effect = value of foods that are no longer wasted - costs associated with addit. electr. use for lower storage t° Net savings per store per year: Meat: 56 kSEK Deli: 5–7 kSEK Cheese & dairy: net losses
					EFFICIENCY: net benefits calculated as benefits minus costs – see "Econ. Costs and benefits" section		
○	Better use of fridges: lowering fridge temperature and refrigerating foods which are not always stored in the fridge	(Brown et al., 2014b) + (WRAP, 2013b, 2015)	Households	UK, society	Results: +/- 71000 t FW avoided by lowering t°; +/- 81000 t for storing additional foods in the fridge	Net benefits = Embodied emissions of foods no longer wasted – emissions from additional electricity use Embodied emissions: 578383 t CO_2; Electr. use: 367411 t CO_2 Net reduction: +/- 210,000 tonnes CO_2	Net benefits = Value of foods that are no longer being wasted – costs associated with additional electricity use (Based on 2011 prices) Embodied value: £283,8m; Electr. costs: £80,9m Net Savings: £200 million (US$320 million)
					EFFICIENCY: net benefits calculated as benefits minus costs – see "Econ. Costs and benefits" section		
○	Freezing at home	(Brown et al., 2014a)	Households	UK, 1 freezer in experimental setting	1 freezer in experimental setting: Avoidance of 2,3 kg food going to waste (consisting of bread and leftovers prior/ after cooking) At society level: 630000 tonnes of "freezable" food frozen and eaten (instead of thrown)	Net benefits = Embodied emissions of foods no longer wasted – emissions from additional electricity use Experimental setting: Embodied emissions: 8,75 kg CO_2; Electr. use: 0,068 kg CO_2 Benefit ratio of 1/100 Savings at society level: over 2.4 million tonnes CO_2	Net benefits = Value of foods that are no longer being wasted – costs associated with additional electricity use (from opening freezer and adding food) Experimental setting: Embodied value: £5,36; Electr. use: £0,018 Benefit ratio of 1/300 Savings at society level: £2.3 billion
					EFFICIENCY: net benefits calculated as benefits ratio – see "Econ. Costs and benefits" section		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	Love Food Hate Waste (LFHW) campaign Evaluation period: 2007-2012 3 parts: Large-scale communications campaigns, local engagement and changes to products, packaging, labelling, media advertising.	(WRAP, 2015; Hanson and Mitchell, 2017)	Households, authorities, businesses	UK, society	15% reduction, or a reduction of 1.3 million tonnes household FW in 2012 compared to 2007 85% of this reduction refers to avoidable FW; avoidable FW thus reduced by 21-24%.	Embodied impacts of food that is no longer wasted. For GHGs: based on entire LC, incl. preparation in the home and waste treatment and disposal. For land use: hectares required to produce food commodity, as found in literature Prevention of 3.4 million tonnes of GHG emissions a year; 1 billion m³ of water saved; avoided use of 430000 ha of land per yr for food production.	Based on: costs of the campaign + avoided disposal costs for local authorities + savings for households in terms of avoiding throwing away food (based on retail prices) Campaign costs: £26 million over 5 yrs (expenditures by WRAP, local authorities, Courtauld Commitment signatories and community groups) Savings over 5 yrs: £86 million for local authorities (avoided FW disposal) + £6.5 billion for households (avoided purchase of food)
					EFFICIENCY: benefit-cost ratio; money spent versus money saved. There is an implicit link to amounts of FW reduced as the savings refer to the embodied economic retail value of food that is no longer wasted and the avoided disposal costs; no link to ecological savings. Every £1 spent by the public and private sector contributed to over £250 of savings.		
●	---- 6 months "Love Food Hate Waste (LFHW)" campaign in West London	(WRAP, 2015)	Households	UK, sub-region (West London), society	+/- 15% reduction for total household food waste		Based on: costs of the campaign + avoided disposal costs for local authorities + savings for households in terms of avoiding throwing away food (based on retail prices) Campaign cost: ca £170,000, (US $270,000) Local authorities save £1.3 million (US $2.1 million); residents save around £14 million (US $22 million).
					EFFICIENCY: benefit-cost ratio; money spent versus money saved. There is an implicit link to amounts of FW reduced as the savings refer to the embodied economic retail value of food that is no longer wasted and the avoided disposal costs; no link to ecological savings. Every £1 (US$1.6) invested = saving around £90 (US$140) for consumers and local authorities.		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	Courtauld Commitment, Voluntary agreement Phase 1 (2005-2010): household food and packaging waste Measures mainly focus on improving/reducing packaging (waste), complemented with extended shelf life thus reducing food waste; setting of clear targets.	(WRAP, 2010a, 2013a, 2013d)	Households	UK, society	1.2 million tonnes of food and packaging waste	Embodied GHGs of foods no longer wasted + avoided disposal impacts Savings: 3.3 million tonnes of CO2eq	Value of food no longer being wasted (based on retail value) + avoided landfilling costs. Not clear if campaign or agreement costs are included Savings: £1.8 billion
●	Courtauld Commitment, Voluntary agreement Phase 2 (2009/2010-2012): focus on packaging waste, and household & supply chain FW Example measures: *HOUSEHOLDS - setting of clear targets; communication campaigns (e.g. Love Food Hate Waste campaign); community engagement and support; design changes to products, packaging and labelling. *SUPPLY CHAIN - setting of clear targets; improved forecasting; innovative packaging to increase shelf life… WRAP provides guidance, tools, expert knowledge and support.	(WRAP, 2013a, 2013d)	Supply chain, grocery sector, households	UK, society and business level; 53 business signatories	Cumulative waste avoided (2009-2012): Household FW: 700 000 t Supply chain FW: +/- 300 000t	Embodied GHGs of foods no longer wasted + avoided disposal impacts Cumulative CO2 eq savings (2009-2012):Household FW: 2 300 000 t; Supply chain FW: 1 100 000t	Value of food no longer being wasted (based on retail value) + avoided landfilling costs. Not clear if campaign or agreement costs are included Cumulative cost savings (2009-2012): Household FW: £ 1 710 000 000 Supply chain FW: £ 170 000 000

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
○	Novel portion packs for fresh meat	(WRAP, 2015)	Households	UK, society	Could lead to a 5-10% reduction in waste	No methodology given; therefore not clear if EoL impacts or packaging impacts were considered. 2-4-fold environmental benefit of the small amount of additional packaging.	Additional packaging costs Additional packaging costs = 0.5% - 1% of current packaging costs
●	Campaign "Food: Too Good to Waste (FTGTW)": behaviour change strategies & tools, messaging and outreach tools. Example measures: tools and guidance for better storage and smart shopping; posters and workshops.	(EPA, 2016)	Households	US, society	Avoidable FW: weight reduction ranging from -11 to -48%; volume reduction ranging from -27 to -39%.	Could not be estimated	Implementation costs for campaigns Implementation costs for campaigns ranged from a few thousand dollars for pilots to above $100,000, not including staff time, for broad scale campaigns
●	BinCam system: waste bin capturing and sharing images of disposed waste on an online social network	(Thieme et al., 2012; Comber and Thieme, 2013)	Households	US, 4 shared households	No absolute data on FW reduction available; relative data only visualised: see economic costs.	/	Participants received visualisations to see how they performed relative to the other households: visualisation included "gold bars" representing the money saved by wasting less; no % changes given or absolute data given. Focus on awareness raising and social influences.
●	Written messages in student dining hall reminding diners to "eat what you take"	(Whitehair et al., 2013)	OoH, university dining	US, 1 mensa	15% reduction in food waste BUT potentially biased results (Ellison, 2017)		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	Using 2nd grade vegetables in commercial kitchens Focus on carrots, onions and leeks.	(Teuber and Jensen, 2016) Based on (Lynnerup , 2016)	OoH	DK, 8 industrial kitchens	More kitchen FW (trimming losses) for leeks and carrots; less for onions. No information on FW reductions at supplier level		Based on price of raw products (rescaled to 10 kg vegetable weight after trimming) and time spent for trimming.
					EFFICIENCY: net benefits calculated as benefits minus costs – see "Econ. Costs and benefits" section Important are: working time spent, purchasing price, utilisation rate (trimming losses) and application. Onions= economic advantage in using 2nd grade; Leeks = moderate advantage; Carrots= almost no advantage		
●	Reduce amounts of food being ordered or prepared; change menus (more child friendly), reduce continuous availability of food on the buffet	(Schmidt et al., 2018)	OoH, schools	DE, several schools	FW reductions: 14 to 48%. Small measures lead to +/- 30% short term reductions Implementing small measures in the 4 schools under study would lead to +/- 5800 kg FW reductions	Embodied life cycle impacts; EoL stage not included. Implementing small measures in the 4 schools under study would lead to 8.7 tonnes CO_2 savings	Based on economic value of food no longer wasted. Savings: between 7 000 and 13 000 EUR per year per school
					EFFICIENCY: For a selection of measures, a qualitative indication is made on the estimated time, labour and costs that go with each measure as well as staff willingness to implement the measure. Expenses, costs or willingness are rated as being "low", "average" or "high" (see fig.22 of original report)		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	The business case for hotels: measure FW, engage staff, rethink the buffet, reduce food overproduction, and repurpose excess food. Case studies given focus on: smart scale, rethink buffet and reduce overproduction, engage staff	(Clowes et al., 2018b)	OoH, hotels	Global, 42 hotel sites in 15 countries	FW generated in kitchen (incl. inedible parts) during preparation and storage, incl. leftovers thrown by staff. Incl. buffet returns. Excl. rescued food (donated) or customer plate leftovers. On average: 21 % FW reduction over 12 months (managers mainly focusing on reducing FW of costly products)		**Costs**: measuring FW (smart scales), identify required actions, implem. costs (consulting, equipment, staff training …), redesign menus; **Benefits**: lower costs & addit. revenue (optimization food/raw material purchase, fewer waste collection, selling food that otherwise would have been unsold…). **Monetary value of FW**; **FW as share of cost of goods sold (COGS)** = share of FW in total food expenditure; investments made **Monetary value FW**: average reduction of 64%; **FW as share of COGS**: average nearly 4% drop; median over 2% drop. Thus half of the sites saved more than 2 cents on every dollar of COGS; **Investments made:** nearly 90% of the sites invested fewer as $20,000 over 3 yrs; on average, only 0.9 % of annual food sales.
					EFFICIENCY: Benefit-cost ratio and Return on investment (ROI). Investments pay-back period (recoup of investment after x yrs). Time period: 3 yr; discount rate: 10% per yr. There is an implicit link to amounts of FW reduced as benefits include changes in food purchase costs; no link to ecological savings. **Benefit-cost ratio:** Average 7:1. Median nearly 5:1 (for every $1 spent, half of the sites realized nearly $5 return; nearly 400% ROI). **Payback period**: 70% within 1 yr; 95% within 2 yrs.		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	The business case for catering: measure FW, engage staff, start small and get creative, reduce overproduction, and repurpose excess food. Case studies given focus on: measure FW, collaborate with non-profits, start small and get creative, engage staff	(Clowes et al., 2018a)	OoH, catering	Global, 86 catering sites, 6 countries	FW generated in kitchen (incl. inedible parts) during preparation and storage, incl. leftovers thrown by staff. Excl. rescued food (donated) or customer plate leftovers. Average FW weight reduction of 36% over 1 year, or 44% over 3 years		**Costs**: measuring FW (smart scales), identify required actions, implem. costs (consulting, equipment, staff training …), redesign menus; **Benefits**: lower costs & addit. revenue (optimization food/raw material purchase, fewer waste collection, selling food that otherwise would have been unsold…). **Monetary value of FW**; **FW as share of cost of goods sold (COGS)** = share of FW in total food expenditure; investments made **Monetary value FW**: average reduction of 56%; **FW as share of COGS**: average site saved more than 5 cents on every $1 of COGS; half of the sites saved over 4 cents; **Investments made over 3 yrs:** 79% invested fewer as $10,000; 98% below $15,000. On average, 1.6% of annual food sales.
					EFFICIENCY: Benefit-cost ratio and Return on investment (ROI). Investments pay-back period (recoup of investment after x yrs). Time period: 3 yr; discount rate: 10% per yr. There is an implicit link to amounts of FW reduced as benefits include changes in food purchase costs; no link to ecological savings. **Benefit-cost ratio:** Average over 6:1. Median over 4:1 (for every $1 spent, half of the sites realized a $4 return or greater; over 300% ROI). **Payback period**: 64% within 1 yr; 80% within 2 yrs.		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	The business case for restaurants: measure FW, engage staff, reduce overproduction, rethink inventory and purchasing practices, and repurpose excess food. Case studies given focus on: manual and digital measurement of FW, start small (gradual implementation of measures), engage staff	(Clowes et al., 2019)	OoH, restaurants	Global, 114 restaurants, 12 countries	FW generated in kitchen (incl. inedible parts) during preparation and storage, incl. leftovers thrown by staff. Excl. rescued food (donated) or customer plate leftovers. Average FW weight reduction of 26% over 1 year, or 58% over 3 years (managers mainly focusing on reducing FW of costly products)		**Costs**: measuring FW (smart scales), identify required actions, implem. costs (consulting, equipment, staff training …), redesign menus; **Benefits**: lower costs & addit. revenue (optimization food/raw material purchase, fewer waste collection, selling food that otherwise would have been unsold…). **Monetary value of FW**; **FW as share of cost of goods sold (COGS)** = share of FW in total food expenditure; investments made **Monetary value FW**: average reduction of 61%; **FW as share of COGS**: average site saved more than 2 cents on every $1 of COGS; half of the sites saved 2 cents; **Investments made over 3 yrs:** between $10,000 and $20,000. On average, 0.4% of annual food sales.
					EFFICIENCY: Benefit-cost ratio and Return on investment (ROI). Investments pay-back period (recoup of investment after x yrs). Time period: 3 yr; discount rate: 10% per yr. There is an implicit link to amounts of FW reduced as benefits include changes in food purchase costs; no link to ecological savings. **Benefit-cost ratio:** 89% of sites had a net positive financial return (>1:1). Average and median both 7:1 (for every $1 spent, half of the sites realized a $6 return or greater; over 600% ROI). **Payback period**: 76% within 1 yr; 89% within 2 yrs.		
●	Mobile catering in hospitals	(Snels and Wassenaar, 2011; Kranert et al., 2012a)	OoH, care	NL, 1 hospital	Only 2,2% of prepared meals ends up as FW (before, it was 36-48%)		Cost savings (from food and personnel savings) Savings: about €1,1 millions
●	Trayless system in a buffet-style university dining hall	(Thiagarajah and Getty, 2013)	OoH, university dining	US, 1 mensa	FW reduction of 18,4% for solid food; 6,8 % decrease for liquid waste		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	University dining hall: education campaign informing diners on FW issues, "Every plate counts" and on FW reduction activities taken up by the dining hall (eg donation)	(Ellison et al., 2017)	OoH, university dining	US, 2 mensas	No significant FW reduction observed		
●	Smart scale - Tracking FW with LEANPATH Case study: Intel's corporate cafeterias (US, April 2009-April 2010)	(City of Hillsboro, 2010)	OoH, business cafeteria	US, 2 cafeterias	pre-consumer food waste cut by 47%	Embodied GHG emissions for a selection of 7 food products + avoided disposal impacts GHG reduction of appr. 100 tonnes CO2	Based on food purchasing prices. No detailed calculations available for implem. costs such as time spent for measuring FW but it was taking into account. Food costs per meal reduced by 13,2%. Time spent for weighting FW (4 min. per week per employee) was offset by time savings from avoiding overproduction.
●	Smart scale – RESOURCE MANAGERFOOD + smaller portions on buffet, changes in buffet refilling, staff awareness	(Leverenz et al., 2016)	OoH, hotel	DE, 1 hotel	After 5 months: 85% reduction in FW at breakfast buffet		Based on purchasing price of foods no longer wasted Along entire project (9 months): savings of 6840 EUR
●	Smart scale WINNOW[2] (1) Since March 2017: Ikea Amersfoort, NL (2) Since Febr 2017: Ikea Gent, BE	(Winnow, 2018a, 2018b)	OoH, restaurant	BE & NL, business	(1) 40% FW reduction; over 15000 meals saved (2) 22% FW reduction; over 4000 meals saved	Embodied CO_2 impacts of food; not clear if EoL was included (1) not given (2) avoiding 7,894 tonnes of CO2	Based on food purchasing costs. (1) annual saving of €102,000 (estimated) (2) saving over €21,000 annually
●	Nudges: reduce plate size and put signs at buffet	(Kallbekken and Sælen, 2013)	OoH, hotels	NO, 14 hotels (7 per nudge) + 38 hotels in control group	FW reduction 19,5% for plate size and 20,5% for sign		

[2] Various case studies at https://www.winnowsolutions.com/en/casestudies

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	Nudges: smaller plate size at buffet	(Wansink and van Ittersum, 2013)	OoH, restaurant	US, 43 guests in 1 restaurant	Diners with larger plates wasted 14.4% of food taken; diners with smaller plates 7.9%	/	/
●	Use of disposable vs. permanent plates	(Williams on et al., 2016)	OoH, lab test + school & university buffet	USA, 2 lab tests + 3 field tests (buffet lunch at school and university)	Permanent plates lead to less FW than disposable ones (detailed data for each of the 5 tests is given in the original source).		
●	Informational and normative prompts in restaurants Encourage guests to ask for take-away boxes for leftover pizza through sign on table	(Stöckli et al., 2018)	OoH, restaurant	SWI, business	No signs: 75% of diners left leftovers (25% asked for take-away boxes) 45% left the leftovers with informational prompt; 36% left leftovers with inform. & normative prompt	Not evaluated	Not evaluated
○	Reduce plate waste by: A) bread on demand B) bulk meal delivery C) choice of portion size D) menu options E) quicker status update	(Dias-Ferreira et al., 2015)	OoH, hospital	PT, 1 hospital (8000 meals)	Before measure: 953 g FW pp/d Annual estimated reductions: A) 14t, B)32t, C) 48t, D) 8t, E) 4t	Embodied CO_2 impacts of food; incl. EoL stage. Based on literature data of 1.9 t CO2 per t of FW (Monier et al., 2010) Annual CO2 savings: A) 26t, B) 61t, C) 92t, D) 15t, E) 8t	Cost = 4.08 EUR per kg of FW. Based on food prices in PT and disposal costs. Annual savings in 1000 EUR: A) 56, B) 131, C) 197, D) 33, E) 18
●	Improved meal presentation	(Navarro et al., 2016)	OoH, hospital	IL, 1 hospital, 206 patients (1/2 control group)	Plate leftovers reduced by 19%		

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	Redistribution of food fit for consumption to charity	(Cicatiello et al., 2016)	retail	IT, 1 supermarket	23,5 ton recovered in 2012 (over 300d) of which 17t was bread. Daily FW average of 80kg.	Impacts based on the water and the ecological footprint of the redistributed food Results given for bread (WF 27545 m³; EF 8,6 gha) and meat (WF 30294 m³; EF 30,9 gha)	ECON: based on econ value of food saved; investments made SOC: amount of meals recovered ECON: €46 000 value of recovered food; investment of €10 000 (by Town council) to monitor recovery & collect related data, to purchase required materials, to provide external assistance to fulfil bureaucratic requirements SOC: 12 full meals/day (3624 meals over 302 d); 73 dessert portions/day; > 100 bread portions/day
					EFFICIENCY: cost-revenue analysis Investment (€10 000) versus return (€46 000), thus producing a multiplier effect of about 4.5		
○	REFED roadmap with 12 avoidance and 7 donation/redistribution measures, as well as 8 recycling measures (out of scope of this paper) Example measures: consumer education, waste tracking, trayless dining, packaging adjustments, cold chain management, donation transportation, … *Each of the measures has been evaluated separately. Overview of all solutions considered and detailed results, see (ReFED, 2016b)*	(ReFED, 2016a)	Entire food chain	US, society and business	20% FW reduction Diversion potential of the solutions: 13 million t/yr - Prevention: 2.6 million t/yr - Redistribution: 1.1 million t/yr - Recycling: 9.5 million t/yr SEE PIE CHARTS showing diversion potential for each measure	Diverted impacts based on embodied GHG emissions and water footprint (per product group; from literature) + avoided landfilling impacts (0,355 kg CO2 per pound) For recycling: addit. CO2 emissions depending on recycling solution (from literature, see Fig 24 in REFED report) Projections (per year): water savings of 1.6 trillion gallons (1.5% of annual U.S. freshwater withdrawals); avoid nearly 18 million tons of GHG emissions (societal value of $200 million to $1 billion per year)	ECON value of a solution: business profit potential based on financial benefits (incl. food costs avoided & revenue generated) and costs (incl. initial capital expenditures & annual operating expenses). Avoided costs from avoided disposal: only considered for the recycling/recovery solutions. Time frame 10 yr, 4 % discount rate. Value of FW: prevented = based on prices in retail ($2,5 per pound) or wholesale ($1-1,25 per pound); donated = $1.71 per pound; or recycled = value of resulting compost, energy, or feed. Required investments: $18 billion ECON projections (per year): Consumers savings $5.6 billion; Business Profit Potential : $1.9 billion (of which over $1.6 billion restaurants & food service providers). SOC: Meals saved and jobs created (only assessed for donation & recycling measures) SOC projections: 15,000 new jobs (recycling, donation storage & distribution …); doubling recovery up to 1.8 billion meals

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
					EFFICIENCY: Expected societal economic value (net economic value = benefits-costs) over 10 yrs; MACC curves (taking into account diversion potential) and a Restaurant solution matrix (taking into account feasibility). There is an implicit link to amounts of FW reduced as the savings refer to the embodied economic retail value of food that is no longer wasted (+ changes in disposal costs in case of recycling solutions); no link to ecological savings. Expected societal Economic Value: $100 billion in over a decade (>75% from prevention solutions, 23% from redistribution and the remaining potential from recycling solutions); MACC curves and solution/feasibility matrices: see original report.		
●	HaFs Hospitality and Food service Agreement - – Voluntary agreement with combined measures HaFs sets clear prevention and waste management target for both food and packaging waste. WRAP provides guidance and tools to set the baseline, set up an implementation plan, take action and monitor progress. Case studies include measures taken in each business related to staff awareness, FW monitoring, changes in amounts of food prepared/served; better menu planning; or maximise ingredient use	(WRAP, 2014, 2017b)	OoH Wide range of case studies are given (see below)	UK, sector	2015 against baseline of 2012: FW reduction of 11 600 tonnes; from 360 to over 760 tonnes donated Over entire HaFS: avoidance of 24 000 tonnes (=48 million meals).	Embodied impacts of food that is no longer wasted. 2015 against baseline of 2012: 11% reduction (> 80 000 tonnes of CO2) from food and packaging waste.	Value of food that is no longer wasted, set at £2,775 per tonne (Source: "the true cost of food waste" (WRAP, 2013e). This price includes purchasing costs as well as disposal costs and resources & time spent for preparing food. No information given on costs of campaign/agreement Over entire HaFS: savings of £67 million.
●	-----*HaFs Case study* Crieff Hydro Hotel: Monitoring, Staff awareness, Changes in breakfast serving	(WRAP, 2017b)	OoH, hotel	UK, 1 hotel	5% decrease in 1st monitoring week (awareness raising of Chef)		£10,000 savings from reducing toast and jam waste at breakfast

	Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
●	-----*HaFs Case study* Restaurant Associates, reducing FW during meetings: changes in amounts of food prepared, avoiding excess food, offer take-away boxes, provide wrapped biscuits	(WRAP, 2017b)	OoH, caterer	UK, company	Over 4 weeks: 20 tonnes less FW		FW contribution to total food purchase costs: decrease from 39 to 18% over 4 weeks
●	-----*HaFs Case study* Inspire Catering: reducing prepared food and plate waste; better menu planning to maximise use of ingredients; improving portion control and encouraging portion options.	(WRAP, 2017b)	OoH, caterer	UK, caterer company	Annual FW savings of 5%.		
●	-----*HaFs Case study* Baxter Storey: FW monitoring and staff training	(WRAP, 2017b)	OoH, hospitality provider	UK, company	FW reduction of over 35%		Savings: over £3 million in food and beverage costs, over £1 million in disposal costs and over £350,000 in energy.
●	-----*HaFs Case study* KFC : food donation scheme Unsold chicken is packaged and frozen so it can be stored and later on collected by charity.	(WRAP, 2017b)	OoH, restaurant	UK, 100 restaurants	over 35,000 meals donated		
●	-----*HaFs Case study* Spirit Pub Company: increased FW recycling by transforming logistics (innovative backhauling measures). Requires better FW segregation, staff training, adaptations to vehicles	(WRAP, 2017b)	OoH, pub	UK, pub company	Large recycling rate increase		Financial savings of over £1.6 million
●	-----*HaFs Case study* Dragon Hotel: increase	(WRAP, 2017b)	OoH, hotel	UK, hotel			Savings of £3,000 through simple no- or low-cost measures during 6 mnth pilot. Now: saving

Measure	Source	LC stage or sector in focus	Location & Scale	Effectiveness	Environmental impacts or savings	Economic costs and benefits Social impacts
recycling rate of food and packaging waste						around £15,000 a year.

3 Supplementary Table S3

Supplementary Table S3 Overview of academic and grey literature sources containing one or more evaluated measure, as a result of Step 2 of the literature search process.

A) Peer reviewed journals			
Author(s)	**Year**	**Title**	**Journal**
Brown, T.; Hipps, N. A.; Easteal, S.; Parry, A.; Evans, J. A.	2014	Reducing domestic food waste by freezing at home	International Journal of Refrigeration
Brown, T.; Hipps, N. A.; Easteal, S.; Parry, A.; Evans, J. A.	2014	Reducing domestic food waste by lowering home refrigerator temperatures	International Journal of Refrigeration
Cicatiello, Clara; Franco, Silvio; Pancino, Barbara; Blasi, Emanuele	2016	The value of food waste: An exploratory study on retailing	Journal of Retailing and Consumer Services
Comber, Rob; Thieme, Anja	2013	Designing beyond habit: opening space for improved recycling and food waste behaviors through processes of persuasion, social influence and aversive affect	Pers Ubiquit Comput (Personal and Ubiquitous Computing)
Dias-Ferreira, C.; Santos, T.; Oliveira, V.	2015	Hospital food waste and environmental and economic indicators--A Portuguese case study	Waste management (New York, N.Y.)
Ellison, Brenna; Nehrling, Erica Whitney; Nikolaus, Cassandra J.; Duff, Brittany R.L.	2017	Evaluation of a Food Waste Reduction Campaign in a University Dining Hall	Journal of Nutrition Education and Behavior
Eriksson, Mattias; Strid, Ingrid; Hansson, Per-Anders	2016	Food waste reduction in supermarkets – Net costs and benefits of reduced storage temperature	Resources, Conservation and Recycling
Kallbekken, Steffen; Sælen, Håkon	2013	'Nudging' hotel guests to reduce food waste as a win–win environmental measure	Economics Letters
Navarro, Daniela Abigail; Boaz, Mona; Krause, Ilan; Elis, Avishay; Chernov, Karina; Giabra, Mursi; Levy, Miriam; Giboreau, Agnes; Kosak, Sigrid; Mouhieddine, Mohamed; Singer, Pierre	2016	Improved meal presentation increases food intake and decreases readmission rate in hospitalized patients	Clinical nutrition (Edinburgh, Scotland)
Ribeiro, I.; Sobral, P.; Peças, P.; Henriques, E.	2018	A sustainable business model to fight food waste	Journal of Cleaner Production
Stöckli, Sabrina; Dorn, Michael; Liechti, Stefan	2018	Normative prompts reduce consumer food waste in restaurants	Waste management (New York, N.Y.)
Thiagarajah, Krisha; Getty, Victoria M.	2013	Impact on plate waste of switching from a tray to a trayless delivery system in a university dining hall and employee response to the switch	Journal of the Academy of Nutrition and Dietetics
Wansink, Brian; van Ittersum, Koert	2013	Portion size me: plate-size induced consumption norms and win-win solutions for reducing food intake and waste	Journal of experimental psychology: Applied

Whitehair, Kelly J.; Shanklin, Carol W.; Brannon, Laura A.	2013	Written messages improve edible food waste behaviors in a university dining facility	Journal of the Academy of Nutrition and Dietetics
Williamson, Sara; Block, Lauren G.; Keller, Punam A.	2016	Of Waste and Waists: The Effect of Plate Material on Food Consumption and Waste	Journal of the Association for Consumer Research

B) Papers submitted to a scientific congress

Author(s)	Year	Title	Congress
Leverenz, Dominik; Pilsl, Philipp; Hafner, Gerold	2016	Entwicklung einer Anwendung zur Erfassung, Bewertung und Vermeidung von Lebensmittelabfällen in gastronomischen Einrichtungen	6. Wissenschaftskongress „Abfall- und Ressourcenwirtschaft“ 2016, Deutsche Gesellschaft für Abfallwirtschaft (DGAW) (Berlin, Germany)
Thieme, Anja; Comber, Rob; Miebach, Julia; Weeden, Jack; Kraemer, Nicole; Lawson, Shaun; Olivier, Patrick	2012	‘‘We’ve bin watching you’’-designing for reflection and social persuasion to promote sustainable lifestyles.	Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems - CHI '12 (Austin, Texas, USA)

C) Reports or Grey Literature

Author(s) or organization	Year	Title
City of Hillsboro	2010	Food Waste Prevention Case Study: Intel Corporation’s Cafés
Clowes, Austin; Hanson, Craig; Swannell, Richard	2019	The business case for reducing food loss and waste: restaurants. A report on behalf of Champions 12.3
Clowes, Austin; Mitchell, Peter; Hanson, Craig	2018	The business case for reducing food loss and waste: hotels. A report on behalf of Champions 12.3
Clowes, Austin; Mitchell, Peter; Hanson, Craig	2018	The business case for reducing food loss and waste: catering. A report on behalf of Champions 12.3
EPA	2016	Food: Too Good To Waste. An Evaluation Report for the Consumption Workgroup of the West Coast Climate and Materials Management Forum
Hanson, Craig; Mitchell, Peter	2017	The Business Case for Reducing Food Loss and Waste. A report on behalf of Champions 12.3
Kranert, M.; Hafner, G.; Barabosz, Jakob; Schuller, H.; Leverenz, Dominik; Kölbig, A.; Schneider, F.; Lebersorger, S.; Scherhaufer, S.	2012	Ermittlung der weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland
Lynnerup, Dorthe	2016	Mindre madspild ved anvendelse af 2. sorterings grøntsager i storkøkkener ("Less Food Waste by using 2nd grade vegetables in industrial kitchens”)
ReFED	2016	A Roadmap to Reduce US Food Waste by 20%
ReFED	2016	A Roadmap to Reduce US Food Waste by 20%. Technical Appendix
Schmidt, Thomas; Baumgartd, Sandra; Blumenthal, Antonia; Burdick, Bernhard; Claupein, Erika; Dirksmeyer, Walter; Hafner, Gerold; Koch, Franziska; Leverenz, Dominik;	2018	Wege zur Reduzierung von Lebensmittelabfällen - Pathways to reduce food waste (REFOWAS). Dritter Zwischenbericht zu Nr. 3.1 BNBest-BMBF 98

Lörchner, Marianne; Ludwig-Ohm, Sabine; Waskow, Frank		
Snels, J.; Wassenaar, N.	2011	Maaltijdservice Máx à la Carte. Effecten van een nieuw maaltijdconcept binnen Máxima Medisch Centrum
Teuber, Ramona; Jensen, Jørgen Dejgaard	2016	Food losses and food waste – Extent, underlying drivers and impact assessment: IFRO report
Winnow	2018	Case study: See how an IKEA store in Netherlands is saving over €100,000 annually by reducing food waste
Winnow	2018	Case study: Food is Precious for IKEA Gent which plans to halve food waste by August 2020
WRAP	2010	Courtauld Commitment 1 (2005-2010). Case studies
WRAP	2013	Courtauld Commitment 2 - Household Food Waste. Technical report
WRAP	2013	Impact of more effective use of the fridge and freezer
WRAP	2013	The Courtauld Commitment, Phase 2. Final Results
WRAP	2014	The Hospitality and Food Service Agreement. Signatory Pack Sept. 2014
WRAP	2015	Strategies to achieve economic and environmental gains by reducing food waste
WRAP	2017	The Hospitality and Food Service Agreement. Taking action on waste

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