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Mapping Food Waste Solutions



WAFF webinar

Jan 30, 2024 at 7-8am and 4-5pm (UK time)



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Who am I?

Reader at the Centre for Food Policy.

- Focus on sustainable food systems and food waste.
- Supporting the FSA/Defra through research projects. Scottish food systems research (ZWScotland). Household Simulation modelling (WRAP). Local food strategy development.
- Nutrition Society Food Systems theme lead. IFST Sustainability working group.

Recent publications

Charlotte Spring and Jordon Lazell









Shout out my other research: The Household simulation model

https://blogs.city.ac.uk/householdfoodsimulation/

HOUSEHOLD FOOD SIMULATION

The Household Simulation Model: A decision making tool for building more sustainable food systems.



FOOD AND PACKAGING TRADE-OFFS

RESEARCH ON NEW PACKAGING SYSTEMS REUSABILITY AND REFILLABILITY



PACK SIZE

ALIGNMENT WITH CONSUMPTION NEEDS PACKAGING LIGHTWEIGHTING



SHELF-LIFE EXTENSION
PACKAGING TECHNOLOGIES EXTENDING SHELF LIFE OF **PRODUCTS**



STORAGE PRACTICES

EDUCATE CONSUMERS ABOUT THE BENEFITS OF MAXIMISING PRODUCT SHELF LIFE THROUGH APPROPRIATE STORAGE **PRACTICES**



COMBINATION OF INTERVENTIONS

SINGLE INTERVENTIONS MAY HAVE LIMITED IMPACTS



Today is a work in progress and part of wider research on FLW policy solutions.

- All input warmly received. (Feedback, questions, your thoughts.)
- Who should I be talking to?





In 2019 I presented this... and published this...





A Local Authority representative in the audience asked "So what can we do to reduce food waste if we follow WRAP guidance already..."

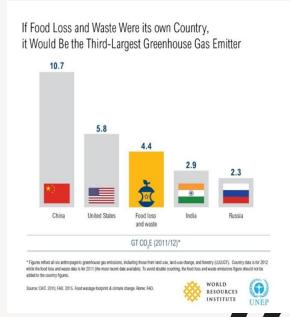
For five years, I have been trying to answer!

So what do we know in 2024?

We know that FLW is a climate issue.

Responses to FLW need to think about climate change

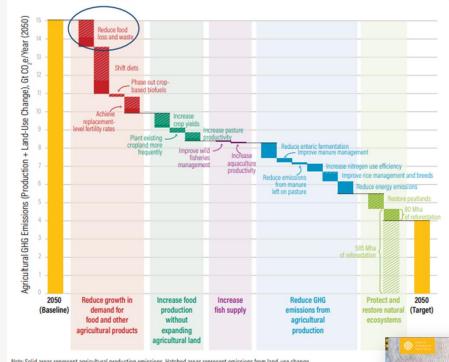




FLW reduction is one of the biggest actions we can take to reduce global GHGE

- The two biggest reductions we can make to agricultural GHGE to achieve a 2° C warming target (4 Gt/year) or 1.5° C warming target (0 Gt/year) are through:
- 1.Shifting to sustainable diets
- 2.Reducing Food Loss and Waste

Figure I.2 | Reducing Food Loss and Waste Can Play an Important Role in Eliminating the Projected 15 Gt of Greenhouse Gas Emissions from Agriculture and Land-Use in 2050 (CO, equivalent)

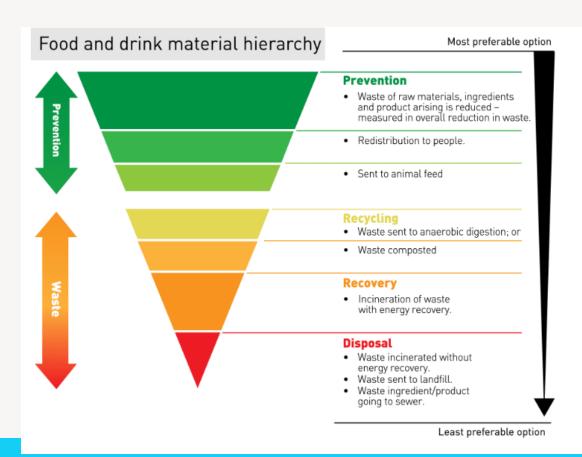


Note: Solid areas represent agricultural production emissions. Hatched areas represent emissions from land-use change. Source: Searchinger et al. (2018).

Many reasons / drivers for FLW

Primary Production	Processing and Manufacturing	Distribution and Wholesale	Retail	Food Service/ Institutions	Household
Spillage	Spillage	Cosmetic or physical	Product recall	Product recall	Product recall
Cosmetic or physical damage	Trimming during processing	damage Spoilage	Food prepared improperly	Food prepared improperly	Food prepared improperly
Damage from pests or animals	Rejected from market	Past sell-by date	Food cooked but not eaten	Food cooked but not eaten	Food cooked but not eaten
Not harvested		Rejected from market	Cosmetic damage	Cosmetic damage Spoilage	Cosmetic Damage
Unable to sell due to quantity or size		Unable to reach market	Spoilage Past sell-by date	openage	Spoilage Past sell-by or use-by date
Unable to reach market					

Food loss and waste solutions are within a hierarchy



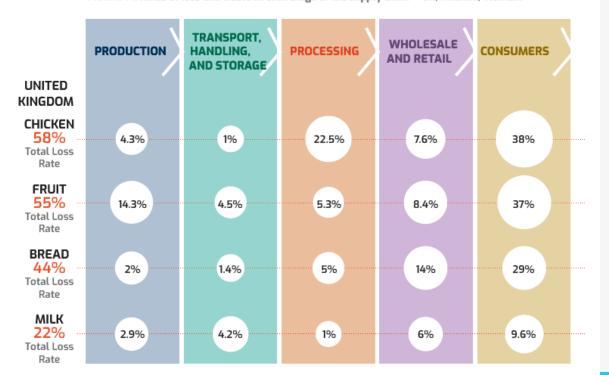
All interventions and policy solutions <u>prevent</u>, <u>divert</u> (recover or recycle), or <u>reduce</u> food loss and waste.

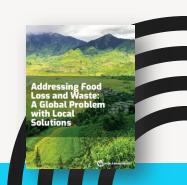
We need a combination of solutions to achieve Sustainable Development Goal 12.3.



Action needed at different points in the supply chain, for diff. products/countries...







Many Actors needed to reduce FLW

Figure 4.2 | Key Actors for Reducing Food Loss and Waste (Not Exhaustive)



2019 - Review: Consumption-stage food waste reduction interventions

- 17 applied interventions that claim to have achieved food waste reductions.
- 13 quantified food waste reductions.
 - Plate size interventions resulted in up to 57% food waste reduction.
 - Changing nutritional guidelines in schools reduced vegetable waste by up to 28%.
 - Information campaigns had up to 28% food waste reduction.
- Lots of gaps and missing data.



A growing reviewed evidence base.

- Zhang et al 2023 https://doi.org/10.1016/j.foodpol.2023.102480
 - Overall effect of nudges on food waste reduction is a 0.38 SD
 - o Effectiveness of nudges can be reinforced when applied in public (vs. private) settings
- Casonato et al 2023 https://doi.org/10.1016/j.spc.2023.08.002,
 - Nudges rated as ++ effective,
 - School education programmes ++ effective
 - Food management skills ++ effective
 - Training + effective
 - Site based posters and awareness campaigns + effective
 - National food waste campaigns +/- effective
- Tian et al 2022 https://doi.org/10.1088/1748-9326/ac72b6
 - Behavioural interventions have a moderate effect (\$z\$ = 0.22) on food waste reduction,
 - Education programs having the most significant impact
 - Informational feedback having the least.
- Stöckli et al. 2018 https://doi.org/10.1016/j.resconrec.2018.03.029
 - Informational interventions: the most commonly used intervention type BUT evidence indicates that this intervention type is relatively ineffective,
 - A lack of evidence of the effectiveness of anti-consumer-food-waste interventions.

Shout out to Van Herpen et al

- Reducing food waste by simply measuring it: insights from interventions to reduce household food waste https://doi.org/10.1108/BFJ-02-2023-0092
 - □ Interventions on cooking planning and purchasing planning
 - □ 166 days data period. Results show that the interventions did not significantly reduce food waste, but measuring food waste alone resulted in a decrease over time.
- Convenient tools and social norms: Measuring the effectiveness of an intervention to reduce household food waste https://doi.org/10.1016/j.jclepro.2023.139604
- A tool kit for food management (measuring cup, stickers, etc) diminished food waste.
 Decreases self-reported food waste by 39.2% (e1) and 23.0% (e 2)
- Effects on waste-preventing behaviours were stronger w/ added social norm messages.
- o In this study, effects of using self-reported food measurement appeared minimal.
- Does Cash Really Mean Trash? An Empirical Investigation into the Effect of Retailer Price Promotions on Household Food Waste https://doi.org/10.1093/jcr/ucad018
 - o Retailer price promotions (eg "buy one, get one") do not cause food waste
 - Households that take advantage of multi-unit deals waste less food (self selection)
 - Promotion-induced overbuying leads to concerns about food waste

Many types of FLW Solutions

	Waste reduction	Savings pe	r tonne of was	te reduced
	potential	Climate	Water	Costs
Products, processing and food wast	e solutions			
Animal feed from insects		•	•	•
Processed food waste to chicken feed		•	•	•
Dairy waste to animal feed		•	•	•
Processing technology to improve shelf life		\langle		
Standardised date labelling				
Better information for longer shelf life	\(\rightarrow\)			
Fibre products from food waste	\langle	•	\langle	•
New food products from processing waste	•	•	•	•
Nutrient extraction from processing waste	•	•	•	•
Packaging size and design adjustments	•			
Relax produce specifications at retail	•	•	•	\limits
fficient business operations and sup	ply chain solu	utions		
Waste tracking and analytics				
Improved cold chain management		\langle	\limits	
Whole crop purchase contracts	\langle	•	•	•
Centralised and 'dark' commercial kitchens				
Manufacturing line optimisation	•	•	_	_

	reduction potential	Climate	Water	Costs
ducation and behaviour change solu	tions			
Household behaviour change programs				
Hospitality and food service solutions	\langle			
Waste audits at hospitality and institutions	*			
		\		
ood rescue, recovery and redistribut		•		
Business-to-consumer platforms Increase food rescue across supply chain		♦		•
Business-to-consumer platforms	•	♦ ♦		• •
Business-to-consumer platforms Increase food rescue across supply chain	•	+++=	•	• •
Business-to-consumer platforms Increase food rescue across supply chain Secondary resellers	•	+++=	•	• •
Business-to-consumer platforms Increase food rescue across supply chain Secondary resellers Legislating food rescue at retail	•	• • • • • • • • • • • • • • • • • • •	•	• •



The Path to Half (Victoria, Au) 25 Solutions

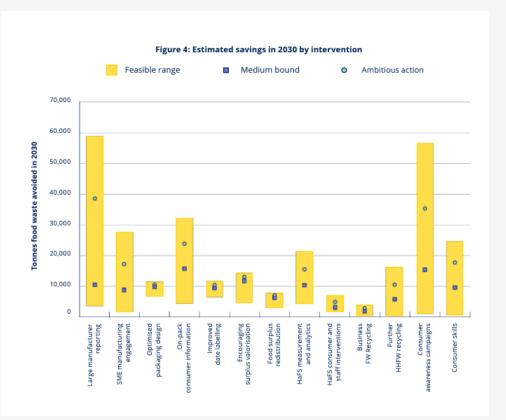
ReFED (USA) 73 Solutions

Australian food waste strategy 41 Solutions

Recommendations for Action in Food Waste Prevention (EU Platform on Food Losses and Food Waste) 47 Solutions



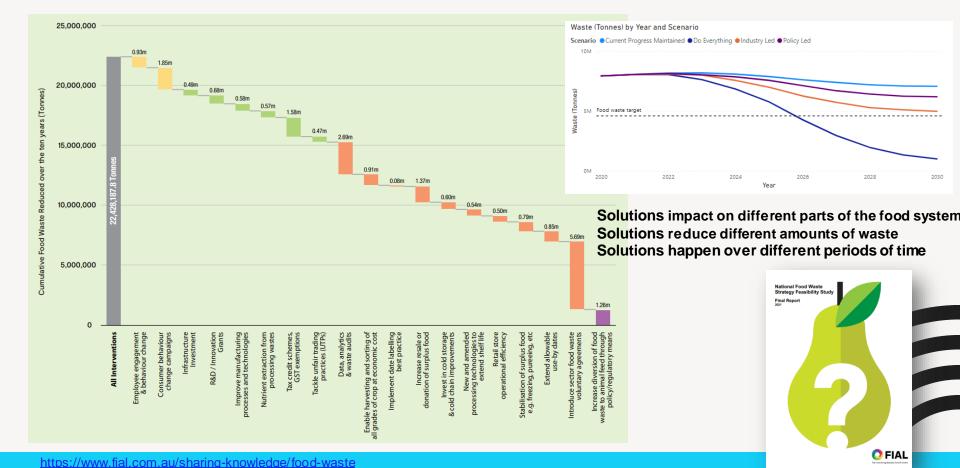
Welsh FW Route map 13 Solutions



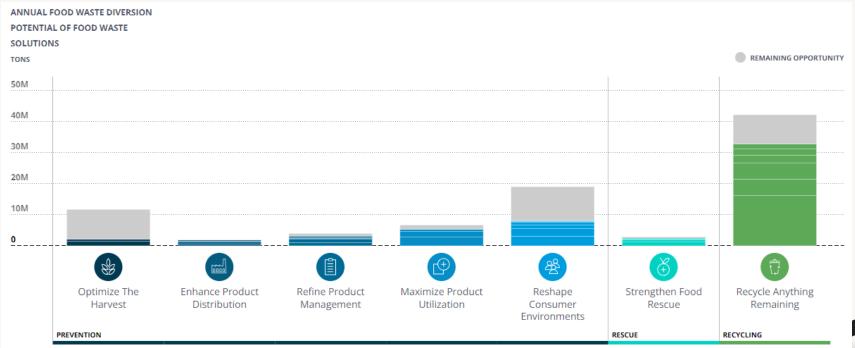


Solutions impact on different parts of the food system Solutions reduce different amounts of waste Solutions happen over different periods of time

Australian FLW strategy 41 Solution



Refed Solutions Database USA 73 Soultions

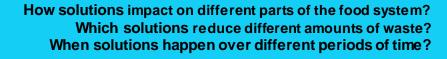


Solutions impact on different parts of the food system Solutions reduce different amounts of waste Solutions happen over different periods of time



We have a growing number of lists of actions across multiple countries...





Objective: Create an evidence base for Actions

- "Imperfect" review of the literature, using 25 Academic articles, NGO reports and policy documents.
- Looking for the suggested actions to reduce and divert FLW
- Recording tonnages and % of diversion
- Mapping these actions to
- 1) 89 Keywords
- 2) 11 categories from the Food Systems Transformation Solution-Bank

25 SOURCES (8 quantified documents) –109 quantified actions, 713 actions total

Source	Quantified Actions	Tota Act	al ions
A meta-analysis on the effectiveness of food-waste reducing nudges (2023)			25
A National Strategy to Reduce Food Waste at the Consumer Level (2020, National Academy of Sciences)			12
Assessment of food waste prevention actions - European Commission (2019)		29	<mark>43</mark>
Call for Testing Interventions to Prevent Consumer Food Waste (University of Bern)			4
Case studies on household food waste reduction interventions Fight Food Waste Cooperative Research Centre (2023)		4	<mark>6</mark>
Changing the rules of the game: Impact and feasibility of policy and regulatory measures on the prevention and reduction of food waste (2020)			32
European Citizens' Panel on Food Waste Final recommendations			23
FIAL (2021). Appendix 2: National food loss and waste reduction: Review of international best practice and interventions,		1	<mark>40</mark>
Food Loss and Waste Sector Guidelines (Greece)			4
Food Loss and Waste Sector Guidelines (Turkey)		1	<u>5</u>
HALVING FOOD LOSS AND WASTE IN THE EU BY 2030:THE MAJOR STEPS NEEDED TO ACCELERATE PROGRESS			6
Mitigating climate change via food consumption and food waste: A systematic map of behavioral interventions (Reisch 2021)			19
New paradigms on how to achieve zero food waste in future cities – Optimizing food use			65
by waste prevention and valorization (2015)			
No time to waste: assessing the performance of food waste prevention actions (Laurentiis 2020)			1
Recommendations for Action in Food Waste Prevention (EU Platform on Food Losses and Food Waste)			47
REDUCING CONSUMER FOOD WASTE USING GREEN AND DIGITAL TECHNOLOGIES (UNEP DTU partnership)			53
Reducing food loss and waste (World Resources Institute)			107
Reducing Food Loss and Waste along the Food Value Chain in APEC during and postCOVID-19 Pandemic (March 2022)			16
ReFED: A Roadmap to reduce US Food Waste by 20% (March 2016)		28 8	<mark>28</mark>
Review: Consumption-stage food waste reduction interventions – What works and how to design better interventions (Reynolds 2019)		8	<mark>17</mark>
Setting the scene for an EU initiative on food waste reduction targets (European Commission 2023)			25
Sustainable Materials Management of Food in the APEC Region: A Review of Public Policies That			82
Support Reducing Food Loss and Waste (2022)			
The Path to half: Solutions to halve Victoria's Food Waste by 2030 (2020)		25	25
Welsh Food Waste Routemap (WRAP 2023)		13	21
What a waste! Evidence of consumer food waste prevention and its effectiveness Cecilia Casonato (2023)			7
Grand Total	1	09	713

Different rates of effectiveness for different actions. Different levels of quantified evidence base.

Category (primary)	Average of Average diversion or reduction potential %		Number of quantified studies
Certification and standards	5%	8	3
Direct food provision		43	13*
Economic/financial	7%	36	1
Framework policies	10%	47	3
Governance/organisation	17%	50	5
Information/communication	13%	206	29
Market intervention		11	0
Not sure	7%	17	2
Regulatory	13%	125	28
Technology/innovation	26%	167	25
* Not all data provided as a % so th	nese could not be included.		

Different rates of effectiveness throughout the supply chain Where the IMPACT happens...

Average diversion or reduction potential %

	On farm/Primary Production	Supply chains Wholesale Manufacturing	Grocery/Retail	Out-of-home	Institutional	Informal	Local government	Consumers & Citizens
Certification and standards	5%							
Direct food provision								
Economic financial	7%			7%				
Framework policies	10%	10%	10%	10%	10%			
Governance organisation		25%	25%	17%	17%	25%		
Information communication				5%	10%			14%
Market intervention								
Regulatory	18%	12%	14%	20%	17%	23%	33%	18%
Technology innovation	17%	28%	31%	27%	24%	24%		32%
Average reduction % per supply chain stage	15%	20%	22%	21%	19%	23%	33%	19%

Different rates of effectiveness throughout the supply chain WHERE THE INTERVENTION HAPPENS

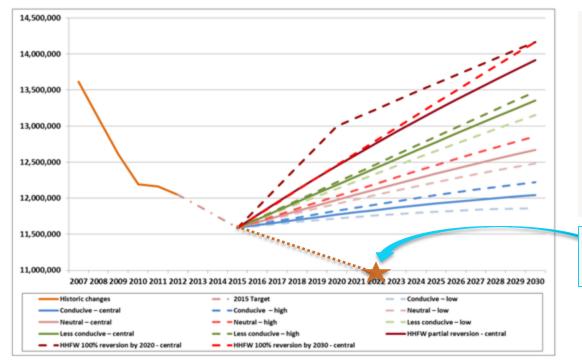
	On farm/ Primary		Grocery/Ret		Institutional			Local_gover			EU government	_	Consumers/ Citizens
Certification and standards		7%	4%	6 8%	ó					8%	ó		
Direct food provision													
Economic/financial										7%	5		
Frameworkpolicies	10%	% 10%	10%	6 10%	6 10%	3						10%	5
Governance/organis ation	,	25%	25 %	6 17%	17%	25 %	, 5						
Information/comm unication		5%	6 5%	6 5%	6 10%	ó	28%	6 17%	ó	4%	ó	5%	ó
Marketintervention	1												
Regulatory	29%	% 12%	15%	6 26%	6 20%	6 54%	5	16%	6 19%	15%	ó	54%	6 54%
Technology/innovation	it 27%	% 30%	20 %	6 28%	6 22%	6 22%	6 22%	6 10%	4%	ú 14%	ó	2%	ó
Average reduction persupply chain Actor	25%	% 19%	6 16%	6 22%	6 18%	6 25%	6 23%	6 15%	6 14%	ú 13%	6	15%	6 54%

So what works?

		Average diversion or reduction potential %	Min diversion or reduction potential %	Max diversion or reduction potential %	# of quantified st udies
	Advisory Guidelines	3%	3%	3%	1
	Food-Related Laws	16%	3%	28%	2
Regulatory	Food-Related Rules	<mark>33%</mark>	12%	54%	2
Negulatory	Industry Voluntary Agreements	<mark>20%</mark>	20%	20%	1
	Labelling	5%	5%	5%	1
	Self-Regulation	11%	1%	30%	12
	Distribution of Food Surplus	<mark>21%</mark>	1%	50%	7
Toologic	Financing of Innovation	<mark>58%</mark>	25%	90%	2
Technology & innovation	Research Activities on Food System	33%	25%	50%	3
	Consumer Information				
Information &	Campaigns	10%	2%	<mark>18%</mark>	3
communication	Digital content	7%	6%	8%	2
	Labelling	5%	5%	<mark>5%</mark>	1
	Skills, Knowledge Training	16%	15%	<mark>16%</mark>	2
Governance & organisation	Mapping, Measuring and Monitoring	17%	9%	25%	3
Certification and	Standards – Food Safety,				
standards	Quality, Composition	5%	1%	8%	3

A reminder: Reduction is not enough

Figure 4 – Estimates of UK food waste (tonnes), incorporating different scenarios for total food waste (three different economic scenarios – 'conducive', 'neutral' and 'less conducive'), under different rates of population growth (low, central and high). Note for the 'reversion' scenario, and the household fraction of the total, 'low' = partial reversion, 'medium' = 100% reversion by 2030 and 'high' = 100% reversion by 2020).



We need a combination of solutions that prevent, divert (recover or recycle), or reduce food loss and waste.to achieve Sustainable Development Goal 12.3.



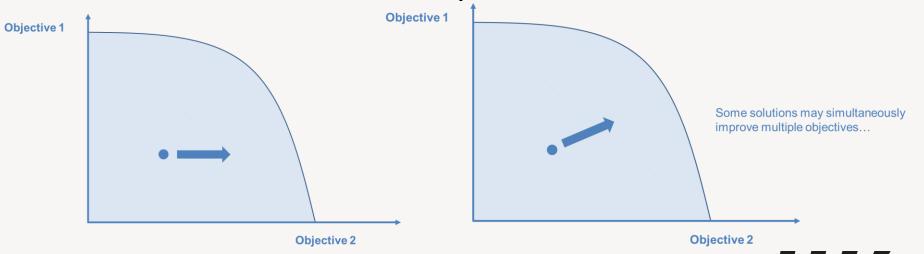
	Food wast	e (kg / capit	a / year)	Change 2018	8 to 2021	Change 2007 to 2021		
	2007	2018	2021	kg / capita/ year	%	kg / capita/ year	%	
Household ¹	90.9	66.5	75.5	+9.0	+13.5%	-15.5	-17.0%	
Supply chain	50.7	43.0	40.2	-2.8	-6.5%	-10.5	-20.7%	
Retail	4.7	3.8 ²	3.5	-0.3	-8.5%	-1.2	-26.0%	
Manufacture	31.03	22.7	20.6	-2.1	-9.2%	-10.4	-33.6%	
HaFS ⁴	15.0 ⁵	16.5	16.2	-0.4	-2.2%	+1.2	+7.7%	
Total	141.7	109.5	115.7	+6.2	+5.6%	-26.0	-18.3%	

Parry A (2014) UK food waste – Historical changes and how amounts might be influenced in the future. Banbury, https://wrap.org.uk/resources/quide/uk-food-waste-historical-changes-and-how-amounts-might-be-influe

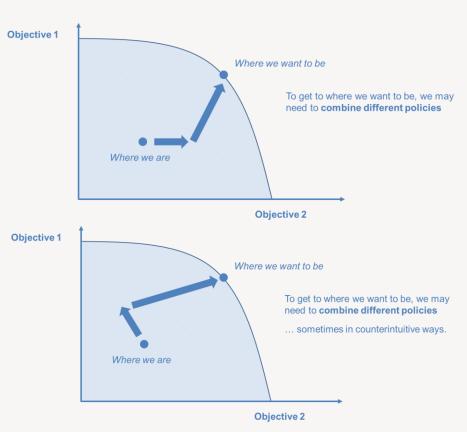
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Lack of data and discussion of Policy Bundles!

- When we think about food waste reduction we think about the movement towards the objective (SDG12.3)
- We have not thought about comparing the magnitude of reduction
- We don't tend to think about impacts on other outcomes.



Lack of data and discussion of Policy Bundles!



- Bundles of solutions/policies may have synergies together,
- They may have tradeoffs or other interaction effects.
- We have not looked into this much at all!

The Path to Half (Victoria, Au) 25 Solutions

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Australian food waste strategy 41 Solutions

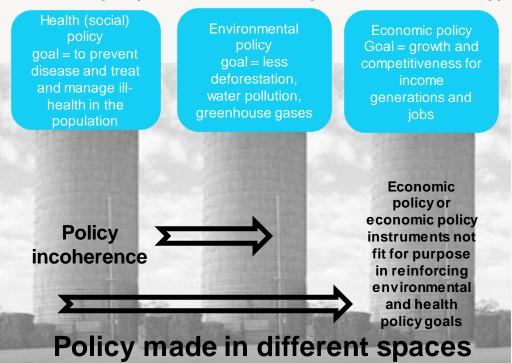
Recommendations for Action in Food Waste Prevention (EU Platform on Food Losses and Food Waste) 47 Solutions

So what does this mean for National and local government Policy?

Multiple Actions need policy coherence

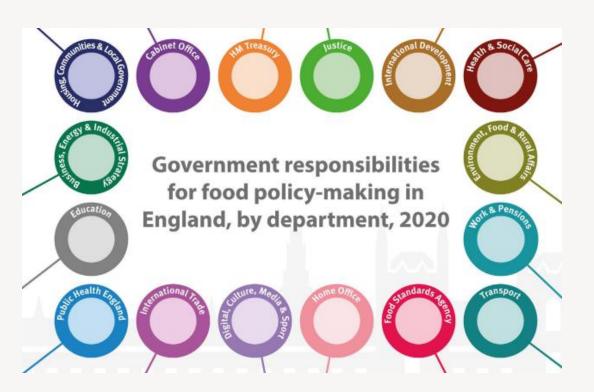
Food policy coherence

The alignment of policies that affect the food system with the aim of achieving health, environmental, social and economic goals, to ensure that policies designed to improve one food system outcome do not undermine others. **Food policy incoherence creates problems and misses opportunities.**





Multiple UK government departments linked to FLW reduction... (but not enough?)



Defra

Agricultural

- BEIS (2021) => Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ)
- FCDO (overseas funding)
- Are they all talking?
- Who is leading?
- Multiple behavior change campaigns on different issues.

Complexity! 34 Local Govt. policy areas linked to food.

Access to safe drinking water

Accessible healthy food retail

Affordable housing

Agrobiodiversity and wild foods

Animal husbandry

Breastfeeding

Dedicated food system policy/strategy

Dietary guidelines for external settings

Education on/enforce food safety regulations

Education/events on food system issues

Encourage existing retailers/caterers to sell healthy, sustainable and affordable food

Encourage opening of new fresh food outlets; discourage unhealthy outlets

Food losses and food waste

Food production on LG land

Food related job creation

Food supply and food system resilience

Healthy eating by LG staff

Healthy/sustainable LG food procurement policies

Home and community gardening

Local food initiatives for economic development

Local food producers

Local, sustainable food processing

Modify housing/property designs to ensure adequate food storage/preparation areas

Nutrition in vulnerable populations

Partner with sport clubs to provide healthy choices

Pregnancy dietary advice

Public food markets and distributors

Restrict unhealthy food advertising; increase healthy food promotion

Restrict unhealthy food in vending machines under LG control

Strengthen food chain connections/distribution

Sustainable local food production

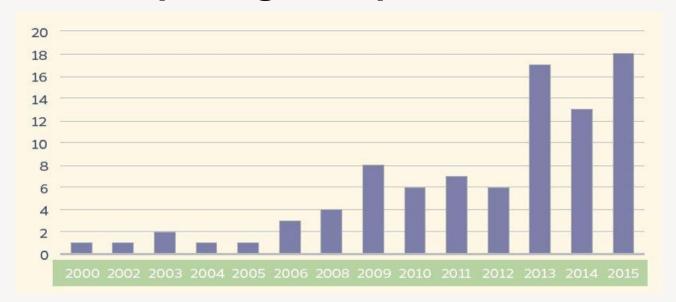
Sustainable water management in food production

Traditional food cultures

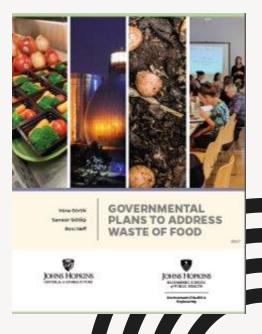
Use economic measures to encourage affordability/consumption of healthier foods; discourage less healthy foods



Write Food Waste into the next LA strategic plan, National plan, global plan etc.



of LA globally with Food Waste plan



Next steps...

- Collaborate with you?
- Find additional studies
- Add to database
- Analysis of database
- Publish database

 Apply for funding for bigger review (policy coherence, policy bundles etc.)



Today is a work in progress and part of wider research on FLW policy solutions.

- All input warmly received.(Feedback, questions, your thoughts.)
- Who should I be talking to?
- Do you have evidence of impact in public documents?

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End of presentation

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https://www.city.ac.uk/about/schools/healthsciences/research/centre-for-food-policy The Centre for Food Policy, City, University of London offers the following courses

Nutrition and Food Policy BSc (Hons)

Undergraduate degree

Food Policy MSc/PGDip/PGCert/MSc

Distance Learning

Postgraduate taught degree

PhD/MPhil Food Policy

Postgraduate research degree

https://www.city.ac.uk/prospectivestudents/courses/postgraduate/food-policy



