

Towards an improved sustainability evaluation of food waste prevention measures

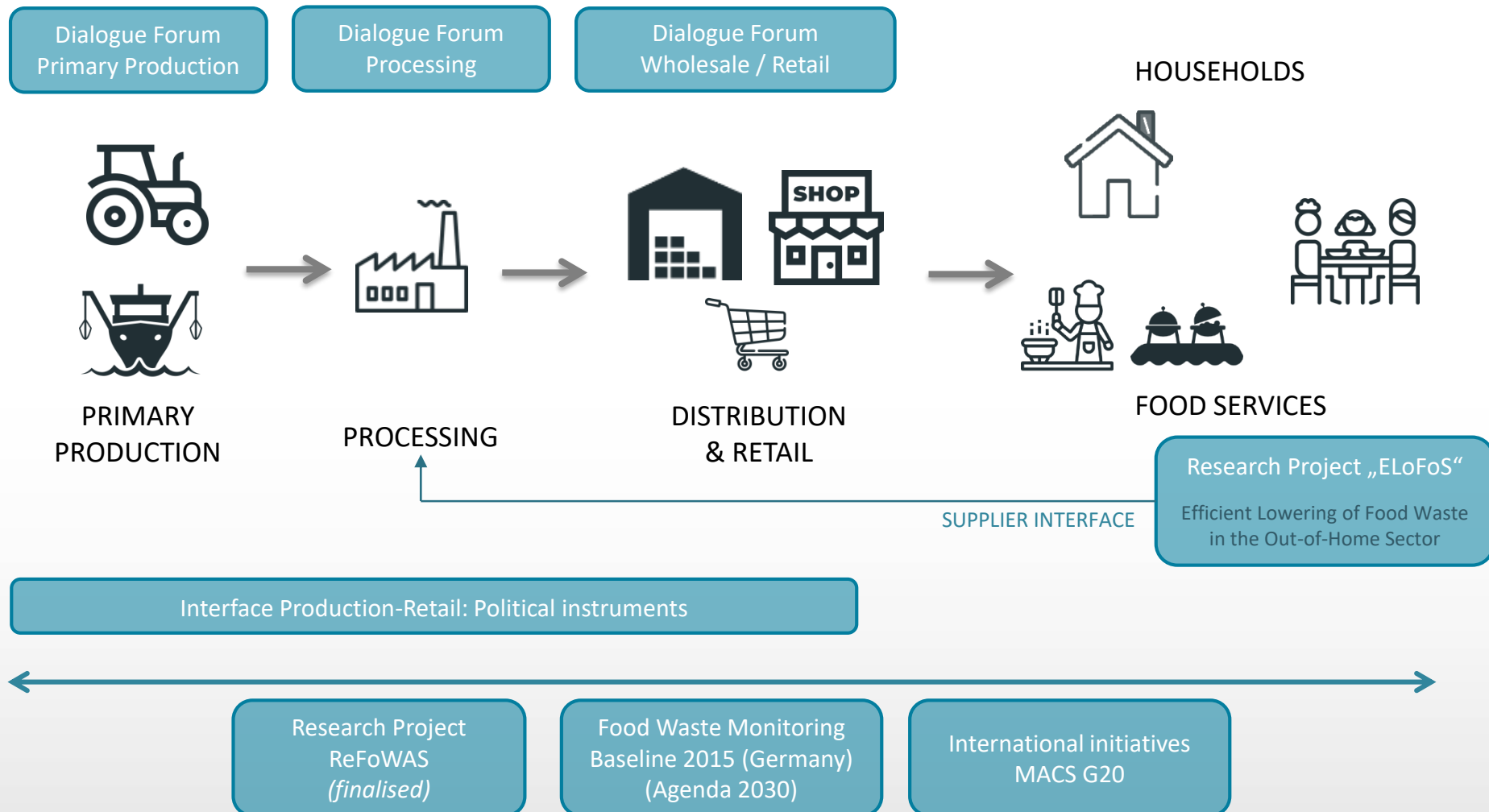
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AVARE - International Workshop Series

Workshop 4: Sustainability Assessment of Food Waste

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Food Waste (FW) reduction measures

Which measure should we choose?

THIS WAY

OR THIS WAY



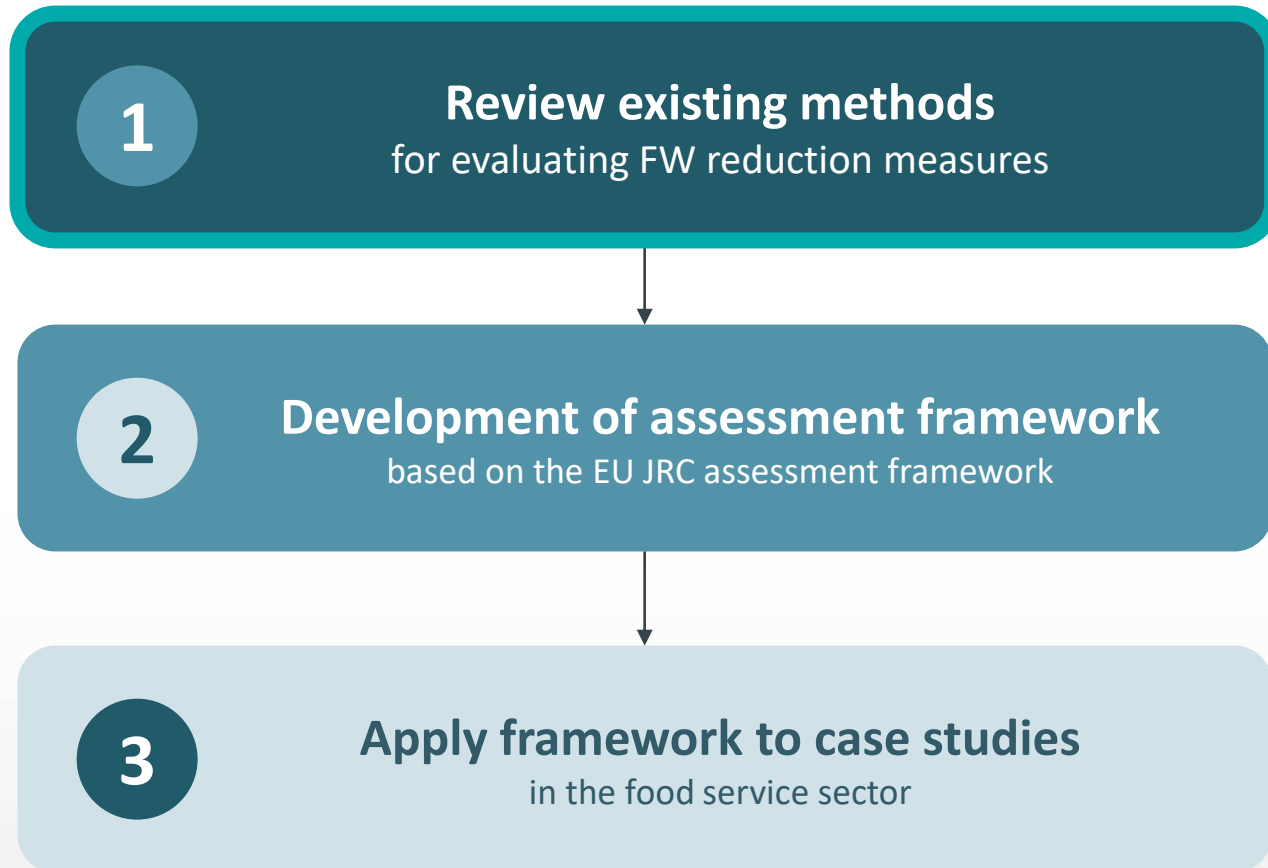
How to select measures? Which measures should be prioritised?

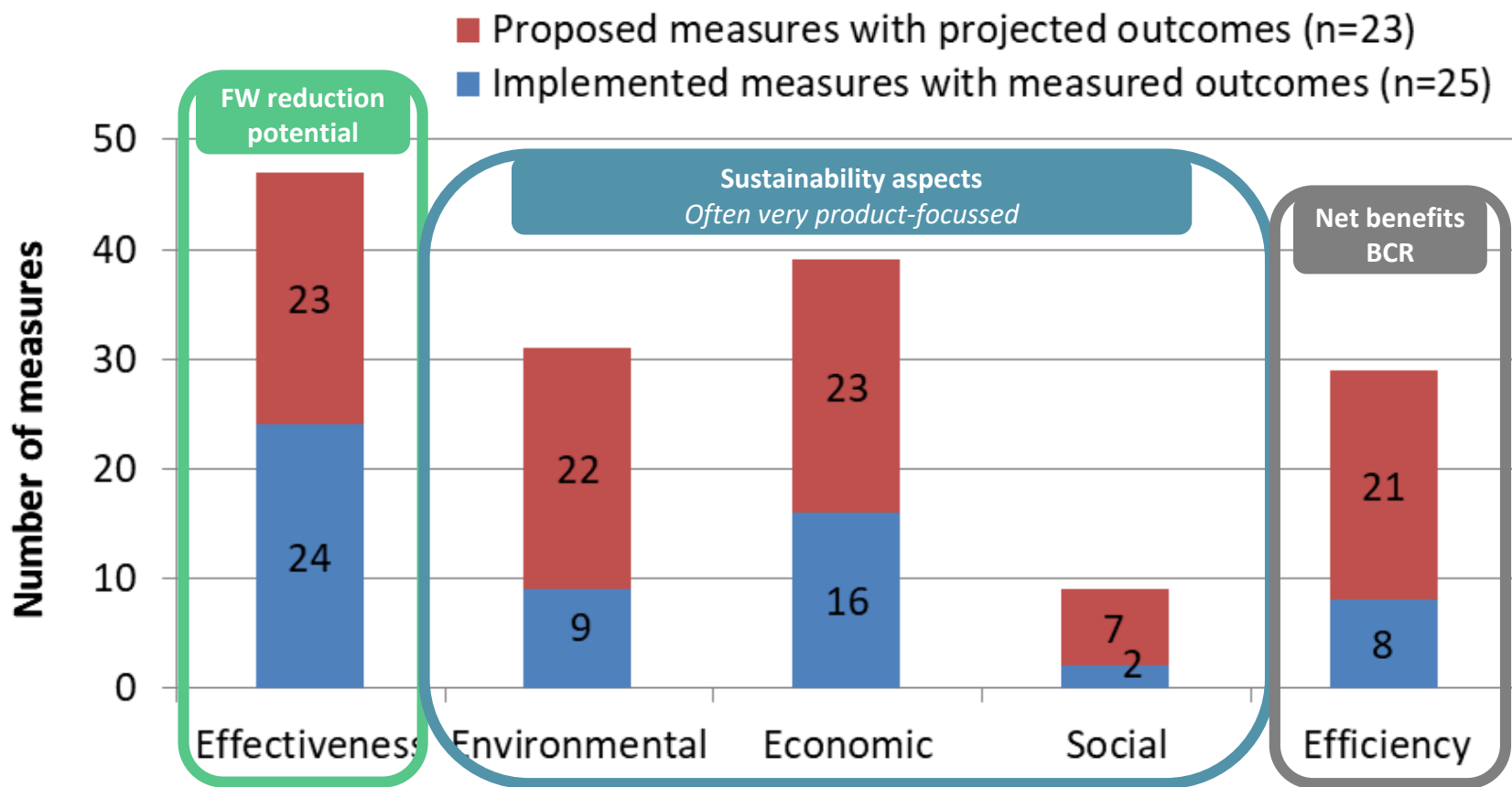
What is the knowledge base for making decisions?

Which measures are effective in reducing environmental impacts and costs?



Evaluation of FW measures: A step-by-step approach



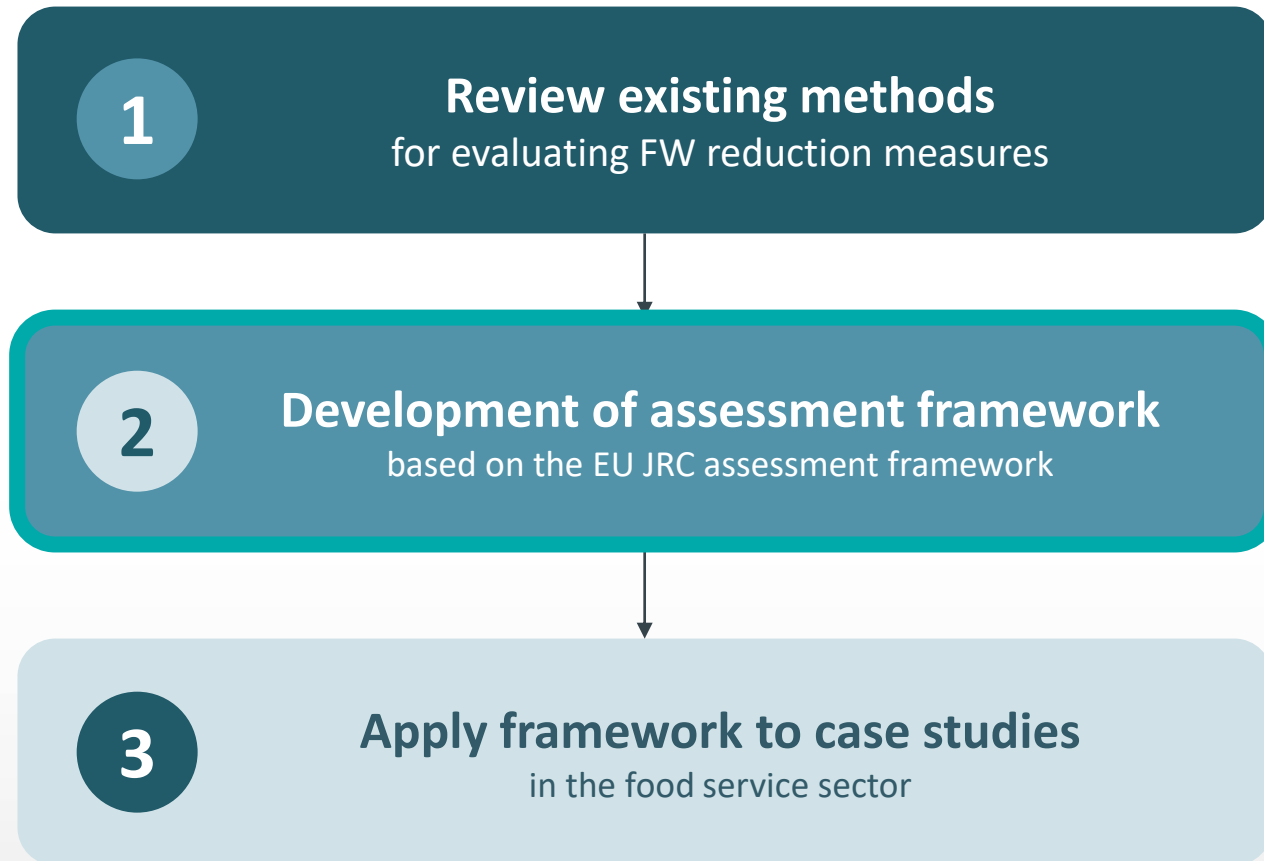


Aspects considered in the evaluation of food waste prevention measures

(Goossens et al., 2019)



Evaluation of FW measures: A step-by-step approach





Description

- Description of the measure
- Stage food chain
- Duration, country of application, scale



Food waste reduction potential

- Types of food waste savings
- Avoided waste collection and treatment



Descriptive evaluation

Quality of the action design

- Problem identification
- Definition of aims & objectives; baseline
- Monitoring details (incl. completeness)

Effectiveness: degree to which desired result is achieved



Data quality of data collected

Rating score (clearness; completeness)



Sustainability evaluation

Quantitative evaluation

- Food waste savings
- Nutritional savings (kcal)

Resource efficiency - Net benefits and savings, BCR

- Environmental impacts
- Economic aspects / costs
- Social effects

Qualitative evaluation

- Outreach and behavioural change
- Effect on working environment
- Implementation effort
- Willingness to implement the measure
- Business image



Taking the measure into the future

- Long-term character and durability over time
- Transferability and scalability
- Inter-sectorial cooperation
- Key success factors and barriers



SUSTAINABILITY EVALUATION – Quantitative assessment



Food waste reductions
(mass)



Nutritional savings
(kcal)

RESOURCES

RESULTS - SAVINGS

NET BENEFITS EFFICIENCY/BCR

Implementation
related inputs

Avoided food
waste

Avoided food
waste disposal

Implementation
related savings

 Environmental
resources

Product-impacts
(throughout
entire life cycle)

Disposal
impacts

Resource
savings

Net resource
savings; Effic.

 Monetary
investments

Product-costs
(Purchasing value,
storage &
preparation costs)

Disposal
costs

Monetary
savings

Net monetary
savings; Effic.

 Employment,
labour

Job creation
Food donation

Net social
benefits



SUSTAINABILITY EVALUATION – Quantitative assessment



Food waste reductions
(mass)

SOURCE: Monitoring,
expert estimations,
business data



Nutritional savings
(kcal)

SOURCE: Nutritional
databases

RESOURCES

Implementation
related inputs



Environmental
resources



Monetary
investments



Employment,
labour

RESULTS - SAVINGS

Avoided food
waste

Product-impacts
(throughout
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Job creation
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NET BENEFITS EFFICIENCY/BCR

Net resource
savings; Effic.

Net monetary
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Net social
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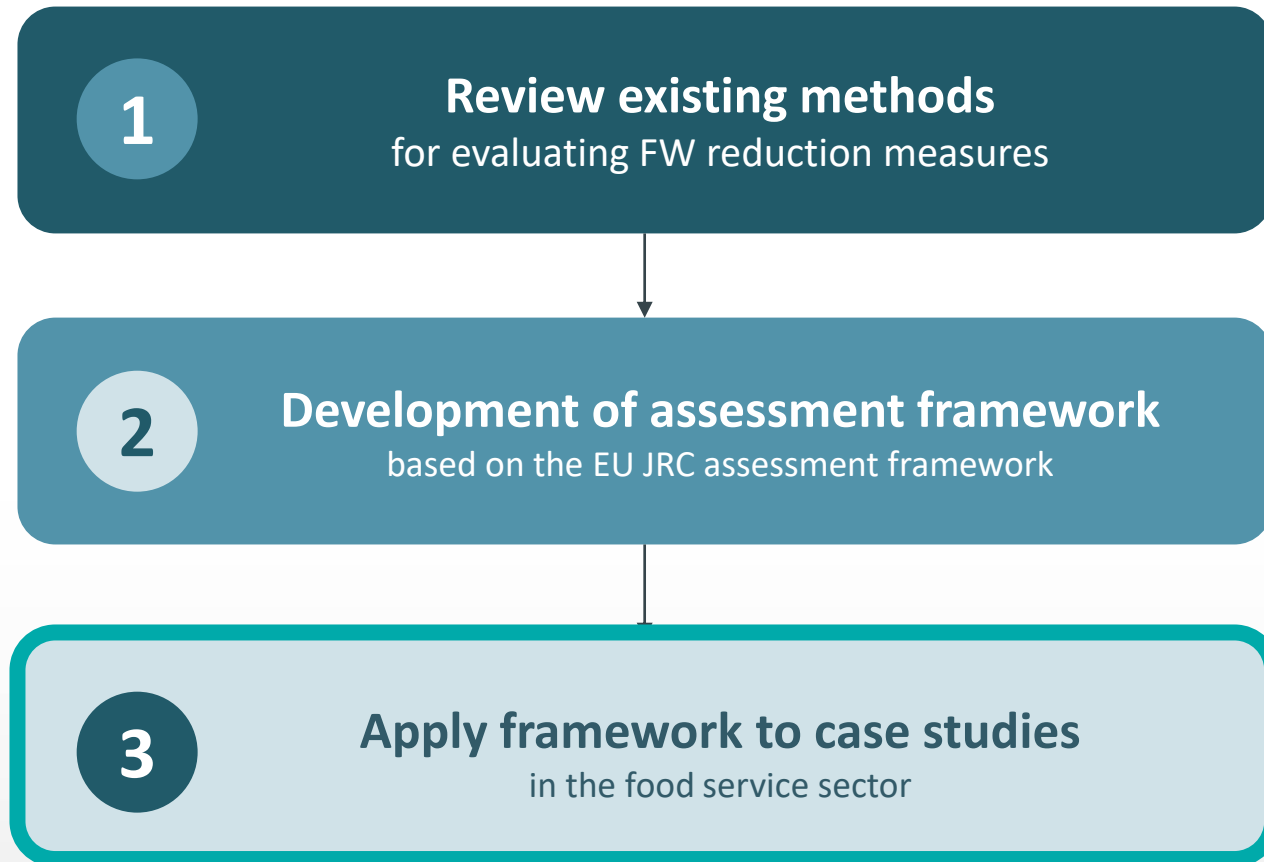
SOURCE: Literature, LCA databases,
market prices, business data, estimations
from experts and actors involved

Know beforehand which data
will be needed as this will have
to be collected at the moment
the inputs/outputs occur

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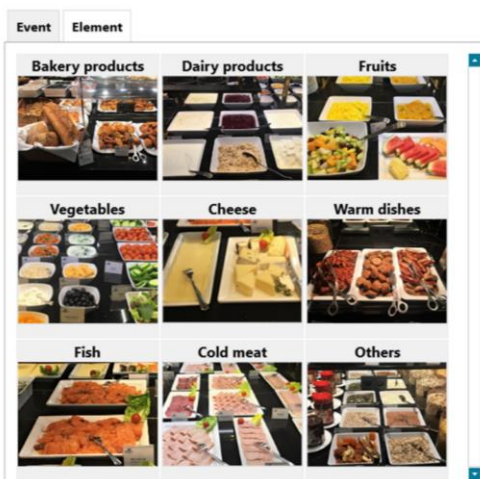
Evaluation of FW measures: A step-by-step approach



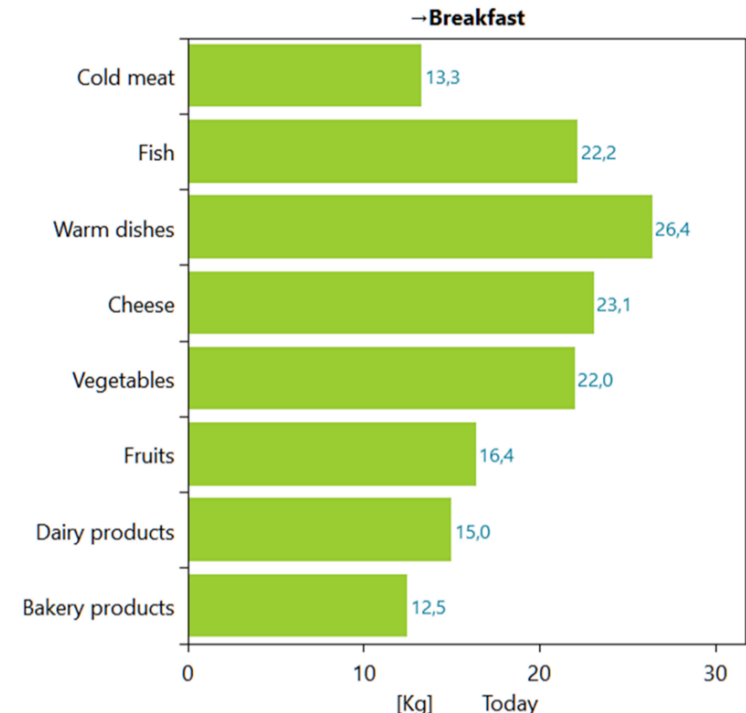


Case study 1:

Self-reporting of breakfast buffet leftovers in hotel kitchens



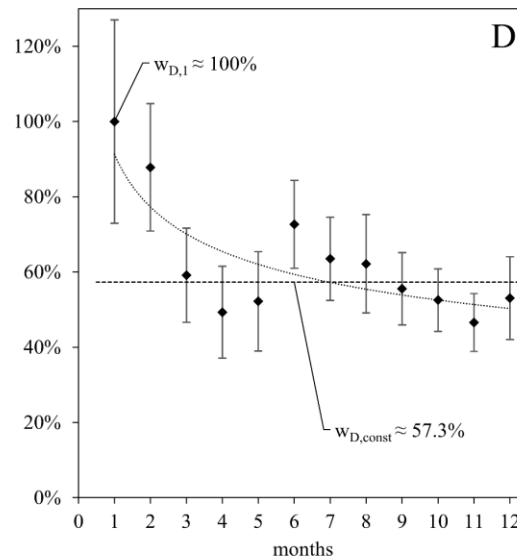
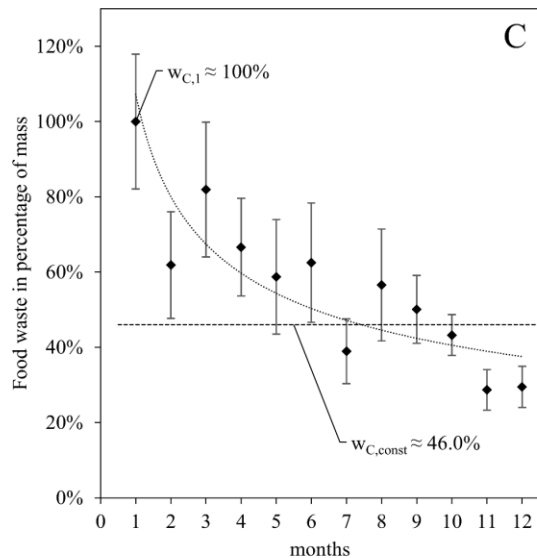
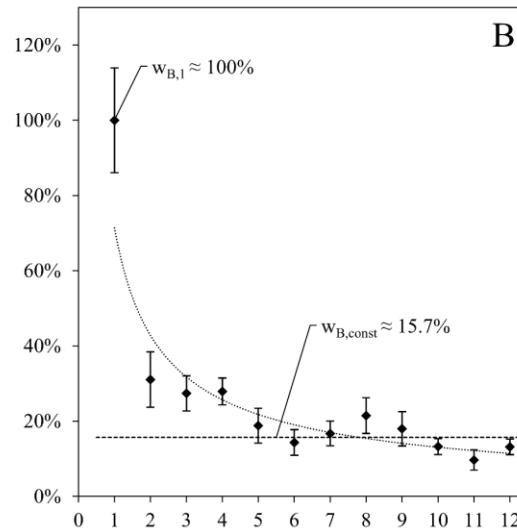
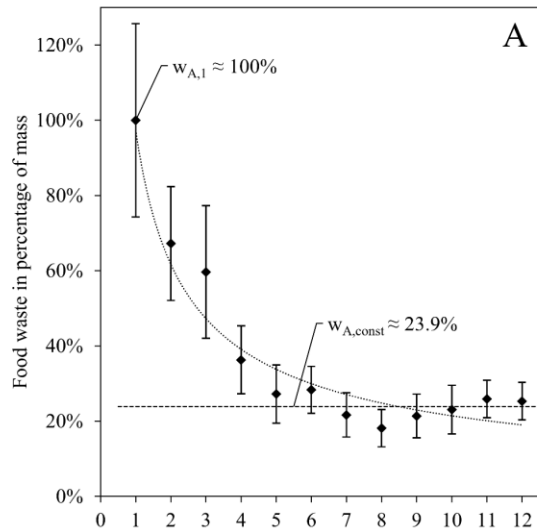
Software ResourceManager



Immediate feedback to kitchen staff

(Leverenz et al., 2020)

12 month monitoring of breakfast buffet leftovers in 4 hotels (A, B, C, D)



After 5 months:

Stabilisation of buffet
leftovers returning to the
kitchen

Average savings of 64 %
as compared to 1st month

(Leverenz et al., 2020)

Associated
environmental savings?
Business case?
Social effects?



LCA

economic
allocation

	Impact elements	Description
INPUTS	Implementation	Production and usage of digital scale*
	inputs	Production and usage of computer/tablet
OUTPUTS	Product impacts (Agribalyse)	Production chain of food products: agricultural production, processing, storage, packaging, transport, distribution Electricity use: Refrigeration on the food service (FS) kitchen + preparation (baking in pan/oven) Upstream losses and mass changes linked to cooking
	Disposal impacts	Disposal of food waste at FS kitchen
	Implementation	No effects
	outputs	

* Could not be quantified



Food service
perspective

	Cost elements	Description
INPUTS	Implementation	Procurement of digital scale and computer/tablet **
	inputs	Electricity use: digital scale and computer/tablet Training of staff, associated labour costs ** Labour costs: time spent monitoring Labour costs: time spent interpreting data; identifying and implementing leftover reducing strategies *
OUTPUTS	Product costs	Purchase of food (commodity purchasing price) by food service (FS) Electricity use: Refrigeration on the FS kitchen + preparation (baking in pan/oven) Labour costs: Preparation in the FS kitchen (baking in pan) Labour costs: Preparation in the FS kitchen (chopping of food, mis-en-place, setting up buffet, cleaning up the buffet after service) *
	Disposal costs	Disposal of food waste at FS kitchen
	Implementation	No effects
	outputs	

* Could not be quantified

** Not applicable in present case study; set to zero

Self-reporting as a successful measure to reduce breakfast buffet leftovers

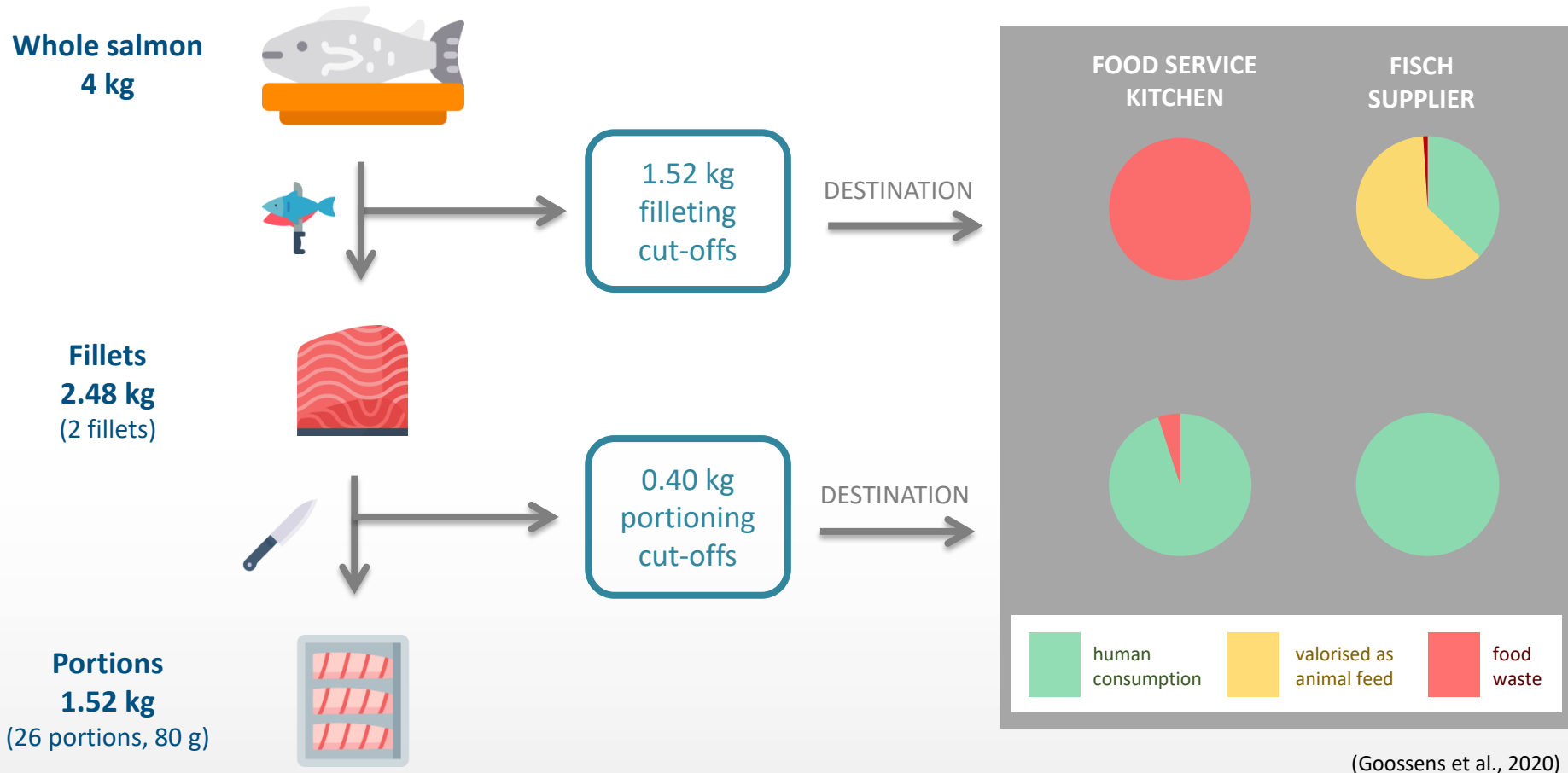


(Goossens et al., in preparation)



Case study 2:

Procurement of fish (salmon) – various convenience grades



Amount of FW ~ where filleting/portioning takes place
⇒ Amount of FW ~ convenience grade of fish purchased by the kitchen



LCA

economic
allocation

Impact Elements	Step	Description
Embodied impacts	a	Aquaculture (fish farming in Norway).
	b	Transport to the supplier manufacturing site (excl. tertiary packaging).
	c	Packaging materials: secondary packaging (reusable plastic crate, ice cubes, plastic cover sheet); no individual primary packaging applicable.
	d	Electricity use for storage at the supplier.
	e	Refrigerated transport from supplier manufacturing site to its distribution centres, and from there to the hotel kitchens.
	f	Electricity use for storage in the hotel kitchen.
	g	Disposal of packaging: plastic sheet disposal at the hotel; disposal of reusable plastic crates at the supplier (taking into account reuse rate).
Food waste disposal impacts	h	Disposal of storage losses at supplier and hotel kitchen.
	i	Disposal of filleting and portioning cut-offs at supplier and hotel kitchen.
Implementation impacts	j	Use of filleting/portioning machine at the supplier (electricity use, excl. capital good).
	k	Use of water at supplier or at the hotel during filleting/portioning and for cleaning afterwards.



Food service
perspective

Cost Elements	Step	Description
Embodied costs	a	Purchase of food (commodity purchasing price) by the hotel.
	b	Storage in fridge at the hotel.
	c	Disposal of packaging materials at the hotel.
Food waste disposal costs	d	Disposal of storage losses at hotel kitchen.
	e	Disposal of filleting and portioning cut-offs at hotel kitchen.
Implementation costs	f	Labour costs for manual filleting/portioning at the hotel kitchen.
	g	Use of water at hotel for cleaning the filleting/portioning workspace.
	h	Net costs for the hotel associated with internal use of portioning cut-offs for fish pans as compared to purchasing them from the supplier in case portioning is outsourced to the supplier

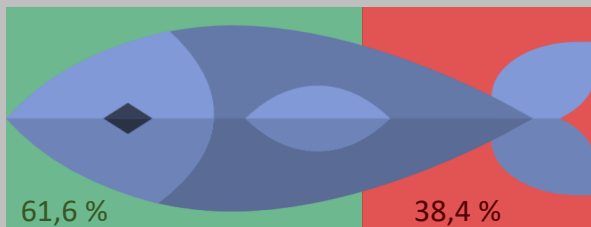
Purchasing scenarios

Processing % per fish

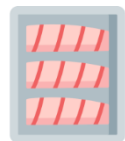
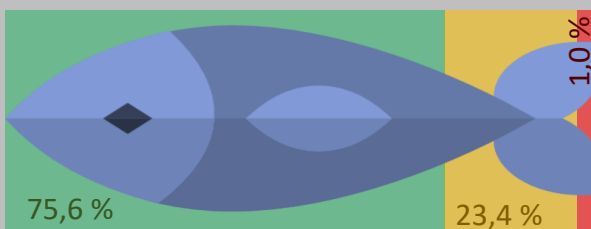
EVALUATION OF FOOD WASTE MEASURE “switch to products with higher convenience grade”



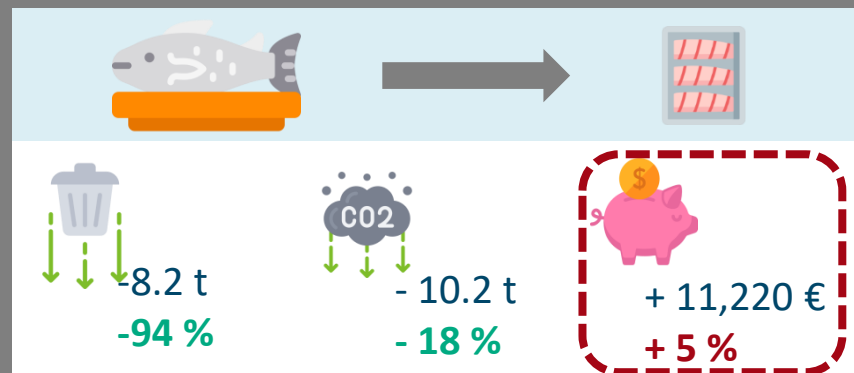
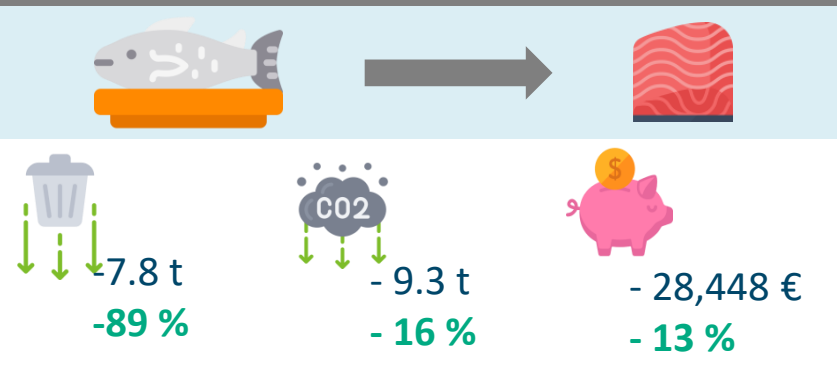
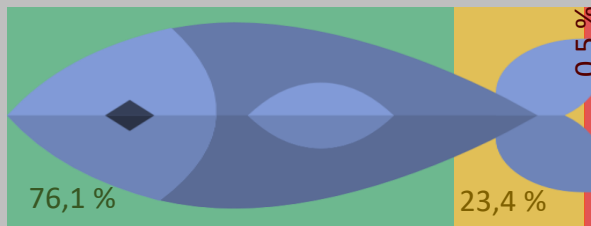
WHOLE SALMON



FILLETS



PORTIONS



Results on an annual basis. Calculations based on the number of fresh salmon portions served in a hotel chain in Germany (ca. 125,000 portions of 80 g per year)

Net costs = € 0 ⇔
Portion price - 5 %

(Goossens et al., 2020)



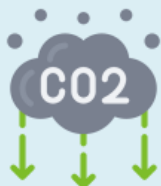
Scale-up measure “switch to products with higher convenience grade” to other products



Big potential to reduce FW because of increased processing and valorisation of trimmings (cut-offs are prevented from becoming FW)



Depends on purchasing prices and time savings & labour costs in the kitchen



Potential to reduce carbon footprint?
Case specific!

No generalisations!



**Example: Increased packaging
⇒ higher carbon footprint?**



Optimisation of kitchen processes:

- Job losses in food service sector?
- Job attractiveness, creativity?
- Deskilling of staff?



References

▷ Evaluation of FW measures – Methodology

Goossens, Y., Wegner, A., Schmidt, T., 2019. **Sustainability Assessment of Food Waste Prevention Measures: Review of Existing Evaluation Practices.** Front. Sustain. Food Syst. 3, 90, 90:1-90:18. <https://doi.org/10.3389/fsufs.2019.00090>.

Wegner A, Goossens Y, Schmidt T G (2020) **Nachhaltigkeitsbewertung von Maßnahmen zur Vermeidung von Lebensmittelabfällen.** Braunschweig: Johann Heinrich von Thünen-Institut, 73 p, Thünen Working Paper 158, DOI:10.3220/WP1603713219000.

Caldeira C, Laurentiis V de, Sala S (2019) **Assessment of food waste prevention actions. Development of an evaluation framework to assess the performance of food waste prevention actions.** JRC Technical Reports, EC-JRC, European Commission Joint Research Centre, Ispra, Italy

Laurentiis, V. de, Caldeira, C., Sala, S., 2020. **No time to waste: assessing the performance of food waste prevention actions.** Resources, Conservation and Recycling 161, 104946. <https://doi.org/10.1016/j.resconrec.2020.104946>.

▷ Evaluation of FW measures – Case studies by Thünen Institute

Goossens, Y., Schmidt, T.G., Kuntscher, M., 2020. **Evaluation of Food Waste Prevention Measures—The Use of Fish Products in the Food Service Sector.** Sustainability 12 (16), 6613. <https://doi.org/10.3390/su12166613>

Leverenz D, Hafner G, Moussawel S, Kranert M, Goossens Y, Schmidt T (2020) **Reducing food waste in hotel kitchens based on self-reported data.** In: Industrial Marketing Management. <https://doi.org/10.1016/j.indmarman.2020.08.008>

Goossens, Y., Leverenz, D., Kuntscher, M. (in preparation). **Increasing the sustainability of breakfast buffets with the use of digital waste-tracking tools.**

▷ More information on our ongoing/past projects

Thünen Institute > Global Food and Resources > Less is more: Reducing food losses and Waste:
<https://www.thuenen.de/en/topics/global-food-and-resources/less-is-more-reducing-food-losses-and-waste>

Research Group on Food Losses and Waste *

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www.thuenen.de

** <https://www.thuenen.de/en/topics/global-food-and-resources/less-is-more-reducing-food-losses-and-waste>*



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