European Commission

The role of Life Cycle Assessment in assessing consumer food waste prevention actions

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25th February, Final Conference of Wasteless Project

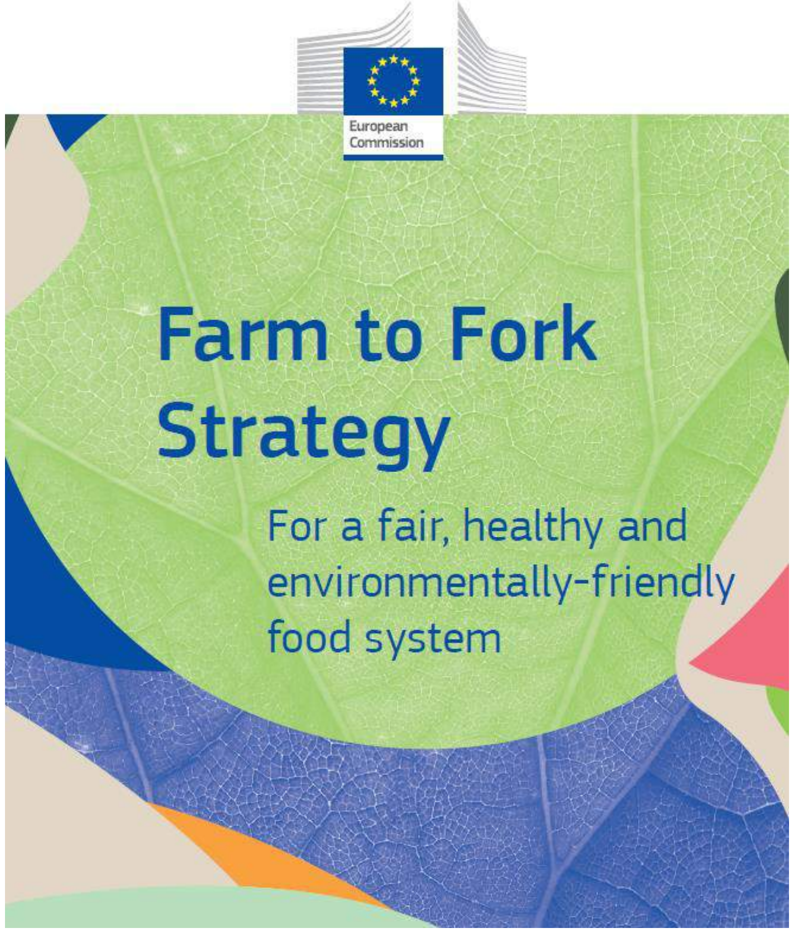
Joint Research Centre

Content

- The EU policy context
- Framework for the evaluation of prevention actions
- Life Cycle Assessment to assess environmental impacts of prevention actions
- Calculator developed to evaluate economic and environmental benefits of prevention actions: illustrative example
- Concluding remarks

EU policies towards sustainable food systems

Increase Food System Efficiency



EU commitment to reduce food waste

“The Commission is ***committed to halving per capita food waste at retail and consumer levels by 2030 (SDG Target 12.3****). Using the new methodology for measuring food waste and the data expected from Member States in 2022, it will set a* ***baseline and propose legally binding targets*** *to reduce food waste across the EU.”*

Farm to Fork Strategy (EC, 2020)

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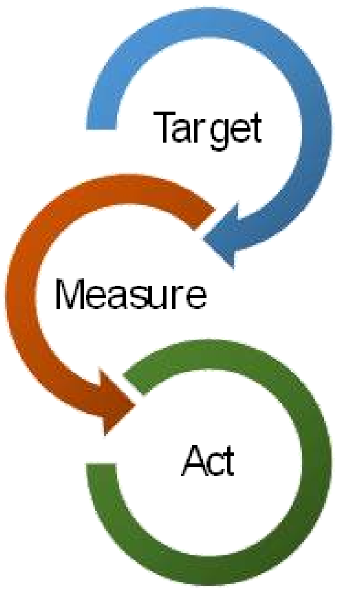
Tackling food waste

Food waste is a **systemic problem** that requires a **system thinking** approach

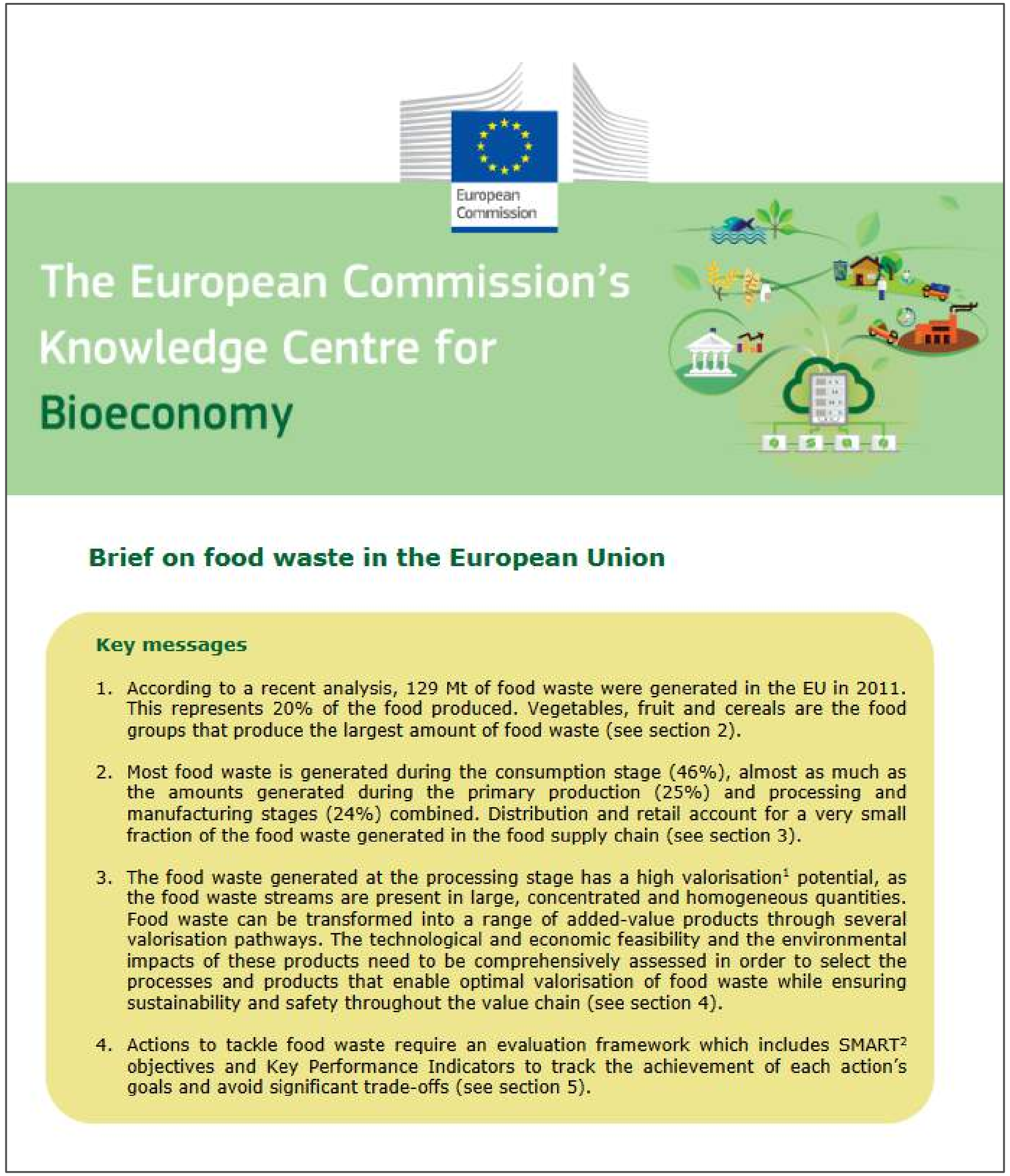
Key Steps to achieve the target:



1. Quantify
2. Identify the causes
3. Food waste strategic plan — Prevention and Valorization
4. Monitor and evaluate

Food waste in the EU

Brief on food waste intend to provide independent evidence for EU policy in this field.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The European Commission's Knowledge Centre for Bioeconomy

Brief on food waste in the European Union

Key messages

1. According to a recent analysis, 129 Mt of food waste were generated in the EU in 2011. This represents 20% of the food produced. Vegetables, fruit and cereals are the food groups that produce the largest amount of food waste (see section 2).
2. Most food waste is generated during the consumption stage (46%), almost as much as the amounts generated during the primary production (25%) and processing and manufacturing stages (24%) combined. Distribution and retail account for a very small fraction of the food waste generated in the food supply chain (see section 3).
3. The food waste generated at the processing stage has a high valorisation[1] potential, as the food waste streams are present in large, concentrated and homogeneous quantities. Food waste can be transformed into a range of added-value products through several valorisation pathways. The technological and economic feasibility and the environmental impacts of these products need to be comprehensively assessed in order to select the processes and products that enable optimal valorisation of food waste while ensuring sustainability and safety throughout the value chain (see section 4).
4. Actions to tackle food waste require an evaluation framework which includes SMART[2] objectives and Key Performance Indicators to track the achievement of each action's goals and avoid significant trade-offs (see section 5).

https://eplca.jrc.ec.europa.eu/FoodSystem.html

Sanchez Lopez, J., Caldeira, C., De Laurentiis, V. and Sala, S. 2020. **Brief on food waste in the European Union**, Avraamides, M. editor(s), European Commission, 2020, JRC121196.

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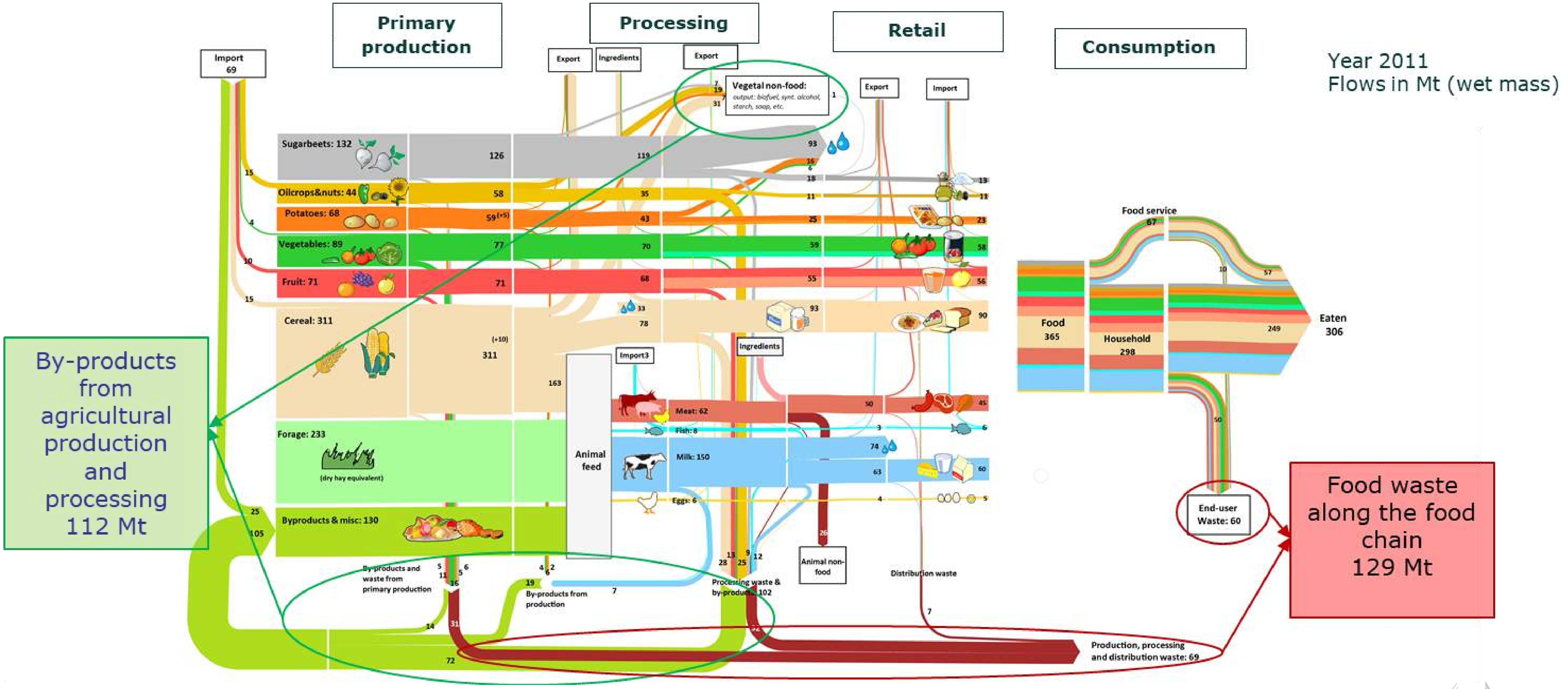
1. Quantify

Mass balance of the EU food system



Caldeira, C., De Laurentiis, V., Corrado, S., van Holsteijn, F., Sala, S. (2019) **Quantification of food waste per product group along the food supply chain in Europe: a Mass Flow Analysis**. Resources, Conservation and Recycling, 149: 479-488

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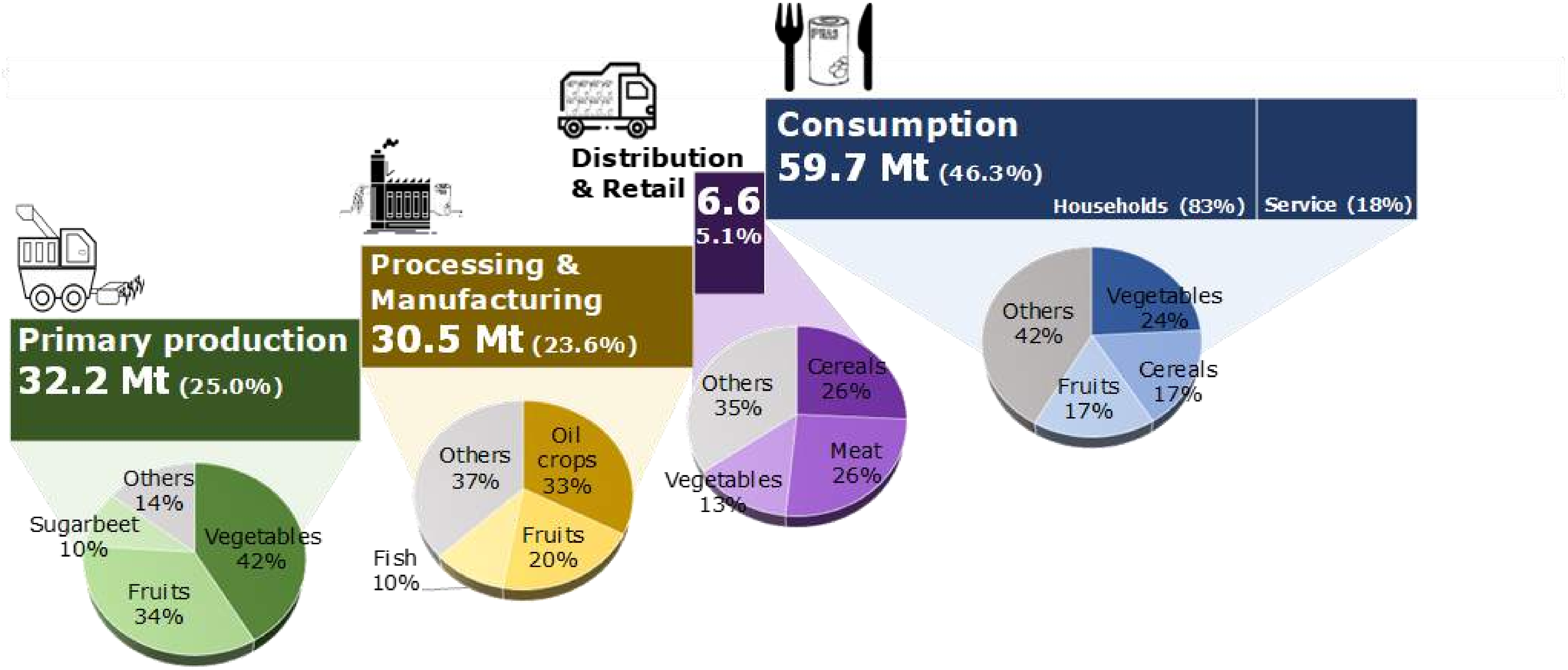
Food waste quantification EU 28, 2011



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Food losses and waste causes

Expiry dates are responsible for 10% of food wasted across the value chain in Europe

USE BY ≠ **BEST BEFORE**

Indicates the **time by when the product should be consumed**. After that date the product presents **health and safety issues.** This is mainly used for perishable products and prevents you from eating the item after the date is exceeded, when you run the risk of getting ill.

Indicates **how long a product can keep its optimum quality.** These dates are set based on best practice guides or experience. Therefore, it's an autoregulation system whereby each individual business sets their own rules, with no clear consistency, alignment or transparency.

Food waste prevention: what works?

“*The main gap observed among the actions collected*, ***was the absence of SMART objectives, baseline values, related Key Performance Indicators (KPIs), and a monitoring system to track progress made towards the stated goal(s)****. These elements are* ***essential to assess the effectiveness and efficiency of the actions*** *and to identify elements of success and obstacles, which can ultimately prove very useful in the development and implementation of future actions.”* Caldeira et el. (2019)

“*Though there have been many interventions, including campaigns addressing consumer food waste, there are* ***only very few studies that have evaluated to what extent these activities actually reduced or prevented food waste****. (…) There is a* ***lack of research surrounding food waste reduction interventions and a lack of evidence that would allow to draw conclusions about the effectiveness, transferability and scaling up of interventions****”* Wunder et al. (2019)

Caldeira, C., De Laurentiis, V., Sala, S.(2019) **Assessment of food waste prevention actions: development of an evaluation framework to assess the performance of food waste prevention actions**, EUR 29901 EN; Luxembourg (Luxembourg): Publications Office of the European Union; JRC118276; doi:10.2760/9773

Wunder, S. van Herpen, Erica, Mcfarland, K., Ritter, A., van Geffen, L., Stenmarck, A., Hulten, J. (2019) **Policies against consumer food waste Policy options for behaviour change including public campaigns** REFRESH Report

Evaluation framework to assess food waste prevention

QUALITY OF THE ACTION DESIGN	• Problem identification, definition of aim, objectives and KPIs • Implementation of a monitoring system
EFFECTIVENESS	• Monitor the KPI before (baseline), during and after the action to measure if the objective has been met
EFFICIENCY	• Accounting for the resources used to implement the action • Monitor KPIs defined to measure efficacy
SUSTAINABILITY OVER TIME	• Existence of a long term strategy to ensure the continuity of the action (e.g. organizational support, economic sustainability)
TRANSFERABILITY AND SCALABILITY	• Degree to which transferability and scalability were considered in the design of the action or implemented
INTERSECTORIAL COOPERATION	• Existence of cooperation between different sectors of the society • How is this cooperation is organized

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Food waste prevention actions evaluation framework: Efficiency

Food waste prevented	Food waste prevented
Economic	Net economic benefit (benefit for society minus cost)
Environmental	Net environmental savings (avoided environmental impacts)
Social	Social benefits (e.g. the number of meals donated, people learning new skills etc.)
Outreach/ Behavior change	Input or outcome indicators associated to e.g. number of people reached by a campaign, number of people that changed behaviour towards food waste

Tool for the quantification of **environmental and economic benefits of food waste prevention**

- To **identify trade-offs** between environmental/economic benefits from avoiding food waste and impacts from implementing an action
- To **communicate** the positive impact (economic/environmental) of an action
- To **compare the performance** of similar actions

De Laurentiis, V., Caldeira, C., Sala, S. 2020. **No time to waste: assessing the performance of food waste prevention actions.** Resources, Conservation & Recycling. 161: 104946.

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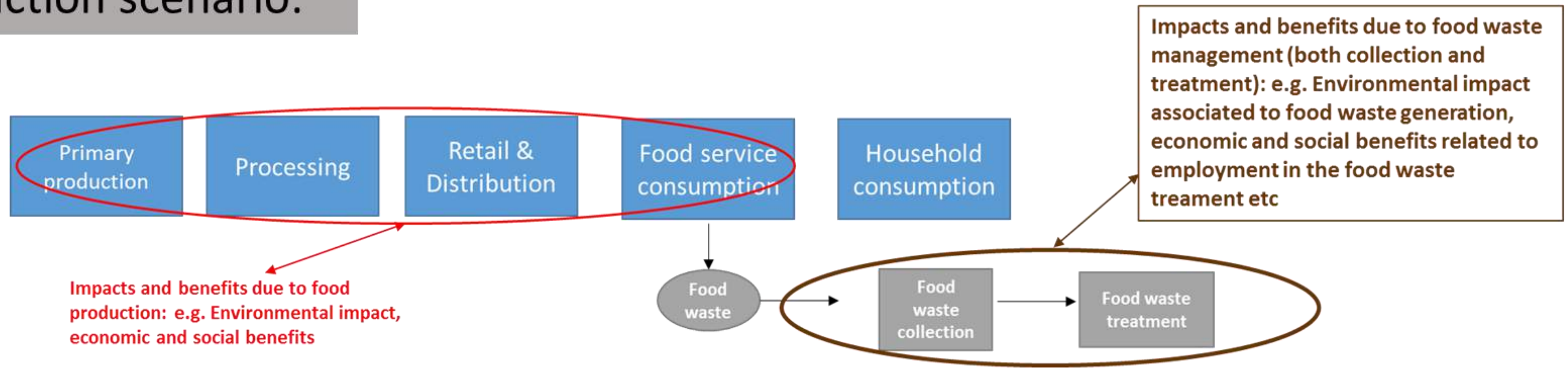
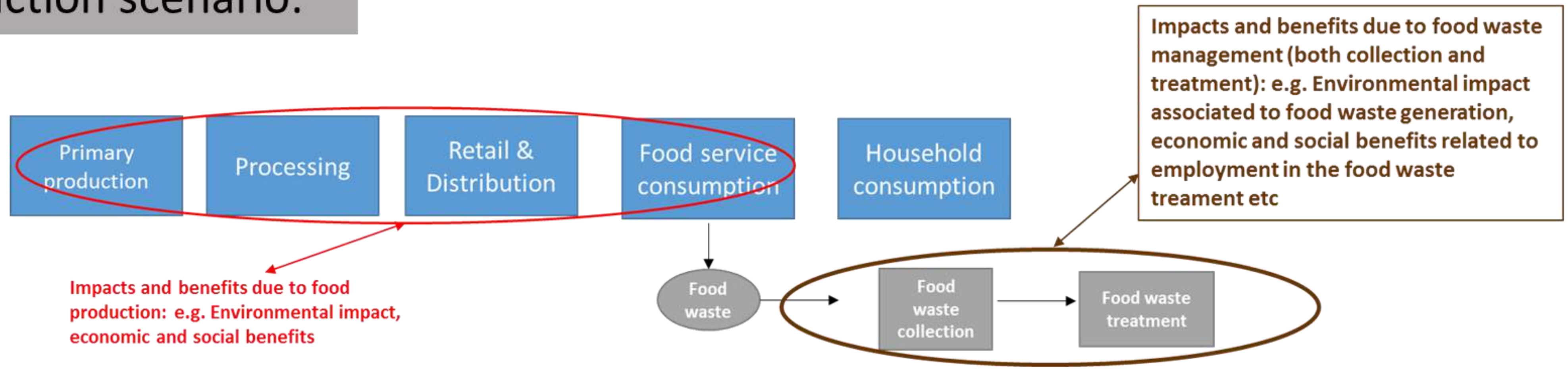
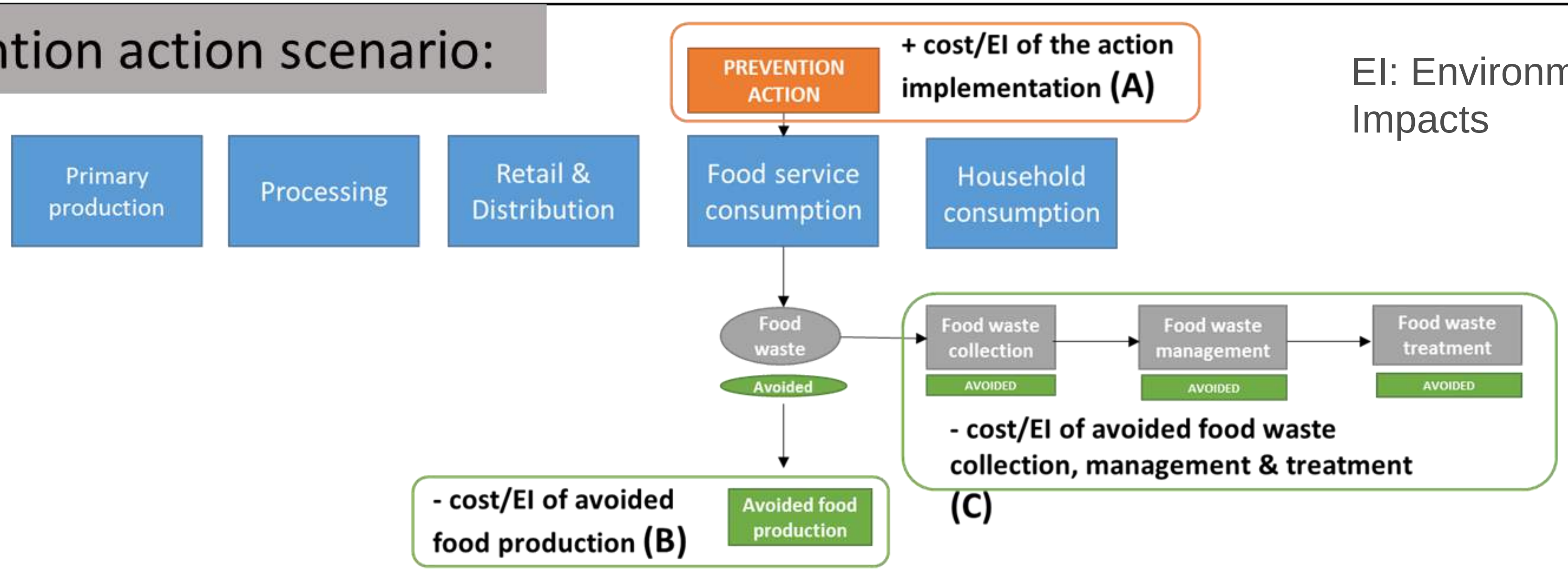
No action scenario:



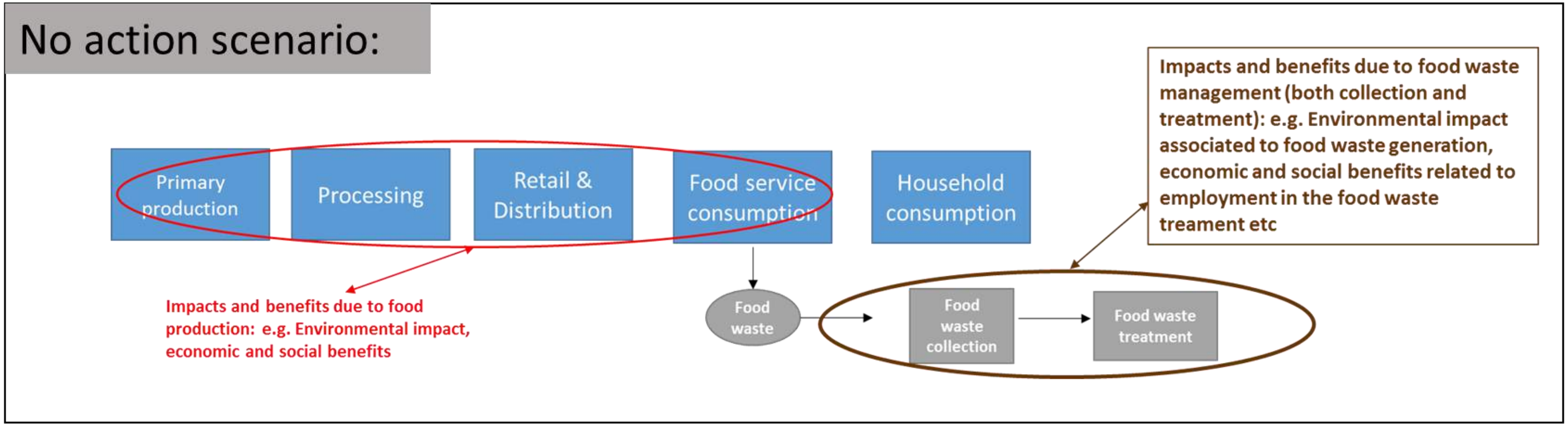
No action scenario:

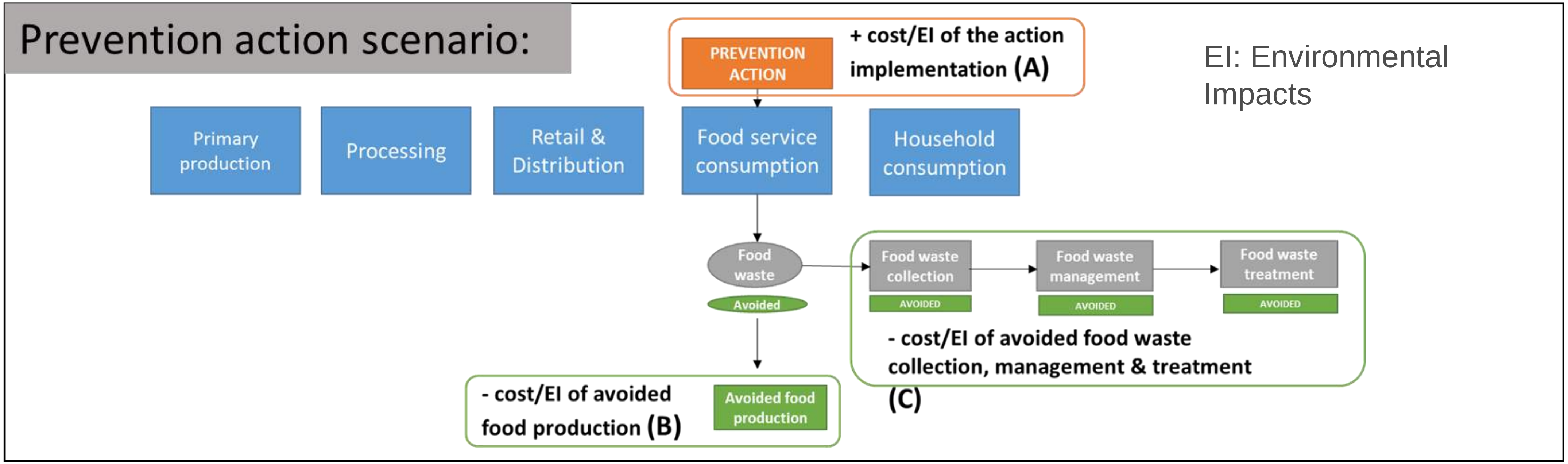


Prevention action scenario:



EI: Environmental Impacts



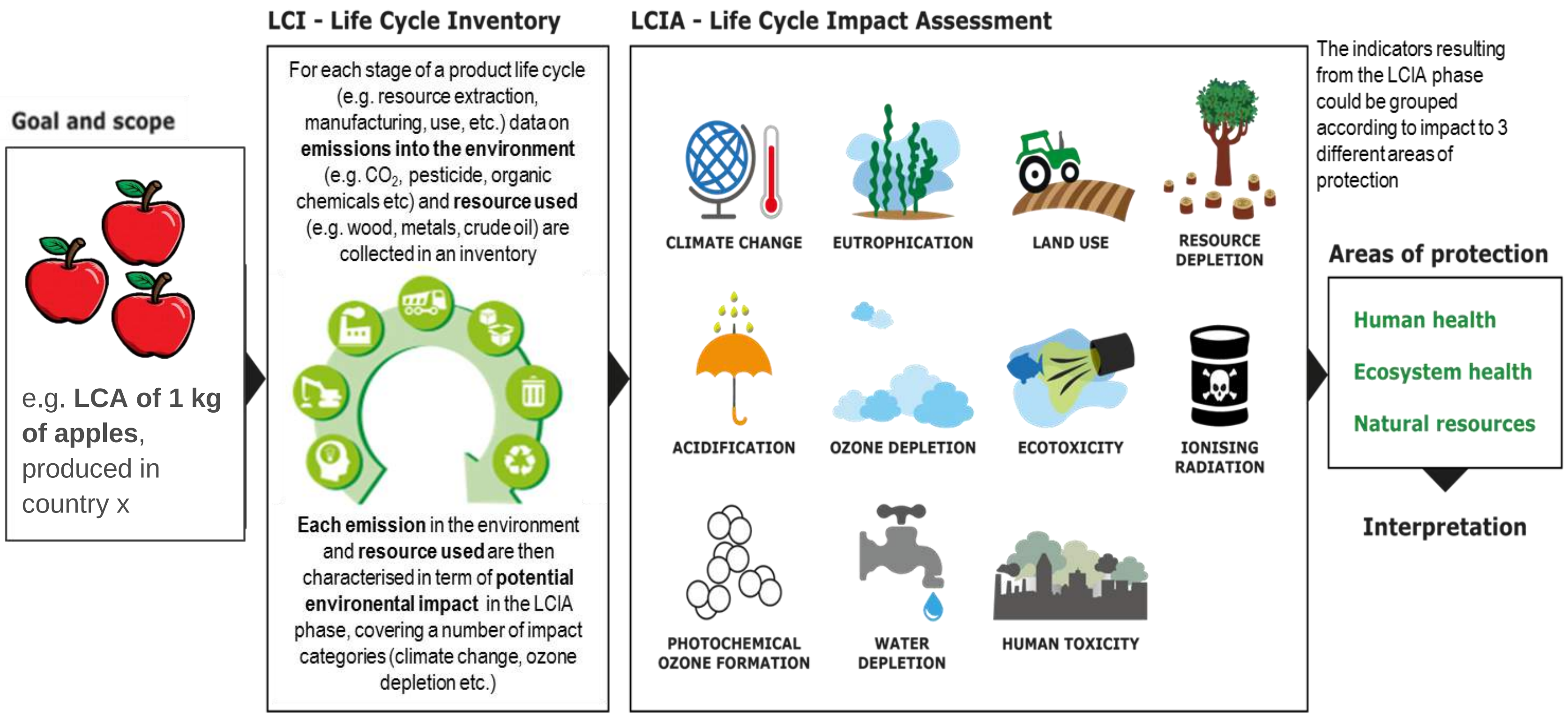


Net economic/Enviromental benefits = B + C − *A*

Food waste prevention: Environmental Impacts

Environmental impacts calculated using life cycle assessment (LCA)

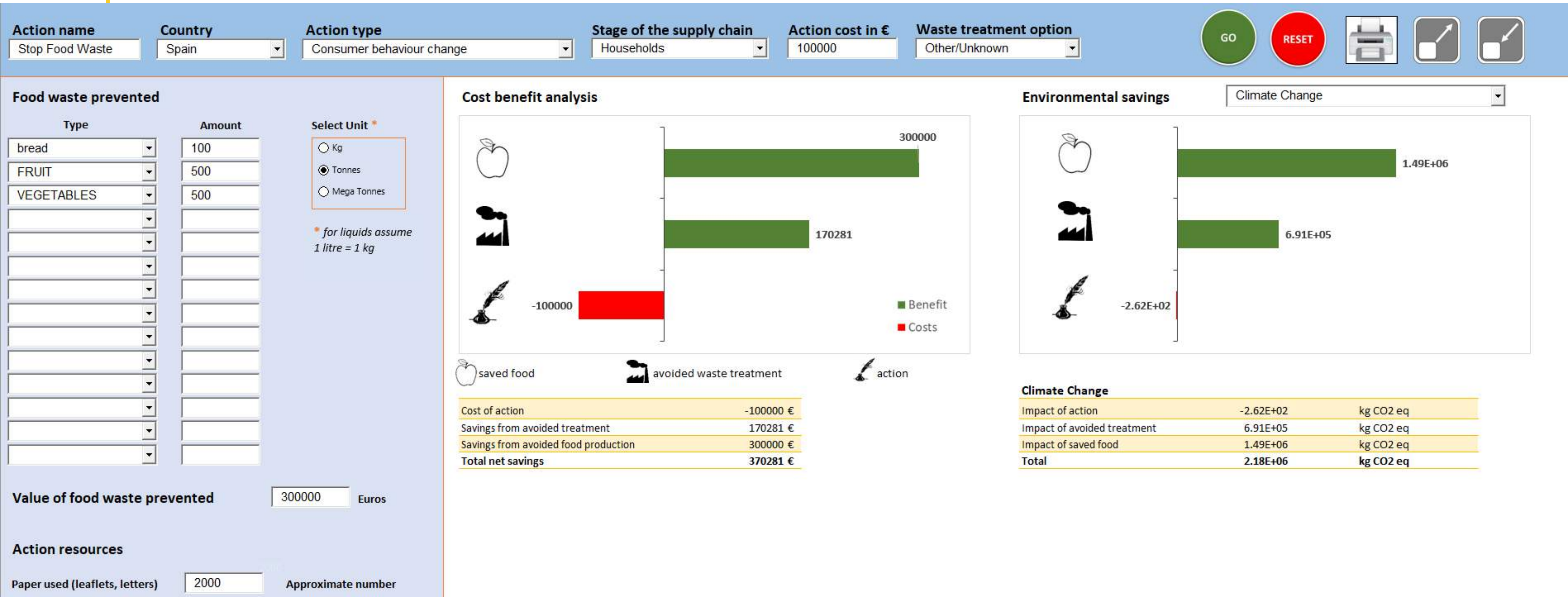
Food waste prevention: Environmental Impacts

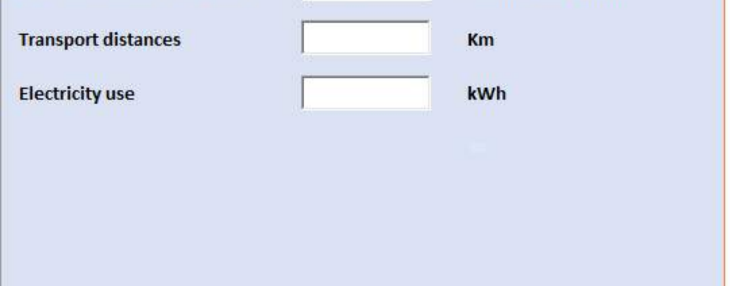


Impact categories as proposed by the
Environmental Footprint method (EC, 2013)

European Commission (2013). **Recommendation 2013/179/ EU on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations**, Annex III, OJL124,4.5.2013,p.1–210.

Food waste calculator





Calculator can be found here:
https://ec.europa.eu/food/safety/food_waste/eu_actions/action-implementation_en

De Laurentiis, V., Caldeira, C., Sala, S. (2020). **No time to waste: assessing the performance of food waste prevention actions.** *Resources, Conservation & Recycling*. 161, 104946

	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
Climate Change	kg CO_2 eq	-2.62E+02	6.91E+05	1.49E+06	**2.18E+06**
Ozone depletion	kg CFC-11 eq	-1.76E-05	4.19E-03	8.06E+00	**8.07E+00**
Human toxicity, non-cancer effects	CTUh	-4.24E-05	1.31E+00	1.01E+00	**2.32E+00**
Human toxicity, cancer effects	CTUh	-3.14E-06	2.23E-02	1.93E-02	**4.16E-02**
Particulate matter	Disease incidences	-1.89E-05	3.74E-03	7.36E-02	**7.73E-02**
Ionizing radiation, human health	kBq U^{235}	-1.42E+01	2.62E+03	5.89E+04	**6.16E+04**
Photochemical ozone formation, human health	kg NMVOC eq	-7.69E-01	4.02E+02	3.44E+03	**3.84E+03**
Acidification	mol H+ eq	-1.67E+00	4.34E+02	1.06E+04	**1.10E+04**
Terrestrial eutrophication	mol N eq	-2.62E+00	1.51E+03	3.84E+04	**3.99E+04**
Freshwater eutrophication	kg P eq	-1.56E-02	3.71E+01	3.93E+02	**4.30E+02**
Marine eutrophication	kg N eq	-2.51E-01	1.59E+03	7.07E+03	**8.66E+03**
Freshwater ecotoxicity	CTUe	-2.93E+02	9.65E+07	2.28E+07	**1.19E+08**
Land use	Pt	-2.21E+04	1.11E+06	6.85E+07	**6.96E+07**
Water use	m^3 world eq. deprived	-1.40E+02	1.71E+04	5.92E+06	**5.94E+06**
Resource use, fossil	MJ	-4.34E+03	2.82E+05	1.38E+07	**1.41E+07**
Resource use, minerals and metals	kg Sb eq	-5.43E-04	1.73E-02	4.09E+00	**4.11E+00**

Calculated with the **Environmental Footprint method** (EC, 2013)

	Unit	Impact of action	Impact of avoided treatment	Impact of saved food	Total
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Human toxicity, non-cancer effects	CTUh	-4.24E-05	1.31E+00	[illegible]	[illegible]
Human toxicity, cancer effects	CTUh	-3.14E-06	2.23E-02	[illegible]	[illegible]
Particulate matter	Disease incidences	-1.89E-05	3.74E-03	[illegible]	[illegible]
Ionizing radiation, human health	kBq U^{235}	-1.42E+01	2.62E+03	[illegible]	[illegible]
Photochemical ozone formation, human health	kg NMVOC eq	-7.69E-01	4.02E+02	[illegible]	[illegible]
Acidification	mol H+ eq	-1.67E+00	4.34E+02	[illegible]	[illegible]
Terrestrial eutrophication	mol N eq	-2.62E+00	1.51E+03	[illegible]	[illegible]
Freshwater eutrophication	kg P eq	-1.56E-02	3.71E+01	[illegible]	[illegible]
Marine eutrophication	kg N eq	-2.51E-01	1.59E+03	[illegible]	[illegible]
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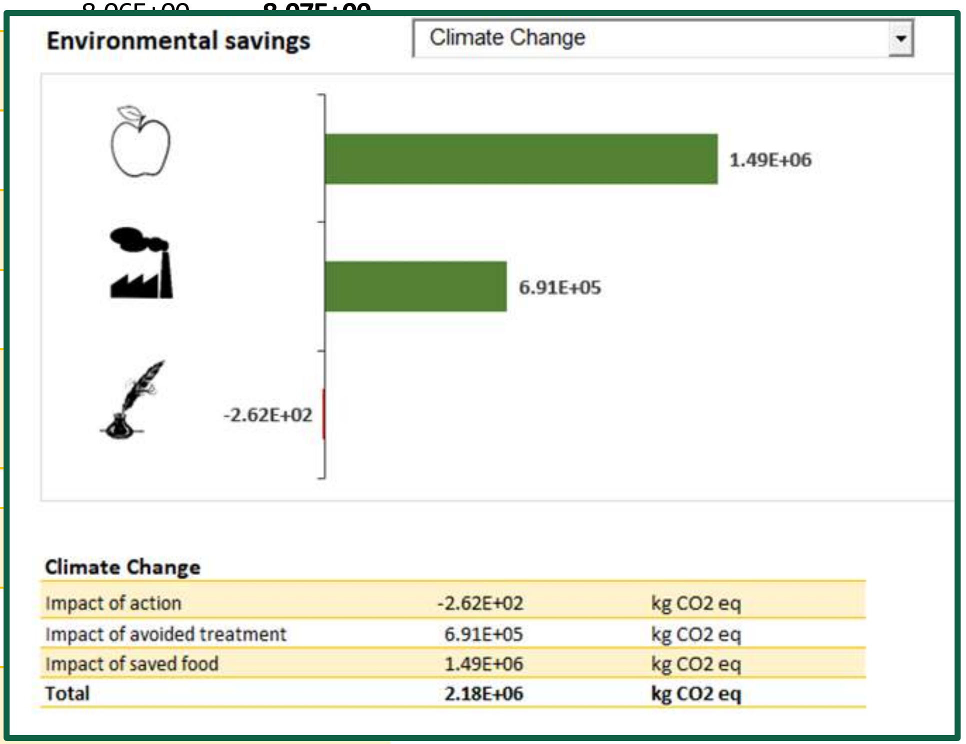

Calculated with the **Environmental Footprint method** (EC, 2013)

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Ilustrative example

Assessment of the initiative “Klimatsmart” developed in the Pre-waste European project

Country/Geographical Area	Sweden, Municipality of Halmstad
Duration*	3 school years, 2008-2011
Stage of the FSC	Food services
Target audience	All pupils, teachers, and canteen staff in 14 middle and high schools run by the municipality (6850 pupils)
Food waste reduction	Food waste per portion was reduced from 44.7 g to 38.8 g (13% reduction)
Amount of food waste avoided	6 837 kg
Value of food waste avoided	Approx. 17 180 €
Cost of the action	Less than 3 300 €
Resources used	Brochures, posters, one scale per kitchen

* Results provided for 1 year

Illustrative example

Assessment of the initiative “Klimatsmart” developed in the Pre-waste European project

Assumptions

- meals composition not provided → average EU food basket
- waste treatment not provided → waste treatment mix for Sweden (Eurostat)
- waste treatment costs not provided → average EU cost of each waste treatment technology
- number of posters/brochures not provided → 2 scenarios

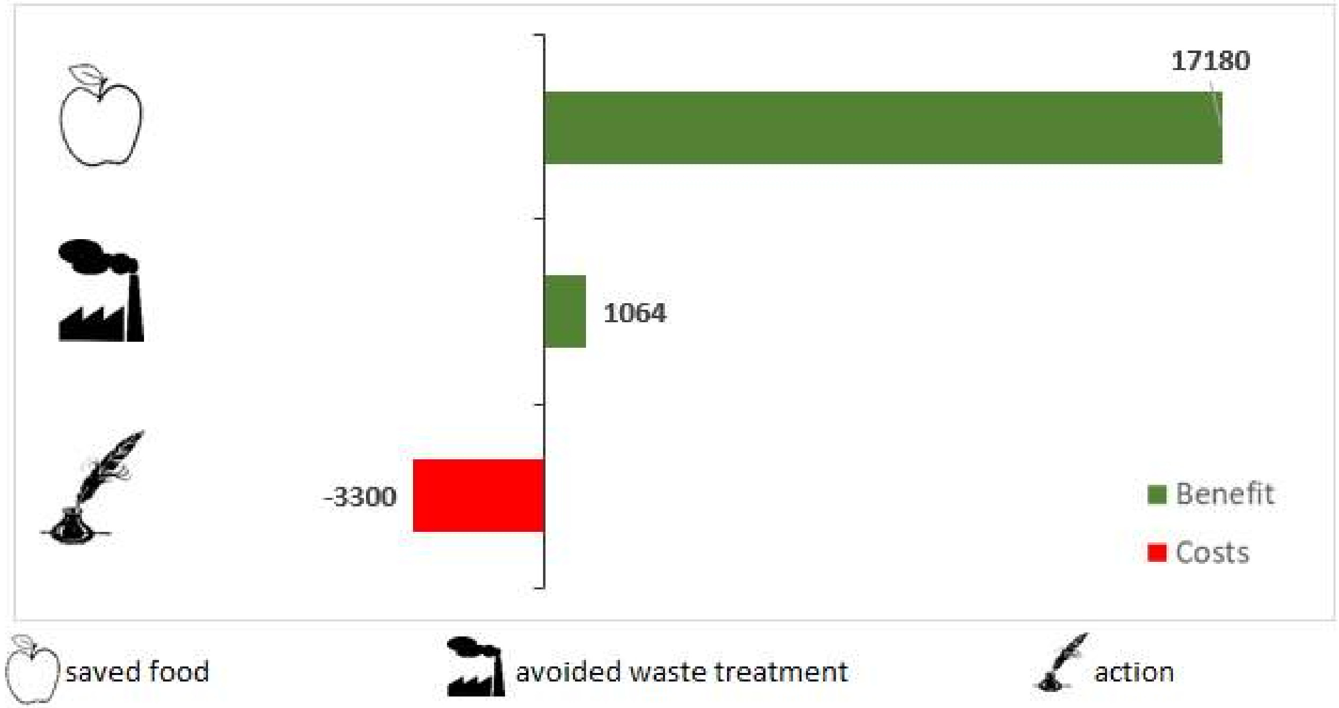
Scenario 1
10 A3 posters per school & 2 A4 leaflets per student
(eq. to 15 000 A4)

Scenario 2
10 A3 posters per school & 12 A4 leaflets per student
(eq. to 80 000 A4)

Illustrative example

Assessment of the initiative “Klimatsmart” developed in the Pre-waste European project

Cost benefit analysis



Cost of action	-3300 €
Savings from avoided treatment	1064 €
Savings from avoided food production	17180 €
Total net savings	**14944 €**

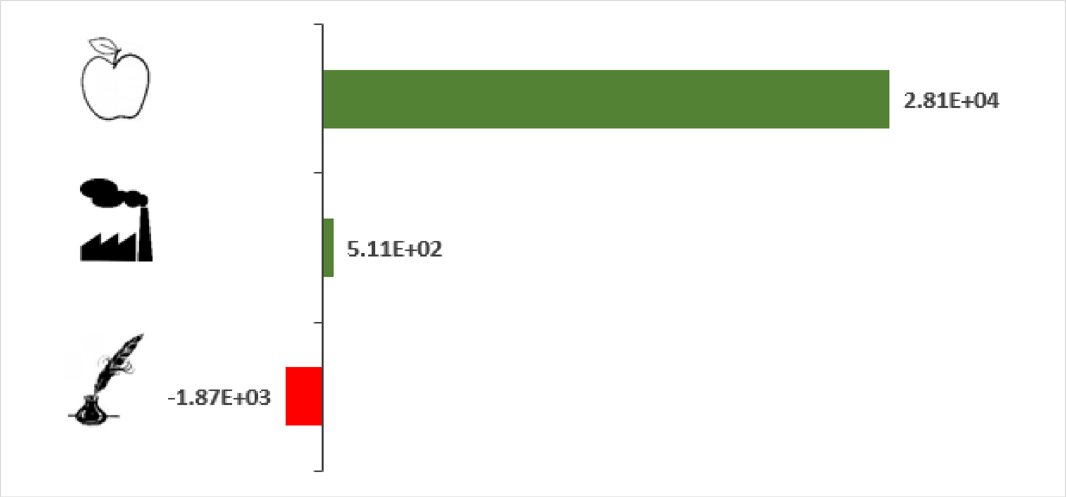
Illustrative example

CLIMATE CHANGE

Assessment of the initiative “Klimatsmart” developed in the Pre-waste European project

Scenario 1

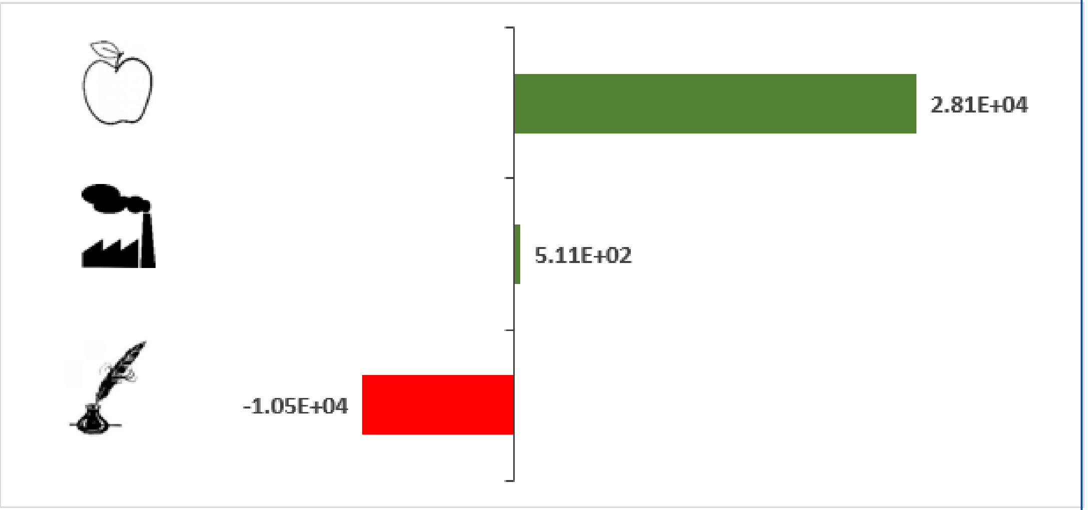
Environmental savings Climate Change



Climate Change		
Impact of action	-1.87E+03	kg CO2 eq
Impact of avoided treatment	5.11E+02	kg CO2 eq
Impact of saved food	2.81E+04	kg CO2 eq
Total	**2.67E+04**	**kg CO2 eq**

Scenario 2

Environmental savings Climate Change



Climate Change		
Impact of action	-1.05E+04	kg CO2 eq
Impact of avoided treatment	5.11E+02	kg CO2 eq
Impact of saved food	2.81E+04	kg CO2 eq
Total	**1.81E+04**	**kg CO2 eq**

Concluding remarks

- To achieve SGD 12.3 target, it is key to identify and implement effective and efficient food waste prevention actions – **Evaluation is imperative**!
- Important to quantify net environmental and economic benefits of food waste prevention actions
- Tool developed for non-LCA experts to perform the evaluation
  - Support the design of food waste prevention actions to maximize their effectiveness and analyze trade-offs
  - Useful to communicate the benefits of a food waste prevention action

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Thank you

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