Collection and evaluation of food waste prevention actions

Carla Caldeira, Valeria De Laurentiis, Serenella Sala
Joint Research Centre
Directorate D – Sustainable Resources

Bio-Economy Unit (D1)

The European Commission’s science and knowledge service
Joint Research Centre
Content

1. Food waste prevention actions evaluation framework
2. Overview of the collected actions
3. The actions evaluation process
4. Key findings and challenges
Context of the work

**SDG 12**

**TARGET 12.3** - By 2030, halve per capita global **food waste** at the retail and consumer levels and reduce **food losses** along production and supply chains, including post-harvest losses

Performance of the prevention actions?

**EC Pilot exercise**

Collection and evaluation of food waste prevention actions

WRAP (2018)
Food waste prevention actions evaluation
Development process

Development of a reporting template
Development of an evaluation framework
Collection of food waste prevention actions
Assessment of the actions
Refinement of the reporting template
Refinement of the evaluation framework

Redistribution
Food valorisation
Consumers behaviour change
Supply chain efficiency
Food waste prevention governance
EVALUATION FRAMEWORK
### Food waste prevention actions evaluation framework: Criteria selected

<table>
<thead>
<tr>
<th><strong>QUALITY OF THE ACTION DESIGN</strong></th>
<th><strong>SUSTAINABILITY OVER TIME</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Definition of the action aims and objectives</td>
<td>• Existence of a long term strategy to ensure the continuity of the action (e.g. organizational support, economic sustainability)</td>
</tr>
<tr>
<td>• Strategy to achieve the objectives</td>
<td></td>
</tr>
<tr>
<td>• Existence of a monitoring system</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>EFFECTIVENESS</strong></th>
<th><strong>TRANSFERABILITY AND SCALABILITY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Degree to which the action was successful in producing the desired result, i.e. in reaching the objectives</td>
<td>• Degree to which transferability and scalability were considered in the design of the action or implemented</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>EFFICIENCY</strong></th>
<th><strong>INTERSECTORIAL COOPERATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• The capacity to reach a desired result with the least time/cost/effort</td>
<td>• Existence of cooperation between different sectors of the society</td>
</tr>
<tr>
<td>• How is this cooperation is organized</td>
<td></td>
</tr>
</tbody>
</table>
Food waste prevention actions evaluation framework:

**Effectiveness**

The effectiveness of a prevention action reflects to which degree the action is **successful** in producing the desired result, i.e. in **reaching the objectives**.

'Specific – target a specific area for improvement.  
Measurable – quantify or at least suggest an indicator of progress.  
Assignable – specify who will do it.  
Realistic – state what results can realistically be achieved, given available resources.  
Time-related – specify when the result(s) can be achieved.’

(Doran, 1981 p .36)

**EXAMPLE OF SMART OBJECTIVE**

to obtain a 10% decrease of the **amount of food waste generated** in 2018 compared with 2017

**Key Performance Indicator**
Food waste prevention actions evaluation framework:

Effectiveness

‘Input objectives’, that refer to something the practitioner has done and are largely a measure of the effort/activity of putting in place the prevention actions (e.g. to distribute 5000 leaflets in one month);

‘Outcomes objectives’, that relate to an intermediate change that happens as a result of the actions one has taken (e.g. to ensure that 2500 households are aware of the campaign); and,

‘Impact objectives’ that reflect a tangible change that has occurred because of the inputs and outcomes (e.g. to achieve a 20% reduction in the food waste generated in the households).
## Food waste prevention actions evaluation framework:

### Efficiency

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

**Efficiency**

Economic efficiency = \( \frac{\text{Net economic benefits}}{\text{Cost of the action}} \)

Environmental efficiency = \( \frac{\text{Net environmental savings}}{\text{Cost of the action}} \)
Food waste prevention actions evaluation framework:

Economic efficiency = \[
\frac{\text{Net economic benefits}}{\text{Cost of the action}} \quad = \quad \frac{A+B-C}{C} \quad \text{or} \quad \frac{R+B-C}{C}
\]

<table>
<thead>
<tr>
<th>Supply chain efficiency</th>
<th>Consumer behavior change</th>
<th>Redistribution (donating surplus food)</th>
<th>Redistribution (selling surplus food)</th>
</tr>
</thead>
</table>
| Cost savings from food waste prevention | A = avoided purchase of raw material  
B = avoided food waste disposal | A = avoided purchase of groceries  
B = avoided food waste disposal | A = avoided purchase of groceries  
B = avoided food waste disposal  
R = revenue from selling surplus food |
| Revenue | C = fixed and variable costs | C = fixed and variable costs | C = fixed and variable costs |

Who pays/benefits:
- Food manufacturers, retailers, food services
- National and local government
- Households
- Charities
**Food waste prevention actions evaluation framework**

**Economic efficiency** = \[ \frac{\text{Net economic benefits}}{\text{Cost of the action}} = \frac{A+B-C}{C} \text{ or } \frac{R+B-C}{C} \]

<table>
<thead>
<tr>
<th>Redist. (donating surplus food)</th>
<th>No action scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost savings from food waste prevention</strong></td>
<td><img src="image" alt="Food purchased to be donated" /></td>
</tr>
<tr>
<td>A = avoided purchase of groceries</td>
<td><img src="image" alt="Charities" /></td>
</tr>
<tr>
<td>B = avoided food waste disposal</td>
<td><img src="image" alt="National and local government" /></td>
</tr>
<tr>
<td>Revenue</td>
<td><img src="image" alt="Households" /></td>
</tr>
<tr>
<td><strong>Cost of the action</strong></td>
<td><img src="image" alt="Food manufacturers, retailers, food services" /></td>
</tr>
<tr>
<td>C = fixed and variable costs</td>
<td></td>
</tr>
</tbody>
</table>

**Who pays/benefits:**
- Food manufacturers, retailers, food services
- National and local government
- Households
- Charities
Food waste prevention actions evaluation framework:

**Environmental Efficiency**

Environmental impacts calculated using life cycle assessment (LCA):
Calculator for costs/environmental impacts calculation

**Cost Benefit Analysis**
- **Value of food waste prevented:** 30,000 euros
- **Cost of action:** -100,000 €
- **Savings from avoided treatment:** 170,081 €
- **Savings from avoided food production:** 30,000 €
- **Total net savings:** 170,081 €

**Environmental Savings**
- **Climate Change:**
  - Impact of action: -2,620 kg CO2 eq
  - Impact of avoided treatment: 6,915 kg CO2 eq
  - Impact of saved food: 1,494 kg CO2 eq
  - Total: 2,186 kg CO2 eq

**Action Resources**
- **Paper used (leaflets, letters):** 2,000
- **Transport distances:** Km
- **Electricity use:** kWh
ASSESSMENT OF ACTIONS SUBMITTED
Overview of the actions collected

<table>
<thead>
<tr>
<th>Country</th>
<th>Reported actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>1</td>
</tr>
<tr>
<td>Belgium</td>
<td>4</td>
</tr>
<tr>
<td>Croatia</td>
<td>7</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>1</td>
</tr>
<tr>
<td>Denmark</td>
<td>10</td>
</tr>
<tr>
<td>Finland</td>
<td>1</td>
</tr>
<tr>
<td>France</td>
<td>3</td>
</tr>
<tr>
<td>Germany</td>
<td>2</td>
</tr>
<tr>
<td>Greece</td>
<td>1</td>
</tr>
<tr>
<td>Hungary</td>
<td>2</td>
</tr>
<tr>
<td>Italy</td>
<td>13</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2</td>
</tr>
<tr>
<td>Norway</td>
<td>7</td>
</tr>
<tr>
<td>Portugal</td>
<td>15</td>
</tr>
<tr>
<td>Romania</td>
<td>1</td>
</tr>
<tr>
<td>Spain</td>
<td>4</td>
</tr>
<tr>
<td>Sweden</td>
<td>3</td>
</tr>
<tr>
<td>Switzerland</td>
<td>2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>3</td>
</tr>
<tr>
<td>International</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>91</strong></td>
</tr>
</tbody>
</table>
### Type of prevention actions and Overview of the actions collected

<table>
<thead>
<tr>
<th>Type</th>
<th>Sub-type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redistribution</td>
<td>Surplus food redistribution, Gleaning, Digital tools for redistribution</td>
</tr>
<tr>
<td>Food valorization</td>
<td>Food valorization</td>
</tr>
<tr>
<td>Consumers behavior change</td>
<td>Consumers behavior change</td>
</tr>
<tr>
<td>Supply chain efficiency</td>
<td>Supply chain efficiency</td>
</tr>
<tr>
<td>Food waste prevention governance</td>
<td>Food waste prevention governance</td>
</tr>
</tbody>
</table>

#### Actions:

- **National FW prev. programme**
- **Regulatory framework/policy**
- **Voluntary agreement**
- **Public procurement**
- **Imperfect product sale**
- **Price discount**
- **Training & guidelines**
- **Packaging**
- **Date marking**
- **Process innovation**
- **Innovation of products**
- **Innovation of products** - date marking
- **Innovation of products** - packaging
- **Training & guidelines**
- **Price discount**
- **Imperfect product sale**
- **Certification**
- **Public procurement**
- **Digital tools for supply chain efficiency**
- **Digital tools (BC)**
- **Awareness/educational campaigns**
- **Voluntary agreement**
- **Regulatory framework/policy**
- **National food waste prevention program**
- **Fiscal incentives**
- **Surplus food redistribution**
- **Gleaning**
- **Value added processing**
- **Animal feed**
- **Awareness/educational campaigns**
Only for those that provided an amount of food waste prevented and a cost it was possible to evaluate the economic and environmental efficiency.
Evaluation process

1. Screening of the reported actions for each type

2. A general evaluation of the actions reported for each criterion, including an assessment of the quality of the data provided

3. Selected actions presented in factsheets

4. Suggestions for actions’ implementation.
Summary of actions presented in factsheets

Primary production → Manufacturing → Retail and distribution → Food services → Households

- R1
- R6, R10
- R11
- R2, R3, R4, R5, R7
- R8, R9
- B3, B5, B7
- B1, B2, B4, B6, B8
- S1, S3, S4, S5
- S2, S6, S7
- F1, V2
- V1
- V3
- F2
- N1, N2, N3

Redistribution
Consumer behaviour change
Supply chain efficiency
Food waste prevention governance

European Commission
Key findings of the evaluation

- The assessment of the actions’ effectiveness was limited by data availability. The main gap was the definition of SMART objectives, related KPIs, and a monitoring system to track their progress towards achieving their goal(s).

- A high variability of the data related to the different actions was reported.

- It is important to be aware of socio-demographic and other context-related factors that may influence the results of the action.
Suggestions for monitoring and reporting prevention actions

- It is crucial to define SMART objectives, related KPIs, and a monitoring system to establish a baseline and track the progress of an action towards achieving its goal(s).

- To evaluate the efficiency of a food waste prevention action is crucial to fully capture the total cost and benefits of the action implementation, which should reflect all the resources used to implement the action and the multiple possible benefits.

- Measurements of the food waste amounts should be done following a defined methodology clearly stating what is the definition of food waste used in the accounting exercise.

- KPIs should be defined according to the type of action. The distinction between actions in which is feasible to account for food waste prevented vs those where this is not possible was taken into account when suggesting KPIs.
Redistribution

Amount of food redistributed

\textit{kg and/or number of meals}

Amount of fresh fruit/meat/dairy redistributed

Number of food insecure people reached

European Commission
**Consumers behaviour change**

**IMPACT OBJECTIVES**
- Actions measuring food waste reduction obtained

**OUTCOME OBJECTIVES**
- Actions measuring a reported increase in awareness/behavioural change (surveys, diaries, focus groups..)

**food waste generated in one year per capita/per household**

**food waste generated per meal served**

**share of people reporting a change in behaviour**
Supply chain efficiency

IMPACT OBJECTIVES

Actions based on the implementation of process/product innovations to reduce food waste

food waste generated per kg sold

food waste generated per kg produced

food waste generated per meal served

OUTCOME OBJECTIVES

Actions that provide information, training or tools to implement or to track success of practical measures to reduce food waste

Number of businesses entering the program

Number of businesses tracking food waste
Voluntary Agreements and National Food Waste Prevention Programmes are a combination of actions that are within the previous types presented:

- Ideally a KPI would be used to measure the overall impact of the action: amount of food waste prevented.
- Each action that constitutes the programme/agreement can be evaluated using the adequate KPI.

For regulatory frameworks, there is the need to account the resources used for the action design and implementation because zero cost is unrealistic.
Challenges

- **Indicators and data may differ** from one typology of action to another
- Very difficult to make any **comparison between the actions**
- Accounting for **voluntary** work
- Difficult to account comprehensively for **burdens and benefits** when many different actors are involved
- Assessing effective reduction of waste when a **change in behaviour** is stated
- How to ensure **transfer of good practices**, including interaction between those providing similar actions but reporting very different outcomes.

- **Maximising FW reduction per resource input**
- **Multiple societal benefits**
- **Sustainability over time**
- **Systemic changes**
Acknowledgements

• Participants which provided data on their actions

• Experts which participated in the workshop for the development of the evaluation framework

• Members of the sub-group Action & Implementation

• Hilke Bos-Brouwers (UR Wageningen), Richard Swannell (WRAP), and Stephanie Wunder (Ecologic Institute)
Stay in touch

EU Science Hub: ec.europa.eu/jrc

Twitter: @EU_ScienceHub

Facebook: EU Science Hub - Joint Research Centre

LinkedIn: Joint Research Centre

YouTube: EU Science Hub