



PLEASE CITE AS:

- F-r ŷ r *Why and How to Measure Food Loss and Waste:*

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ABOUT THE AUTHORS:

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TABLES

Table 1: FET costs and Benefits As

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- ✓ **Step 1: Determine why you want to reduce food loss and waste.**
(Module: Why Measure FLW?)

- ✓ **Step 2: Establish your business case for reducing food loss and waste.**
(Module: The Business Case for FLW Reduction)

- ✓ **Step 3: Prepare for the change of measuring and reducing food loss and waste.**
(Module: Managing Change)

- ✓ **Step 4: Determine your definition of food loss and waste.**
(Module: Setting Your Scope)

- ✓ **Step 5: Determine your causes of food loss and waste and identify solutions.**
(Module: Determining Root Causes)

- ✓ **Step 6: Identify your key performance indicators and impacts.**
(Module: Selecting Key Performance Indicators and Identifying Impacts)

- ✓ **Step 7: Select and implement a food loss and waste measurement method based on your sector.**
(Module: Sector-Specific Guidance)

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ECONOMIC impact of food loss is substantial, as it represents a significant waste of resources and labor. Reducing food loss is crucial for ensuring food security and sustainability. The **ENVIRONMENTAL** impact of food loss is also significant, as it represents a waste of natural resources and contributes to greenhouse gas emissions. Reducing food loss is essential for a sustainable and resilient food system.



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Setting Your Scope

1. Define what FLW is being tracked. This includes defining the scope of the tracking, such as the types of food waste and the locations where it is generated. The standard provides a list of potential waste streams to track, including:

- Food waste (e.g., spoiled food, food scraps, food service waste)
- Food packaging waste (e.g., food containers, food wrappers, food trays)
- Food processing waste (e.g., food byproducts, food waste from food processing)
- Food waste from food service (e.g., food waste from restaurants, food waste from food service areas)
- Food waste from food production (e.g., food waste from food processing plants, food waste from food production facilities)

2. Determine the boundaries of the tracking. This includes identifying the locations and activities that are included in the tracking. The standard provides a list of potential locations and activities to track, including:

- Food service areas (e.g., restaurants, food service areas, food service facilities)
- Food production facilities (e.g., food processing plants, food production facilities)
- Food waste management facilities (e.g., food waste management facilities, food waste management plants)
- Food waste management activities (e.g., food waste management activities, food waste management processes)

3. Establish the tracking methodology. This includes determining the methods and procedures for tracking food waste. The standard provides a list of potential tracking methods and procedures, including:

- Direct measurement (e.g., weighing food waste, measuring food waste volume)
- Indirect measurement (e.g., estimating food waste based on food service data, estimating food waste based on food production data)
- Accounting (e.g., tracking food waste through accounting systems, tracking food waste through inventory systems)
- Reporting (e.g., reporting food waste data to management, reporting food waste data to stakeholders)

TRACKING PROGRESS ON PREVENTING FLW

4. Monitor and report on progress. This includes tracking food waste over time and reporting on the results. The standard provides a list of potential tracking and reporting methods and procedures, including:

- Regular monitoring (e.g., daily monitoring, weekly monitoring, monthly monitoring)
- Reporting to management (e.g., reporting food waste data to management, reporting food waste data to stakeholders)
- Reporting to stakeholders (e.g., reporting food waste data to customers, reporting food waste data to the community)
- Public reporting (e.g., reporting food waste data to the public, reporting food waste data to the media)

5. Evaluate and improve. This includes evaluating the effectiveness of the tracking and reporting system and making improvements as needed. The standard provides a list of potential evaluation and improvement methods and procedures, including:

- Regular evaluation (e.g., annual evaluation, biennial evaluation)
- Improvement (e.g., improving tracking methods, improving reporting methods)
- Continuous improvement (e.g., ongoing improvement, ongoing evaluation)

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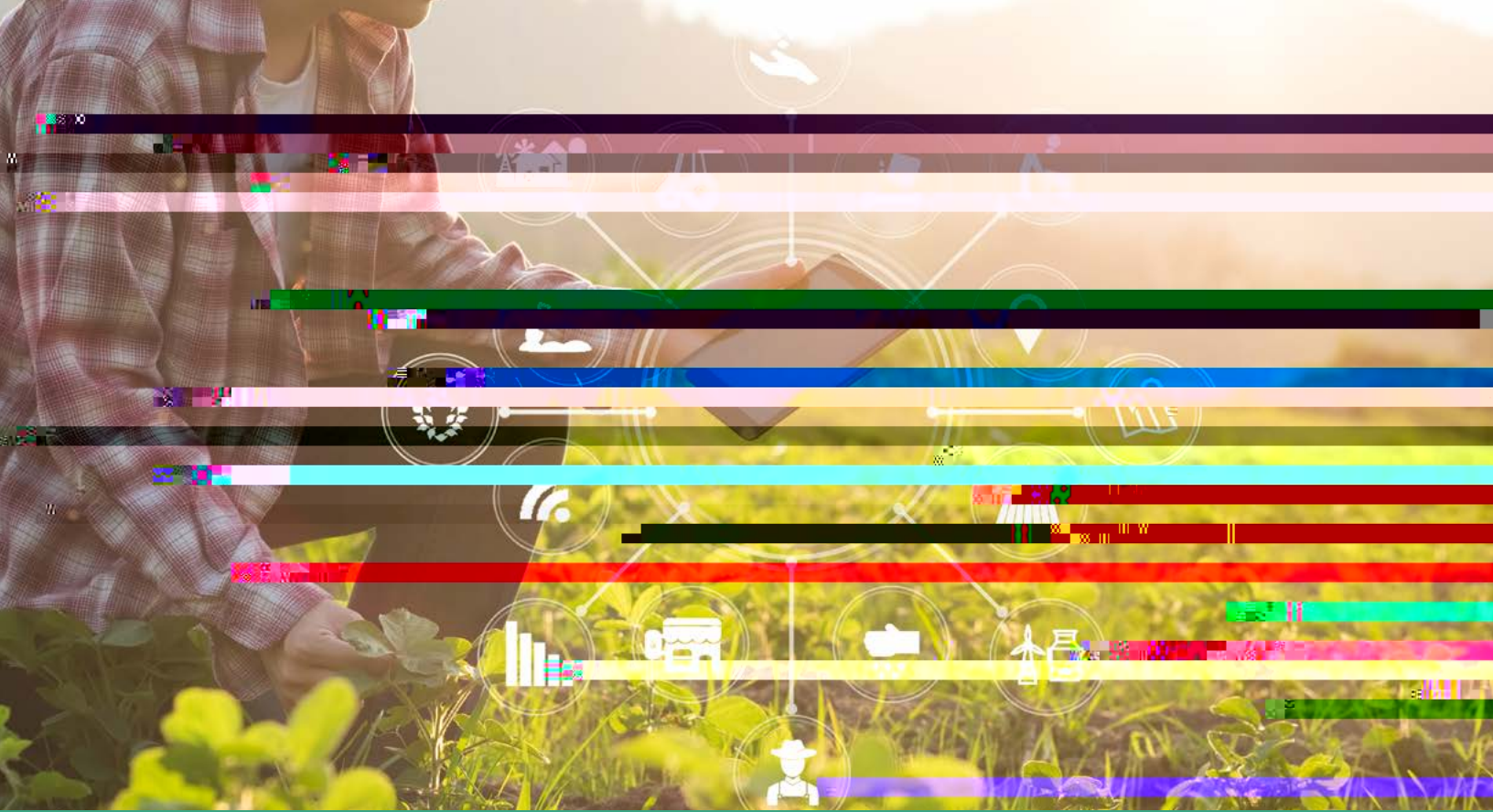
Figure 2. Scope of an FLW Inventory

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Determining Root Causes

It is difficult to determine the root causes of a problem. This is because the problem is often complex and the causes are often hidden. The root causes are the underlying factors that lead to the problem. They are the causes that are not obvious and are often overlooked. The root causes are the causes that are the most important and the most difficult to identify. The root causes are the causes that are the most important and the most difficult to identify. The root causes are the causes that are the most important and the most difficult to identify.

DEFINING CAUSES AND DRIVERS

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Table 4. Some Causes of FLW by Stage of the Food Supply Chain

Primary Production	Processing and Manufacturing	Distribution and Wholesale	Retail	Food Service/ Institutions	Household
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HOW TO TRACK CAUSES AND DRIVERS

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Table 7. Tracking Causes and Drivers

Food Type	Amount	Stage of the Supply Chain	Cause	Driver
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Selecting Key Performance Indicators and Identifying Impacts

WHICH IMPACTS SHOULD I TRACK?

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Sector-Specific Guidance

- Primary Production
- Processing and Manufacturing
- Distribution
- Retail
- Food Service/Institutions
- Households
- Whole Supply Chain Approaches

Primary Production

INTRODUCTION

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INTRODUCTION

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Methodology for FLW Quantification
 The FLW Ranking Tool by the University of Guelph
 The FLW Ranking Tool is a methodology for quantifying food loss and waste (FLW) in the processing and manufacturing sector. It is based on the FLW Toolkit developed by the Provision Coalition. The tool is designed to be used by food processors and manufacturers to identify areas of opportunity for reducing FLW and to track progress over time. The tool is based on the following methodology:

Table 9. Methods Used to Measure FLW in the Processing and Manufacturing Sector

Method	Source	Year	Scope	Notes
Method 1	Source 1	Year 1	Scope 1	Notes 1
Method 2	Source 2	Year 2	Scope 2	Notes 2
Method 3	Source 3	Year 3	Scope 3	Notes 3
Method 4	Source 4	Year 4	Scope 4	Notes 4
Method 5	Source 5	Year 5	Scope 5	Notes 5

Methodology for FLW Quantification
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SECTOR LEVEL CASE STUDY

Byblos Bakery is the top branded pita maker in western Canada. Byblos worked with Provision Coalition and Enviro-Stewards to measure and prevent FLW generation in its manufacturing operations and saved over C\$200,000 from the interventions implemented. Enviro-Stewards conducted a food waste prevention assessment of the facilities and the Provision Coalition’s FLW Toolkit helped develop a set of FLW reduction strategies and solutions. By using a facility assessment along with the FLW Toolkit, Byblos could identify root causes for FLW generation and tailor interventions to its business. For example, improvements to retail inventory management helped minimize retail returns and relatively small tweaks to the production process and facility immediately reduce waste generation in the factory. In total, Byblos reduced its food waste by 29% (Provision Coalition 2017).

Distribution and Wholesale

INTRODUCTION

- **DO YOU WANT TO TRACK PROGRESS OVER TIME?** [FLW Quantification Method Ranking Tool](#) by [FAO](#) and [IFREMER](#) (2017)

Table 10. Methods Used to Measure FLW in the Distribution and Wholesale Sector

Method	Year	Country	Scope	Key Findings
Visual inspection	2015	Mexico	Wholesale	High FLW observed in fresh produce
Weight loss measurement	2016	Mexico	Distribution	Significant weight loss in meat products
Inventory tracking	2017	Mexico	Wholesale	FLW linked to poor inventory management
Supplier audits	2018	Mexico	Wholesale	Identified gaps in cold chain infrastructure
Customer surveys	2019	Mexico	Wholesale	Consumer preferences impact FLW
Supply chain mapping	2020	Mexico	Wholesale	Complex supply chains increase FLW risk
Blockchain technology	2021	Mexico	Wholesale	Improved traceability reduces FLW
AI and data analytics	2022	Mexico	Wholesale	Predictive modeling for FLW hotspots

CASE STUDY FOR THE DISTRIBUTION AND WHOLESALE SECTOR

The Mexican Transport Institute (Instituto Mexicano del Transporte–IMT) developed a methodology to identify cold-chain coverage and gaps across the country. The IMT uses a database with several metrics, including origin and destination of shipments, classification of loads, ownership of transportation units and cost of transportation. It monitors the status of the distribution and transportation system across Mexico alongside relevant costs, shipment data and records. This allows IMT to identify potential FLW hotspots and regions needing cold-chain management and infrastructure (Morales 2016, CEC 2017).

INTRODUCTION

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Table 12. Methods Used to Measure FLW in the Food Service Sector

Method Name	Direct FLW Access Needed?	Level of Accuracy?	Level of Resources Required?	Tracks Causes?	Tracks Progress Over Time?
Methods for gathering new data					
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Methods based on existing data					
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CASE STUDY FOR THE FOOD SERVICE SECTOR

Sodexo has prevented FLW through its “WasteWatch powered by LeanPath” program, which reduces on site food waste by an average of 50 percent. This program uses smart scales, which categorize food waste and generate a food waste inventory that helps identify how much and where food goes to waste. These inventories and continuous direct measurement allow staff to identify hotspots, take action and monitor progress over time. Sodexo found that tailored messaging to employees improved staff engagement in the FLW prevention program and that this staff engagement was particularly impactful in the food service sector. Additionally, Sodexo identified products going to waste that could not be sold but were still safe for human consumption. In the United States, Sodexo has collaborated with Food Recovery Network, Feeding America and Campus Kitchens to connect surplus food to those in need (Clowes et al. 2018).

INTRODUCTION

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METHODS USED TO MEASURE FLW

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Table 14. Methods Used to Measure FLW across the Whole Supply Chain

Method Name	Direct FLW Access Needed?	Level of Accuracy?	Level of Resources Required?	Tracks Causes?	Tracks Progress Over Time?
Methods for gathering new data					
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Methods based on existing data					
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Less commonly used methods across the whole supply chain					
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CASE STUDY FOR MEASURING ACROSS THE WHOLE FOOD CHAIN

The US Department of Agriculture (USDA) Economic Research Service (ERS) estimates all post-harvest losses, through the entire food supply chain for over 200 agriculture product types, through its Loss-Adjusted Food Availability Data Series. This data series helps the USDA ERS produce estimates of loss-adjusted food availability as a proxy for food consumption. To create this data series, the USDA ERS developed loss coefficients, updated primary conversion factors and compared shipping and point-of-sales data. By estimating food losses in the United States with such a high level of accuracy, the USDA ERS helps US state and local governments, food industries, nongovernmental organizations and others identify opportunities to prevent FLW. These estimates allow others to identify hotspots in which to conduct more detailed research with the aim of preventing FLW (Buzby et al. 2014).

Table A1. Factors to Consider When Using Diaries to Quantify FLW

Strengths	Limitations / Points to Consider
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Step 4: Recruit participants

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Step 5: Prepare questions to quantify FLW

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Table A2. Advantages, Disadvantages and Examples of Diary Types

Method	Advantages	Disadvantages	Example
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COMMON DATA CHALLENGES IN USING A DIARY

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USING DIRECT MEASUREMENT TO QUANTIFY FLW IN DISTRIBUTION AND WHOLESALE

USING DIRECT MEASUREMENT TO QUANTIFY FLW IN FOOD SERVICE AND INSTITUTIONS

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Table A6. Factors to Consider when Using Scanning for FLW Quantification in Retail

Strengths	Limitations / Points to Consider
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g bbm6Tfà fT% yi }iŽ <6 i}<ë T<i T mT%>ì 6É	g i<mëf } Žirrk
financia k i%½ëm6% i%<T • <6 } bb6m< y }ë%>g	g f%ëi<6 6ž i%6 b }É<i fT% yi iÉbi%>ë½i y < fT% yT}iŽ 6% iÉë<ë%ì T i } ŽT<T }É<i r
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ò6 mfij <à6m}r

HOW TO CONDUCT A SURVEY TO QUANTIFY FLW

$\rho_{\text{à}} \approx \frac{1}{2} \left(\frac{f_{\text{à}}}{m} + \frac{f_{\text{à}}}{n} \right)$

Step 1: Set hypotheses and determine the survey approach

The null hypothesis (H_0) is that there is no difference in the proportion of respondents who are satisfied with the service between the two groups. The alternative hypothesis (H_1) is that there is a difference.

Table A12. Advantages and Disadvantages of Methods for Conducting Surveys

Method	Advantages	Disadvantages
By mail	<ul style="list-style-type: none"> Low cost High response rate Convenient for respondents 	<ul style="list-style-type: none"> Low response rate Long time to receive responses Low response rate
Telephone	<ul style="list-style-type: none"> High response rate Convenient for respondents High response rate 	<ul style="list-style-type: none"> High cost Low response rate Low response rate
Electronic	<ul style="list-style-type: none"> Low cost High response rate Convenient for respondents 	<ul style="list-style-type: none"> Low response rate Low response rate Low response rate
In-person	<ul style="list-style-type: none"> High response rate High response rate High response rate 	<ul style="list-style-type: none"> High cost Low response rate Low response rate

Step 4: Prepare and Analyze the Data

HOW TO USE PROXY DATA TO QUANTIFY FLW

Step 1: Determine what data are needed

For filling identified gaps in the quantification of FLW, you need to determine what data are needed. This involves identifying the specific data points required to calculate FLW, such as the amount of food waste generated, the amount of food waste recycled, and the amount of food waste sent to landfills or incinerated. You also need to determine the sources of these data, such as government agencies, industry associations, or academic institutions.

Step 2: Determine available proxy data

Once you have identified the data needed, you need to determine what proxy data is available. Proxy data is data that is used to estimate the value of a variable that is difficult to measure directly. For example, you might use the amount of food waste generated in a restaurant to estimate the amount of food waste generated in a city. The Food Waste Atlas and FAOSTAT are two sources of proxy data for food waste.

Step 3: Select the data to use

Once you have identified the proxy data available, you need to select the data to use. This involves evaluating the quality and reliability of the data. You should consider factors such as the source of the data, the methodology used to collect the data, and the time period covered by the data. You should also consider the representativeness of the data, meaning that the data should be representative of the population or area you are studying.

Table A14. Factors to Consider when Using Proxy Data to Quantify FLW

Strengths	Limitations / Points to Consider
<ul style="list-style-type: none"> • Sufficient data available • Data is reliable and accurate • Data is representative of the population or area being studied 	<ul style="list-style-type: none"> • Insufficient data available • Data is unreliable or inaccurate • Data is not representative of the population or area being studied • Data is outdated • Data is difficult to access • Data is expensive

Additional text or notes related to the table.

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COMMON DATA CHALLENGES WHEN USING RECORDS

INCONSISTENCIES BETWEEN DATA SOURCES. - à | % } ë % ì

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Step 7: Analyze the data

LACK OF INFORMATION ON CAUSES.

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COMMON DATA CHALLENGES WHEN CONDUCTING A WASTE COMPOSITION ANALYSIS

ADDITIONAL RESOURCES FOR USING WASTE COMPOSITION ANALYSIS

RELUCTANCE TO PARTICIPATE

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SAMPLE COLLECTION ERRORS.

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UNREPRESENTATIVE DATA.

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