INTRODUCTION

Aware of the urgency emerging from the Barilla Center for Food & Nutrition Foundation studies, Barilla, as a food company, has started to analyse three of its supply chains (pasta, tomato sauce and bread) in collaboration with Last Minute Market (LMM), a spin-off from the University of Bologna.

Its goal is to monitor the food losses and waste all along the value chains, identifying the causes and the measures to reduce them. The reference standard used for this analysis is the global Food Loss and Waste Accounting and Reporting Standard (FLW Standard).

This document refers to Barilla Soft Wheat Bread “Pan Bauletto”. 
WHY FOOD WASTE IS SO IMPORTANT

Food waste is one of the most significant social, economic, and environmental issues facing our Planet.

At a time in history where nearly one billion people are still dying of hunger or have to settle for inadequate nutrition every year, it is unacceptable that over a third of the world’s food remains abandoned in fields or ends up in landfills.

Food waste has serious environmental impacts. Today, we know that every product not only generates CO2 throughout its life cycle, but also has a water footprint that weighs heavily on climate change. Producing food that will never end up on a table means unnecessarily aggravating our Planet’s health. Besides the moral and environmental effects, food waste also results in the decreased social value of food. After years of agricultural industrialisation, the decline in food prices has been relentless.

This phenomenon has fuelled the hopes of those who believe it would be possible to feed everyone on the Planet. Unfortunately, the main result has rather been the loss of people’s perception of food’s real value, that is to say, the effort it takes to produce, cultivate and harvest food.

“Food is not simply a matter of what we put on our plate every day. It is the energy of our lives. It is about wellbeing, culture, conviviality, the resources required to produce it, and is the livelihood of many people around the world. These are the true values of food we want to preserve. It is our duty to avoid unnecessary waste, reduce the impact of the food system on the Planet and inspire people to consume responsibly and enjoy.”

CLAUDIO COLZANI
CEO, Barilla Group
Barilla, analysed the entire life cycle - from field to table - of the bread that it produces in Italy. It has been found that this supply chain is an example of a true circular economy, where almost nothing is lost.

Food loss in the field is very limited (around 2% due to grain losses), while the straw obtained during the harvest—weighing the same as wheat—is usually used as animal feed and for litter. Losses of the edible parts generated during the grinding of the grain and the bread production around 2%.

However, the research carried out has shown that the greatest wastage is concentrated in the final phase. In fact, the product wasted at the final level (distribution and consumption phase) amounted around 8.5%.

Data collected in 2019

For 1 kg of Barilla Pan Bauletto:

- **FLW 1,711 g**
  - 1,626 g 95% CULTIVATION
  - 85 g 5% MILLING
  - 1,552 g 91% BREAD PRODUCTION
  - 159 g 9% RETAIL
  - 85 g 5% CONSUMPTION

**Product Analysed**
Barilla Soft Weath Bread Pan Bauletto 1 kg

**Lifecycle Stage(s)**
Entire soft wheat bread supply chain, from field to table

**Total Food Losses and Waste (FLW)**

- **Food losses and waste 1,711 g**
  - 76% COMING FROM CULTIVATION
  - 17% COMING FROM MILLING
  - 1.8% COMING FROM BREAD PRODUCTION
  - 0.8% COMING FROM RETAIL
  - 4.2% COMING FROM CONSUMPTION

- **Valorized 97.8%**
  - 97.8% LANDFILL DISPOSAL
  - 97.8% COMPOSTING
  - 91% INEDIBLE PARTS
  - 9% FOOD - EDIBLE PARTS

- **Left in field 1,3%**

- **Animal feed 0.8%**

- **Energy recovery 4.2%**

- **Domestic waste 2.2%**

- **Food bank 0%**
BARILLA PAN BAULETTO
A GOOD EXAMPLE OF CIRCULAR ECONOMY
Product, Co-product and Waste

SOFT WHEAT CULTIVATION

MILLING

BREAD PRODUCTION

DISTRIBUTION

CONSUMPTION

SOFT WHEAT BREAD LOSSES AND WASTE

Soft wheat bread losses and waste 2%

Milling & Production Waste 2.25%

Distribution and Consumption losses 8.5%

Data collected in 2019.
Percentage refers to each single phase of the supply chain.

DESTINATIONS

LEFT IN FIELD

ANIMAL FEED

ENERGY RECOVERY

COMPOSTING

FOOD BANK

LANDFILL DISPOSAL

SOFT WHEAT

SEMOLINA FLOUR

WHEAT CO-PRODUCTS

MILLING WASTE

77.8%

97.85%

22.1%

0.1%

2.15%

7.2%

1.3%

7.2%

48%

50%

2%

2%

2%

GRAIN FIELD LOSSES

STRAW

SOFT WHEAT

DOMESTIC FOOD WASTE

DAMAGED & UNSOLD

1.3%

3.7%

22.1%

48%

50%

2%
METHODOLOGY

The reference standard used for this analysis was the global Food Loss and Waste Accounting and Reporting Standard (FLW Standard).

“The Food Loss and Waste Accounting and Reporting Standard (or FLW Standard) is a global standard that provides requirements and guidance for quantifying and reporting on the weight of food and/or associated inedible parts removed from the food supply chain—commonly referred to as “food loss and waste” (FLW). Using the standard enables countries, cities, companies, and other entities to develop inventories of how much FLW is generated and where it goes. The FLW Standard is designed to allow for the fact that different organizations will have different reasons for quantifying FLW. These different goals lead to (or government regulations may even explicitly state) different definitions of what constitutes FLW. The FLW Standard is designed to allow for the fact that different organizations will have different reasons for quantifying FLW. These different goals lead to (or government regulations may even explicitly state) different definitions of what constitutes FLW. The FLW Standard, therefore, defines the possible components of FLW in terms of the possible material types (i.e., food and/or associated inedible parts) and destinations (where material removed from the food supply chain is directed—see Figure 1). It allows an entity to select which combination of material types and destinations it considers to be “food loss and waste,” in accordance with the entity’s stated goals”. The FLW Standard provides a credible, practical, transparent, and internationally consistent basis for entities to account for and report on FLW. An FLW inventory must meet a number of requirements to be in conformance with the standard; these requirements are listed in Table 3 at the end of this executive summary. The full document provides guidance on implementing these requirements, as well as additional recommendations.”

Regardless of the particular scope selected, the FLW Standard requires an entity to report on four components:

- **Timeframe**: the period of time for which the inventory results are being reported.
- **Material type**: the materials that are included in the inventory (food only, inedible parts only, or both).
- **Destination**: where FLW goes when removed from the food supply chain.
- **Boundary**: the food category, lifecycle stage, geography, and organization.

![FIGURE 1](https://via.placeholder.com/150)

**FIGURE 1** Material types and possible destinations under the FLW standard

![FIGURE 2](https://via.placeholder.com/150)

**FIGURE 2** Scope of an FLW Inventory

NOTE: Inventory results reflect the state in which the FLW was generated (i.e., before water is added or before intrinsic water weight of FLW is removed).

* Cereals Products not ready to eat (shelf-stable) (SIC codes: 10000285)

** Bread and other Bakery Products, except Cookies and Crackers (SIC Code 2051)

*** UN code: 380

Pre-harvest losses, packaging and any other non-FLW material are excluded from the weight of FLW because they are not relevant for the purpose of this study.
SCOPE AND RESULTS

The study was carried out by analysing the FLW of the life cycle of 1 Kg of Soft Wheat Bread “Pan Bauletto” produced in Italy.

The scope of this FLW inventory is the quantification of loss and waste from field to fork for the production of 1 kg of Barilla Pan Bauletto Bread.

PRODUCT
Pan Bauletto 400 g.

TIMEFRAME
The study began in January 2019 and ended in September 2019. Data relevant to bread factory date back to 2018.

MATERIAL TYPE
The total weight of the FLW has been quantified in 1.71 kg for 1 kg of bread produced. The total is the sum of the food (0.16 kg) and the inedible parts (1.55 kg). “Food” refers to any substance—whether processed, semi-processed or raw—that is intended for human consumption. “Inedible parts” refer to components associated with food that, in the food supply chain, is not intended to be consumed by humans.

DESTINATION
As “destination” we indicate where the material removed from the food supply chain is directed.

BOUNDARIES
We analysed the boundary of the FLW inventory in terms of the food category, lifecycle stage, geography and organisation.

EXCLUSIONS AND RELATED ISSUES

- Packaging and any other non-FLW material have been EXCLUDED from inventory results.
- Inventory results reflect the state in which the FLW was generated (i.e., before water is added or before intrinsic water weight of FLW is removed).
- Pre-harvest losses have been EXCLUDED from inventory results, because they are not relevant for the purpose of this study.

<table>
<thead>
<tr>
<th>Destination</th>
<th>Weight of FLW (g)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human consumption</td>
<td>7.0 g</td>
<td>0.4 %</td>
</tr>
<tr>
<td>Animal feed</td>
<td>593.2 g</td>
<td>34.7 %</td>
</tr>
<tr>
<td>Composting/aerobic processes</td>
<td>36.0 g</td>
<td>2.1 %</td>
</tr>
<tr>
<td>Landfill</td>
<td>37.3 g</td>
<td>2.2 %</td>
</tr>
<tr>
<td>Not harvested/plowed-in</td>
<td>472.7 g</td>
<td>27.6 %</td>
</tr>
<tr>
<td>Energy Recovery</td>
<td>565.2 g</td>
<td>33.0 %</td>
</tr>
<tr>
<td><strong>Total FLW</strong></td>
<td><strong>1,711.4 g</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

BOUNDARY

- **Food category(ies)**: Cereals Products – Not Ready to Eat (Shelf Stable) (GPC codes: 100000285)
- **Lifecycle stage(s)**: Bread and other Bakery Products, except Cookies and Crackers (SIC Code 2051)
- **Geography**: Italy (UN code: 380)
- **Organization**: All sectors in the company
METHODS AND DATA SOURCES

Data have been collected by:

- **Barilla G.R. Fratelli SpA**, which supplied data and information concerning the processes of cultivation, milling, and bread production.
- **Last Minute Market Srl**, accredited spin-off of the University of Bologna, which provided data about cultivation, distribution, and consumption.

In regard to the **cultivation stage**, we analysed documented research which provided an overview about field loss, particularly during the harvest stage. Through the comparison of various studies, we estimated the average field loss for soft wheat. In particular, we consulted 2011 FAO’s ‘Global Food Losses and Food Waste’ and a study about loss in primary production conducted by Barilla.

In regard to the **processing stage** (milling and bread production), we referred to data provided by Barilla and by the Italian primary and secondary processing plants that were taken into consideration. The data were specifically collected from one mill for the primary processing and from two production plants for the secondary processing.

In regard to **distribution**, we referred to data provided by Italian retail establishments. The data were collected by LMM through a survey conducted in 5 brands of the Italian large-scale distribution. The resulting data, useful for our analysis, were provided by four of these five companies. They refer to 1,700 points of sale, representative of the categories present in the Italian territory, from small supermarket to larger hypermarket.

The data referring to the **last stage** of the supply chain, the consumption, derives from a Last Minute Market estimate. The percentage of waste detected (7% of estimated waste for the consumption phase, which accounts for 4% of the total FLW), is calculated as the ratio between: 42.6 grams/week that is the domestic waste of bread per capita (source Department of Agro-Food Sciences and Technologies of the University of Bologna-unpublished data) and 85 grams/day that is the average consumption of bread per capita in Italy (source Confederazione Nazionale Coldiretti-published data).

**DATA SOURCE**
- Orta for cultivation data
- Barilla plants of Cremona and Melfi
- Last minute Market for retail and consumption data

**REFERENCES**
- www.eu-fusions.org
- www.fao.org
- www.theconsumergoodsforum.com
- web.unep.org
- www.wbcsd.org
- www.wrap.org.uk
- www.wri.org
## Causes of Food Loss and Waste

The causes of FLW are due to a number of conditions, especially regarding the production process we consider below. For example, when we analyse the wheat cultivation process, the straw production is an inevitable part and is, therefore, considered a 'joint' production. In order to produce a certain amount of grain, straw will inevitably be produced as well. The straw produced during the cultivation stage will not be discarded, but utilised as litter and animal feed.

<table>
<thead>
<tr>
<th>FLW Type</th>
<th>Weight g</th>
<th>% FLW on the whole</th>
<th>Cause</th>
<th>Additional notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivation - Straw</td>
<td>1,260.4</td>
<td>73.6%</td>
<td>Physiological</td>
<td>Joint production. That is, in order to produce a certain amount of grain, a certain amount of straw is produced. (Physiological process)</td>
</tr>
<tr>
<td>Cultivation - Field losses</td>
<td>52.5</td>
<td>3.1%</td>
<td>Combine harvester failure</td>
<td>Using the best technology available and maximizing the performance, it is not possible an increase of the amount of the harvested wheat.</td>
</tr>
<tr>
<td>Milling - Wheat co-products</td>
<td>290.2</td>
<td>17%</td>
<td>Wheat pre-cleaning</td>
<td>Physiological waste in pre-cleaning stage of wheat is, nevertheless, used in alternative production, especially in animal feed.</td>
</tr>
<tr>
<td>Milling waste</td>
<td>1.3</td>
<td>Neg.</td>
<td>Wheat pre-cleaning</td>
<td>The pre-cleaning plant removes the impurities before the wheat is stocked in the silos. These losses are partially used for animal feed. Their non-edible parts are disposed as waste.</td>
</tr>
<tr>
<td>Bread production scraps</td>
<td>21.5</td>
<td>1.3%</td>
<td>Equipment cleaning</td>
<td>The FLW in this stage of production is mainly the consequence of production lines cleaning and changes of bread shapes, still usable for human consumption.</td>
</tr>
<tr>
<td>Bread production scraps</td>
<td>0.5</td>
<td>Neg.</td>
<td>Equipment cleaning</td>
<td>The FLW in this stage of production is mainly the consequence of production lines cleaning and changes of bread shapes, still edible.</td>
</tr>
<tr>
<td>Retail unsold</td>
<td>13.0</td>
<td>0.8%</td>
<td>Damage</td>
<td>In retail store, the main cause of waste is the breaking or damaging of packaging, which makes the bread unsellable.</td>
</tr>
<tr>
<td>Consumption</td>
<td>72.0</td>
<td>4.2%</td>
<td>Expired, purchase higher than necessary</td>
<td>Info not available</td>
</tr>
<tr>
<td><strong>Total FLW</strong></td>
<td><strong>1,711.4 g</strong></td>
<td><strong>100%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data collected in 2019
INVENTORY RESULTS

The following table shows the FLW by food category and lifecycle stages.

In regard to the edible parts of the FLW, amounting to 9.32% only of the total losses, we see that the FLW mainly occurs in the consumption stage. If on the total losses of the FLW the consumption phase represents the 4.2%, it accounts for over 45.1% on the edible parts.

During the primary and secondary production stages (milling and bread production), the FLW is limited to a 13.8% of the edible parts. More important, almost all the FLW of the edible portion during the production stage is reused in alternative productions, such as that of animal feed or donate for human consumption.

On the other side, considering the FLW in domestic context, excluding rare occasions of recycle of surplus for social purposes, the FLW is inevitably disposed.
BREAD SUPPLY CHAIN: LOSSES AND WASTE

Each kg of bread produces 1.71 kg of losses and waste. It is important to analyze the composition and causes of FLW to identify corrective actions. In this study, we included edible and inedible parts of FLW, and the overall results are deeply influenced by the inedible part, considering that only at the cultivation stage we have almost 50% of straw losses.

Composition of FLW: food and inedible parts

Along the supply chain, 90.68% of all FLW consist of inedible parts, mainly related to physiological issues, such as straw (76.7%), and a small part during milling and pasta production stages. Only 9.32% are considered as edible parts, mainly wasted in the consumption stage (45.1% of all edible part).

Where are FLW allocated in the chain

95% of all FLW are allocated in the previous stages to the distribution, 5% in the final part of the supply chain, in distribution and consumption phase. However, we must consider that we lose most edible part at the consumption level (45.11% on the total edible part).

Destinations of FLW: an example of circular economy

97.8% of the total of FLW is used into alternative sectors, while only 2.2% is destined to landfill disposal. In particular considering alternative destinations, we have 34.7% of total FLW used for animal feed and care, 27.6% not harvested, 33% recover for energy, 2.1% composting, and 0.4% for human consumption.
BARILLA CANTEEN’S PROJECT TO REDUCE FOOD LOSS AND WASTE

A research by Last Minute Market on domestic waste in the Italian households (www.sprecozero.it), shows that in Italy the total food waste is worth over €15 billion and what we throw into homes, canteens and restaurants represents 4/5 (€12 billion) of the total.

Awareness about this issue, Barilla has started in March 2018 a pilot project, called Winnow, for measuring and minimizing waste of the catering service in its Pedrignano office restaurant’s.

BARILLA’S WINNOW PROJECT

Winnow project has been implemented in collaboration with the catering partner Felsinea Ristorazione and with the technological support from the English company Winnow.

The project concerns the use of a tablet for the measurement and analysis of food waste and the implementation of a special routine: Felsinea staff throws food waste into a dedicated bin and registers the weight and type of food waste via the digital tablet directly connected to Winnow’s system that records all the information and create daily reports showing waste trends in the time. By analysing reports and trends Felsinea staff can understand what are the food waste main causes, improvement areas to work on and the action plan to adopt.

Thanks to this project the canteen’s staff is now more aware and able to focus on specific improvement areas.

THE RESULTS

By implementing the project’s routine Felsinea has saved from waste, in the period from March 2018 to December 2019, 4,800 kg of food, equivalent to 11,946 meals and 21,000 kg of CO₂ eq. The largest amount of food waste has been recorded in the meal preparation phase and in the end of service returns. For these reasons Felsinea is working for reducing waste during meal preparation phase and is implementing strategies to increase customer awareness.

Thanks to the great results obtained Barilla is planning to expand the project to other Company’s canteens in its Italian plants aiming to reduce food waste.

FOOD SAVED FROM WASTE

In 22 months the project has allowed to save from waste

| 21,000 kg CO₂ eq | 4,800 kg of food | ≈12,000 meals |

PROJECT’S PARTNERS

Felsinea Ristorazione is an Italian company that provides catering services for over 45 years. It is specialized in corporate catering and offers its service in most of Barilla Italian plants’ canteens.

Winnow is an English company that builds artificial intelligence tools to help chefs run more profitable and sustainable kitchens by cutting food waste. They develop digital tools that provide data to drive improvements in kitchen production processes and reduce environmental footprint.

HOW DOES IT WORK

The canteen’s routine implemented with the project consists of simple steps:

1. Throw
   - Throw the food in a dedicated bin

2. Track
   - Register the food waste

3. Report
   - Analyze the daily report to understand the waste of the previous day

4. Briefing
   - Discuss with the team priorities and find solutions

5. Act
   - Integrate changes based on team’s decisions
Barilla is an Italian, family-owned food company. Established in 1877, it’s now an international player in the market of pasta, ready-to-use sauces, bakery products and crispbreads. Barilla is recognised worldwide as a symbol of Italian know–how and is present in more than 100 countries through its brands, which have become the icon of excellence in the food sector.

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Barilla Foundation has always worked to build a better future and it does so starting from the study of food systems, because the well-being of Planet Earth and its inhabitants also depends on our awareness and the result of our daily actions. Through research and dissemination projects, it promotes sustainable behaviors and healthy food choices for a concrete change in society.

www.fondazionebarilla.com

Last Minute Market is an accredited academic spin-off of the University of Bologna engaged in waste reduction and prevention. Active for more than 15 years, it operates with enterprises and public administrations across Italy ideating, implementing and monitoring recovery projects. Unsold (not for sale, but still edible) goods are donated to charities. LMM is also doing research, training and food waste analysis. It also promotes initiatives aimed at raising public, private and governmental awareness on waste issues. LMM started in 1998 as a research project by the Department of Agricultural Economics and Engineering of the University of Bologna, testing new practices of the social valorisation of the copious amount of unsold, fresh food that supermarkets dispose daily.

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