Retail food waste: Quantification and potential to change through the analysis of in-store data

Chroni C.¹, Abeliotis K.¹, Sigala E.¹, Piperis S.¹, Sapounaki A.², Macheras A.², Dionysopolous D.², Lasaridi K.¹

¹Harokopio University
²AB Vassilopoulos
In terms of definition

According to EU, **Food Waste (FW)** is defined as any substance or product (processed, partially processed or unprocessed), intended to be, or reasonably expected to be ingested by humans, that becomes waste.
Food waste is generated in each stage of the food supply chain

Estimates of 2013 (FUSION Stenmark et al., 2016)
- Food waste in EU is estimated as 88 million tons per year, 173 kg/capita
- 20% of total food produced in the EU
- 53% of such waste is produced at households

931 million tonnes of food waste was generated in 2019:
- 61% of which came from households,
- 26% from food service
- 13% from retail
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.
• Food retailers are key supply chain players
• Various store sizes
• Geographical distribution
• Multiple suppliers/complex logistics
• Different shelf lives of products
• Lack of reported data
The retailer dilemma

Customer supply/quality satisfaction

Customer waste concerns
<table>
<thead>
<tr>
<th>Sector</th>
<th>Methods of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing (if included)</td>
<td>Mass balance</td>
</tr>
<tr>
<td>Retail</td>
<td>Counting/scanning</td>
</tr>
<tr>
<td>Food service</td>
<td>Diaries (for material going down sewer, home composted or fed to animals)</td>
</tr>
<tr>
<td>Household</td>
<td>Volumetric assessment</td>
</tr>
<tr>
<td></td>
<td>Waste composition analysis (for waste streams in which food is mixed with non-food)</td>
</tr>
</tbody>
</table>

*Table 4: Appropriate methods of measurement for different sectors*

*Source: UNEP Food Waste Index Report 2021*
Methodology

Quantification through the analysis of in-store data

- AB Vassilopoulos: Leader-by-example
- In order to tackle the problem, AB Vassilopoulos and Harokopio University are working together
- Raw data provided by the retailer (shrink)
- Further actions include interviews with suppliers of the retailer and diaries & questionnaires for households
In-store departments – food categories

- Fresh grocery (fruits and vegetables)
- Bread/pastry
- Cooked
- Basic processed products
- Dairy/refrigerated
- Flour/Pasta/Rice/Legumes
- Fresh meat
- Fresh fish
- Cured meat/fish
Five reported areas

- Donation
- In-store waste (multiple reasons)
- Warehouse waste (multiple reasons)
- Store returns
- Warehouse returns (no waste)
Key results

• During 2019: 8,584,171 kg of food waste were generated, for a total value of 22.8 million €

• 35.1% wt. (18.3% value) from fresh grocery department
• Dairy/refrigerated (25.4% wt./ 22.2% in value)
• Bread/Pastry/Cooked (17.1% wt./ 20.3% in value)

• Donations: 819,669 kg
<table>
<thead>
<tr>
<th>Department</th>
<th>Donation (kg)</th>
<th>Food Waste (kg)</th>
<th>Warehouse returns (kg)</th>
<th>Total (kg)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRUITS, VEGETABLES &amp; PLANTS</td>
<td>27,498</td>
<td>3,013,303</td>
<td>5,188,450</td>
<td>8,229,252</td>
<td>49.5%</td>
</tr>
<tr>
<td>DAIRY</td>
<td>387,928</td>
<td>2,176,676</td>
<td>732,634</td>
<td>3,297,238</td>
<td>19.8%</td>
</tr>
<tr>
<td>DELI &amp; BAKERY</td>
<td>275,351</td>
<td>1,464,330</td>
<td>108,778</td>
<td>1,848,461</td>
<td>11.1%</td>
</tr>
<tr>
<td>MEAT &amp; FISH (FRESH/PROCESSED)</td>
<td>53,679</td>
<td>1,261,186</td>
<td>182,460</td>
<td>1,497,326</td>
<td>9.0%</td>
</tr>
<tr>
<td>GROCERY FOOD</td>
<td>71,422</td>
<td>573,787</td>
<td>686,545</td>
<td>1,331,755</td>
<td>8.0%</td>
</tr>
<tr>
<td>FROZEN</td>
<td>3,788</td>
<td>94,887</td>
<td>329,715</td>
<td>428,391</td>
<td>2.6%</td>
</tr>
<tr>
<td>Total</td>
<td>819,669</td>
<td>8,584,171</td>
<td>7,228,585</td>
<td>16,632,425</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Food waste (%wt) - areas

- Warehouse returns 43.5%
- Store returns 9.0%
- Warehouse waste 2.3%
- Other reason 40.3%
- Donations 4.9%
### % (weight) waste generated per department

<table>
<thead>
<tr>
<th>Department</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROZEN</td>
<td>0.9%</td>
<td>17.6%</td>
<td>4.0%</td>
<td>0.6%</td>
<td>77.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROCERY FOOD</td>
<td>5.4%</td>
<td>33.2%</td>
<td>7.2%</td>
<td>2.8%</td>
<td>51.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEAT &amp; FISH (FRESH/PROCESSED)</td>
<td>3.6%</td>
<td>79.9%</td>
<td>1.5%</td>
<td>2.8%</td>
<td>12.2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DELI &amp; BAKERY</td>
<td>14.9%</td>
<td>41.3%</td>
<td>1.3%</td>
<td>36.6%</td>
<td>5.9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAIRY</td>
<td>11.8%</td>
<td>40.5%</td>
<td>3.5%</td>
<td>22.0%</td>
<td>22.2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRUITS, VEGETABLES &amp; PLANTS</td>
<td>0.3%</td>
<td>35.2%</td>
<td>1.3%</td>
<td>0.2%</td>
<td>63.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Reason 19, Other reason, Καταστροφές αποθηκών, Επιστροφές καταστημάτων, Επιστροφές αποθηκών*
% (VALUE) waste generated per department

- **FROZEN**
  - Reason 1: 0.9%
  - Other reason: 17.6%
  - Καταστροφές αποθηκών: 4.0%
  - Επιστροφές αποθηκών: 0.6%
  - Ποσοστιαία κατανομή αιτίου σπατάλης (κ.β.): 77.0%

- **GROCERY FOOD**
  - Reason 1: 5.4%
  - Other reason: 33.2%
  - Καταστροφές αποθηκών: 7.2%
  - Επιστροφές καταστημάτων: 2.8%
  - Ποσοστιαία κατανομή αιτίου σπατάλης (κ.β.): 51.6%

- **MEAT & FISH (FRESH/PROCESSSED)**
  - Reason 1: 3.6%
  - Other reason: 39.9%
  - Καταστροφές αποθηκών: 2.8%
  - Επιστροφές καταστημάτων: 1.3%
  - Ποσοστιαία κατανομή αιτίου σπατάλης (κ.β.): 12.2%

- **DELI & BAKERY**
  - Reason 1: 14.9%
  - Other reason: 41.3%
  - Καταστροφές αποθηκών: 1.3%
  - Ποσοστιαία κατανομή αιτίου σπατάλης (κ.β.): 36.6%
  - Επιστροφές καταστημάτων: 5.9%

- **DAIRY**
  - Reason 1: 11.8%
  - Other reason: 40.5%
  - Καταστροφές αποθηκών: 3.5%
  - Επιστροφές καταστημάτων: 22.0%
  - Ποσοστιαία κατανομή αιτίου σπατάλης (κ.β.): 22.2%

- **FRUITS, VEGETABLES & PLANTS**
  - Reason 1: 0.3%
  - Other reason: 35.2%
  - Καταστροφές αποθηκών: 1.3%
  - Επιστροφές καταστημάτων: 0.2%
  - Ποσοστιαία κατανομή αιτίου σπατάλης (κ.β.): 63.0%
Conclusions
• An in-store data analysis has been performed for the first time in Greece
• The fresh grocery products dominate in-store food waste followed by dairy products
• The overall percentage of food waste is modest, at <2% of sales, indicating a high efficiency of processes
• However, grocery retailers can - and should - make meaningful changes to help limit food waste mainly through increasing donation
• Donation is about 10% of the total unsold food
• Donation at the store level is resource intensive, but can be further enhanced
Thanks for your attention!
FW quantification: preliminary results

Avoidable food waste percentage per food category

- Vegetables: 14%
- Fruits: 12%
- Meats: 4%
- Fish: 4%
- Bakery: 11%
- Dairy: 14%
- Eggs: 3%
- Veean products: 3%
- Pasta & Rice: 5%
- Cakes, Snacks, etc: 6%
- Legumes: 6%
- Potatoes: 5%
- Ξηροί Καρποί: 6%
- Ζυμαρικά & Ρύζι: 5%
- Μπισκότα: 6%
- Όσπρια: 5%
- Πατάτες & Πουρές: 3%
- Άλλα: 3%
- Spreads: 3%
- Other: 3%

42 kg avoidable FW / person / year

<table>
<thead>
<tr>
<th>Category</th>
<th>MO (gr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Λαχανικά</td>
<td>48,6</td>
</tr>
<tr>
<td>Φρούτα</td>
<td>41,9</td>
</tr>
<tr>
<td>Κρέατα</td>
<td>12,4</td>
</tr>
<tr>
<td>Ψάρι</td>
<td>11,2</td>
</tr>
<tr>
<td>Αρτοποιήματα</td>
<td>39,5</td>
</tr>
<tr>
<td>Γαλακτοκομικά</td>
<td>44,6</td>
</tr>
<tr>
<td>Αβγά</td>
<td>9,8</td>
</tr>
<tr>
<td>Φυτικά</td>
<td>8,7</td>
</tr>
<tr>
<td>Ζυμαρικά &amp; Ρύζι</td>
<td>20,0</td>
</tr>
<tr>
<td>Γλυκά, Κέηκ,</td>
<td></td>
</tr>
<tr>
<td>Μπισκότα</td>
<td>8,8</td>
</tr>
<tr>
<td>Όσπρια</td>
<td>20,4</td>
</tr>
<tr>
<td>Πιτάτες &amp; Πουρές</td>
<td>20,0</td>
</tr>
<tr>
<td>Ξηροί Καρποί</td>
<td>14,1</td>
</tr>
<tr>
<td>Αλείμματα</td>
<td>19,9</td>
</tr>
<tr>
<td>Άλλα</td>
<td>15,1</td>
</tr>
</tbody>
</table>
Recruitment platform

Number of volunteers = 2,897
Number of selected participants = 2,519

(questionnaire)

Food waste diary

- **1st wave:** 13/03/2021 – 19/03/2021
- **2nd wave:** 20/03/2021 – 26/03/2021

<table>
<thead>
<tr>
<th>Target: 7 days</th>
<th>A’ wave</th>
<th>B’ wave</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 days</td>
<td>243</td>
<td>289</td>
</tr>
<tr>
<td>6 days</td>
<td>67</td>
<td>47</td>
</tr>
<tr>
<td>5 days</td>
<td>46</td>
<td>30</td>
</tr>
<tr>
<td>&lt; 5 days</td>
<td>276</td>
<td>171</td>
</tr>
<tr>
<td>Total &gt; 5 days</td>
<td>356</td>
<td>366</td>
</tr>
</tbody>
</table>