Collecting Data to Monitor SDG Target 12.3

FAO Workshop on: Monitoring SDG 12.3.1 Global Food Loss Index
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Presenters:
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Reminder:
- Definition of Food Losses
- Food Loss Percentage

Complexity of measuring losses at country level
- Harnessing multiple dimensions: stages of the supply chain, types of actors, commodities..

The need to have a data collection strategy
Food Loss Percentage (FLP) of a country is the average percentage losses of key items weighted with their value of production:

$$FLP_{it} = \frac{\sum_j l_{ijt} \cdot (q_0 \cdot p_0)}{\sum_j (q_0 \cdot p_0)}$$

- Where:
  - $l_{ijt}$ is the loss percentage (estimated or observed)
  - Country = i, year = t, commodity = j
  - 0 is the base year
  - $q_0$ is the production quantities by country, commodity in the base period
  - $p_0$ is the international price by commodity (at international $)

- A country’s Food Loss Percentage can be interpreted as the average percentage of supply that does not reach the retail stage.
Framing the Perspective: How the data feeds the SDG 12.3.1
The Global Food Loss and Waste – extent, causes and prevention

FAO (SAVE FOOD) to the Swedish Institute of Food and Biotechnology (SIK) from August 2010 to January 2011. The estimates from this paper conclude that the global food loss and waste is approximately 30% of all food produced.

The study uses a mass flow model to quantify the annual volumes of food loss and waste at a global scope.

- It divides the world into three main categories (low-, medium- and high-income countries)
- Food Balance Sheet (FBS) groupings (Cereals; Root & Tubers; Oilseeds & Pulses; Fruit & Vegetables; Meat, Fish & Seafood; Milk & Eggs).
- Conversions factors were used to convert food available for human consumption to their equivalents based on the literature available on non-edible quantities of different commodities.
- Included animal feed and consumer and retail
- Is not replicable, given the high uncertainty of where the conversion factors on the supply stages originated
Supply Chain – Broad picture

- **Mexico’s Maize Value Chain**
- Each color represents a different stage,
- Each change in color represents a strata in the stage
- The green stage alone impacts almost 3 million farmers/firms

\[ l_{ijt} = 17.6\% \]
Supply Chain – Broad picture

• Break down the problem into structured parts – stages
  • Simplify the supply chain to main stages

• Get to loss estimates for each stage
  • then aggregate to the whole chain (do not add percentages across the value chain)
  • Each stage will have different measurement challenges in terms of tracking loss quantities over time

• Evaluate where the information comes from at each stage
  • How to think about layering information to keep this cost-effective
Let’s assume a production curve for a country and then segment out the supply chain.

(start simple and then add complexity where needed)
Different actors on the chain – Broad picture

The area under the production curve is the total amount produced in the country.

The area under the loss curve is the total amount lost in the country.

National loss % for the farm stage = Total losses / Total production * 100
Different farm types experience different loss levels. They differ by their number too.

- Break down the problem into structured parts—farms by size and/or type.
- Get to nationally representative loss estimates for each group: then aggregate to the whole chain.
- Evaluate the available data sources: How to think about layering information to keep this cost-effective.
Current State of Data and Knowledge
Current status of data

• Loss data are collected by FAO though its agricultural production questionnaire.
• Total quantities by main products, from farm up to but excluding retail
• Provide a mechanism for aggregating subnational data to a national estimate for each country/commodity/year
  • Most data available is studies from sub-national stages
  • Comparison to the FBS/SUA National level data
  • Improve variability of data
    • Necessary in modeling estimates – difficultly modeling flat lines
Summary

• Not all the information has been tapped yet
  • Limited access to National reports
  • Language barrier
  • Up-coming case studies and partnerships with international organizations

• Importance of increasing the evidence base
• The international model is a forced solution for the moment
Strategy & Recommendations
Strategy & Recommendations

• FAOs approach has focused on more cost-effective and simplified methods to strengthen the knowledge base through:
  • Improving data collection
    • Starting with the rapid appraisal & case study methods and moving to more strategic but nationally representative estimates in critical loss points
    • Policy can drive further disaggregation at stages (e.g. export markets vs subsistence)
    • Assess current data collection efforts and how they can be improved for loss data collection
    • Strategies and complexities by each stage are outlined in the Guidelines
    • Improve cost-effectiveness by collected and estimated with a variety of tools
  • Strengthen National estimates thru national statistics that can be consistently collected
  • Improving the predictive power of models (in years where data is not collected)
Measurement approaches

• No single solution, the choice depends on the:
  • Purpose of the measure: preliminary estimate for quick assessment, national figure for policy purposes, etc.
  • Resources available (financial, human, technical)
  • Prior experience in loss assessments
  • Time available, etc.

• Strategy to chose the most cost-effective statistical tool to fit the purpose

• Data collection efforts need to be prioritized and STRATEGISED:
  • Which crops?
  • Which segment of the value chain (on/off-farm, etc.)?
  • Which method for crop x segment?
Data collection methods: Guidelines on the measurement of losses

- **Objective:** To obtain nationally representative loss estimates
- Grounded in the National Statistics Systems
- Range of surveys and sample-based statistical tools are described
- Drawn from 40 years of methodological literature and field practice
Measurement approaches from the Guidelines
Measurement approaches – range of tools

• Data collection methods can (should) be combined:
  • **Rapid assessments to identify the loss “hot spots”**: non-survey approaches, qualitative methods (focus groups, etc.), small samples, visual scales, etc.
  • **Experimental designs to go in-depth into a specific aspect**: e.g. differences in losses across certain varieties, specific farming practices (e.g. harvesting method/time), etc.
  • **Qualitative approaches (e.g. focus groups) to better understand the socio-economic dynamics** underpinning post-harvest management practices
  • **Full-sample surveys to construct national loss estimates** by crops, that can be used as a benchmark
  • **Modelling to improve the quality of the estimates** (e.g. correcting declarative bias) and their efficiency, by allowing to reduce sample sizes or by providing model-based estimates between two survey rounds
FAO Food Loss Analysis (FLA) methodology
and links to SDG 12.3 monitoring at the national level
Food loss analysis case study methodology

Food loss is a complex issue, often with multiple and interrelated causes operating at different levels. This e-learning course introduces the FAO Case study methodology for the analysis of critical food loss points. This method focuses on revealing and analyzing the multidimensional causes of losses in selected food supply chains, identification of critical loss points, and recommendation of feasible food loss reduction solutions and strategies.

Objectives of the Food Loss Analysis (FLA) Case study methodology and uses of FLA outputs

- Identification of **Critical Loss Points** of selected Food Supply Chains (FSC) *where measurements and loss reduction investments and actions need to be prioritized*

- Identification of **major causes of losses** (technical / economic / social) at different levels *and causes at micro – meso – macro levels*

- Identification/assessment of **feasible/sustainable/profitable solutions, and strategies in a given context** *(taking in account causes related to specific agro-ecology, level of development / knowledge, available solutions, etc.)*
Objectives of the Food Loss Analysis (FLA) Case study methodology and uses of FLA outputs

- Identification of environmental impacts / climate smart solutions
- Contribution to the formulation of FLR strategies and policies
- What questions to ask at the proper level to feed into a national level monitoring tool of food losses or into a food loss estimation model
- FAO’s current programme: Save Food Initiative, technical assistance provided, overview of results
Food Loss Analyses approaches used along the selected food supply chains

Focus group discussions
Key informants interviews

Observations
Harvesting practices

Storage practices and traditional granaries

Load tracking, observation of symptoms and causes of losses
Piloting of recommended technical solutions

- Allgate dryer (DRC)
- Manual sheller (DRC)
- Mechanized sheller (Burkina Faso)
- Small plastic cans (DRC)
- Metal and plastic silos (DRC)
- Tarpaulins (Uganda, DRC, Burkina Faso)
- Cribs (Uganda)
- Hermetic bags (Burkina Faso, DRC)
- Metal and plastic silos, hermetic bags (Uganda)
Scaling up efforts

Moving to the National Level estimates for losses
Rapid Appraisals/Case studies are typically limited to few observations and may not be representative but are useful for strategizing critical loss points.

The rapid appraisal methods will also likely overestimate losses both when expanded to the national production estimates and when put into basic regressions.

For critical loss points – more knowledge & structure is needed.
Using supply chain analysis to identify the critical loss points

- measuring losses at the critical loss points
- Identify the critical missing data/surveys that may cover these stages and loss points
Using supply chain analysis to identify the critical loss points

These best guess-estimates are based on experts and stakeholder roundtables, producer groups etc.

Rapid Assessments typically stop here.

<table>
<thead>
<tr>
<th>Fase</th>
<th>Tipo</th>
<th>Número</th>
<th>Volumen (mil ton)</th>
<th>Pérdidas en %</th>
<th>Pérdidas en Volumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cosecha y post-cosecha</td>
<td>Producción de tecnología y producción alta</td>
<td>248,000</td>
<td>13,016</td>
<td>4%</td>
<td>521</td>
</tr>
<tr>
<td></td>
<td>Producción de tecnología y producción media</td>
<td>519,000</td>
<td>4,722</td>
<td>12.2%</td>
<td>581</td>
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<tr>
<td></td>
<td>Producción de autoconsumo</td>
<td>2,3 millones</td>
<td>4,875</td>
<td>14.6%</td>
<td>572</td>
</tr>
<tr>
<td></td>
<td><strong>Total producción</strong></td>
<td></td>
<td>21,693</td>
<td>7.3%</td>
<td>1,673</td>
</tr>
<tr>
<td>Acopio y transporte</td>
<td>Comercializadores formales</td>
<td>12,000</td>
<td></td>
<td>1.5%</td>
<td>263</td>
</tr>
<tr>
<td></td>
<td>Acopiadores y comercializadores informales</td>
<td>6,058</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total acopio</strong></td>
<td></td>
<td>18,058</td>
<td>1.5%</td>
<td>263</td>
</tr>
<tr>
<td></td>
<td><strong>Total sin acopio</strong></td>
<td></td>
<td>3,635</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Almacenamiento</td>
<td>Nivel 1 – Instalaciones mecanizadas</td>
<td>190</td>
<td>7,559</td>
<td>3%</td>
<td>189</td>
</tr>
<tr>
<td></td>
<td>Nivel 2 – Semi-mecanizadas</td>
<td>286</td>
<td>2,268</td>
<td>4%</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>Nivel 3 – Interrupciones</td>
<td>152</td>
<td>394</td>
<td>4%</td>
<td>15.7</td>
</tr>
<tr>
<td></td>
<td>Nivel 4 – Patios y terrenos baldíos</td>
<td>540</td>
<td>772</td>
<td>8%</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Almacenamiento informal</td>
<td>??</td>
<td>6,081</td>
<td>15%</td>
<td>1,020</td>
</tr>
<tr>
<td></td>
<td><strong>Total almacenamiento</strong></td>
<td></td>
<td>19,378</td>
<td>7.7%</td>
<td>1,377</td>
</tr>
<tr>
<td></td>
<td><strong>Total sin almacenamiento</strong></td>
<td></td>
<td>2,315</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procesamiento</td>
<td>Industria de harina de maíz</td>
<td>55</td>
<td>2,487</td>
<td>2%</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Industria de la masa y la tortilla</td>
<td>5,146</td>
<td>3,783</td>
<td>5.1%</td>
<td>262</td>
</tr>
<tr>
<td></td>
<td>Tortillerías tradicionales de tortillas</td>
<td>85,924</td>
<td>5,012</td>
<td>4.6%</td>
<td>174</td>
</tr>
<tr>
<td></td>
<td>Consumo en granos o masa</td>
<td>1,998</td>
<td>1,998</td>
<td>1%</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Total industria</strong></td>
<td></td>
<td>13,414</td>
<td>3.5%</td>
<td>506</td>
</tr>
<tr>
<td></td>
<td><strong>Total sin procesamiento</strong></td>
<td></td>
<td>8,279</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total de pérdidas</strong></td>
<td></td>
<td></td>
<td>17.6%</td>
<td>3,820</td>
</tr>
</tbody>
</table>
Measurement approaches - recommended

The first best are sample surveys for data collection at the critical points because:

• They are able to provide statistically representative and comparable estimates, for a country, by crop, agro-ecological zone, etc.

• Estimates of precision can be provided, that indicate how confident we can be in the results

• Modelling can be used to improve survey results and increase efficiency (e.g. allowing for smaller sample sizes)

• Most countries already have farm surveys, to which a PHL module can be anchored => cost-efficiency

• Focuses efforts where they are most needed

• Measurement of losses follows best practices: physical measurements, visual scales, etc.
Measurement approaches – range of tools

• Choice of instrument will be needed to mapped to existing instruments and policies
  • Appropriate to the data needs
  • Connects policy decisions with problems in the markets

• Should collect data that will aid in modeling during years that data is not collected

• Cost-effective to use existing surveys and information systems
  • Helps assessing the national level data that is available and the coverage of existing efforts
  • Use existing sampling frames where possible for comparison of data collected over time
  • Long-term measurements vs. one-offs
### Linking Rapid Appraisals to Existing Instruments – Mexico Example

- Systematically went stage by stage, to see where there were existing instruments and for the key loss causes identified by the rapid assessment.

- Questions from the instrument were assessed to see if they would give enough information to better inform the loss percentages at each stage, across value-chains and additionally where more narrow instruments are being applied.

- Where there is no information existing suggestions for new instruments are being discussed with the government.

#### Maize: Medium sized farmers storing at farm level

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Instruments and Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator on food loss due to not proper storage at farm level</td>
<td>INEGI – Agriculture Statistics Survey: includes a question if product is stored</td>
</tr>
<tr>
<td>Indicator on types of storage facilities used or storage services paid for</td>
<td>INEGI – Agricultural Census: includes a question if product is stored, but no details on types of storage</td>
</tr>
<tr>
<td>Indicator on the amount stored and time of storage (short term - medium term)</td>
<td>Pilot of INEGI – Supply Chain Survey where details on storage at farm level are asked</td>
</tr>
<tr>
<td>Indicator on the destination of the product (animal feeding, selling, own consumption)</td>
<td>INEGI – Agriculture Statistics Survey: exists the indicator, but needs to disaggregated by medium sized products</td>
</tr>
<tr>
<td>Indicator on commercialization linkages</td>
<td>INEGI – Agricultural Census: question on type of buyer (middlemen, direct to consumer, industry, etc.) but has to be disaggregated for small scale farmers</td>
</tr>
<tr>
<td>Timing of harvesting and commercialization (access to machinery services, enforcement of middleman agreements)</td>
<td>No information existing CIMMYT might have information</td>
</tr>
<tr>
<td>Secondary market dynamics (the role of animal feeding as lower quality market)</td>
<td>No information existing CIMMYT might have information</td>
</tr>
<tr>
<td>No markets available/market accessibility constraints</td>
<td>No information existing CIMMYT might have information</td>
</tr>
<tr>
<td>Indicator on processing of the product applied (drying, shilling, cleaning, packaging)</td>
<td>No information existing, but pilot of INEGI – Supply Chain Survey where they ask for post-harvest processes as packaging or other value added CIMMYT might have information</td>
</tr>
</tbody>
</table>

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**Non-intentional storage on farm**

**Market linkages**

**Harvest and post-harvest handling**
Linking Rapid Appraisals to Existing Instruments

• One Conclusion for the rapid assessment for maize in Mexico was:
  • Storage at middle scale farmers’ level: 15.2% of total food losses occur here.
    • The solution [for maize] would need to cover amounts of between 4-5 tons (covering production over 1-2 ha) for the small scale farmer and 60-200 tons (6-8 ha) for the medium scale farmer.
    • In addition, the solutions would need to be deployable for short to medium term (1-2 weeks to 3-4 months).”

• Potential questions that would need to be covered in a survey:
  • What kind of storage does the farmer have access to?
  • How much of the commodity does the farmer store? For how long?
Cost-effective Data Sources for each objective

• Monitor the efficiency of supply chains through food losses
  • Integration of losses into the national statistics – collect data at a marginal cost
    • from sector-specific data collection to general food system across the whole supply chains
  • identification of cross-cutting data gaps to understand linkages between the different stages of the food system
  • Sustainability and consistency across time
  • Expand **existing** national agricultural surveys, Value Chain surveys, develop surveys on stages that aren’t covered
It may not be effective to use sample surveys for the entire stage of the supply chain.

- For firms that are large enough, direct accounting may give the best data.
Cost-effective Data Sources for each objective

• Design concrete policy interventions through Indicators at micro level
  • product specific indicators that require detailed information and an additional survey
    • To inform questions, model losses or adjust policies
    • Focus on the principal causing factors or intervention strategies
  • Ex. National Value Chain surveys

• Expand and impute food loss factors and integrate them into the nation-wide assessment
  • Administrative data needed to expand the loss factors from stratifications in the sample surveys and experimental design results with data at the national level
  • Ex. Experimental Designs, target population surveys
Aggregating data - Across the Value Chain
Aggregating Subnational Data

• One of the most significant mistakes in overestimating losses has been in aggregating estimates along the supply chain.

• Different stages have different starting quantities, and therefore percentages cannot be summed across the entire chain.
  • If available, the area under the loss curve can be summed at each stage and divided over the total quantity at that stage,
  • However, that only gets us to the national estimate for losses at each stage not across the supply chain.
Using $\hat{L}$ in the Supply Chain

<table>
<thead>
<tr>
<th></th>
<th>Farm</th>
<th>Transport</th>
<th>Storage</th>
<th>Wholesale</th>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting Amount</td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Losses (%)</td>
<td>7.3</td>
<td>1.5</td>
<td>7.7</td>
<td>0</td>
<td>3.5</td>
</tr>
<tr>
<td>Amount Lost</td>
<td>73</td>
<td>13.905</td>
<td>70.308</td>
<td>0</td>
<td>29.497</td>
</tr>
<tr>
<td>Amount Remaining</td>
<td>927</td>
<td>913.095</td>
<td>842.787</td>
<td>842.787</td>
<td>813.289</td>
</tr>
<tr>
<td>% of original still in the market</td>
<td>81.3% ($813.289/1000) *100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% lost from farm to (but not including) retail</td>
<td>18.7% ($1-0.813)*100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>