



Food and Agriculture Organization
of the United Nations

PILOT TESTING THE FOOD LOSS INDEX

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Introduction

The objective of the Sustainable Development Goal (SDG) 12 is to ‘Ensure sustainable consumption and production patterns’, with the more specific Target 12.3 which aims, “by 2030, to 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.” The indicator for this target (Global Food Loss Index) was categorized as a Tier III indicator, meaning that the methodology, data collection mechanisms and a baseline needed to be fully developed, tested and adopted. This paper proposes the methodology for the Global Food Loss Index developed by FAO to measure and monitor losses for its up-grade to Tier II.

The custodian agencies, FAO and UNEP, have proposed to split the target 12.3 into two stages with the first focus on the ‘*reduction of losses along the food production and supply chains*’ (*supply oriented*) and the second to measure the ‘*halving per capita global food waste at the retail and consumer level*’ (*demand oriented*). The nature of the target with its two distinctly worded components, waste and loss, implies the identification of two separate aspects of an efficient sustainable food system, with different policy tools and objectives. While the two concepts are related and the precise boundaries between them may be blurred conceptually, for operational clarity and measurement and to bring more effective and efficient outcomes, it is necessary to separate the supply and the demand sides of the matter.

It is therefore proposed to have an indicator 12.3.1 Global Food Loss Index (GFLI) and an indicator 12.3.2 Global Food Waste Indicator (GWLI), which is still under development. This document presents instructions for piloting the Food Loss Index and Food Loss Percentages (FLI/FLP) for countries that have data. The respective country FLIs aggregate to the Global Food Loss Index across all countries.

From the methodological document which describes the steps for calculating the index along with a method to aggregate data from subnational stages of the supply chain to the national level. To measure and monitor food losses along the supply chain countries can follow the main principles of the methodology, which will be explained in depth throughout the document:

Steps to compiling the Index if the data exists:

1. Select Basket of Commodities and compile weights
2. Compile Food Loss Percentages¹, starting from SDG reporting year 2015
1. Compare the Food Loss Percentage over time²
3. Report the percentage losses, converted to quantity in the Food Balance Sheets

¹ These should be nationally representative estimates at minimum, countries may get more value from having these losses represented at subnational stages.

² For the baseline it is recommended to survey 3 consecutive years and then measured again every 3 to 5 years after

Data Sources

Several sources of data can be used to compile the loss percentages at country level to feed into the SDG target 12.3 on decreasing post-harvest losses and the Food Loss Percentages by commodity and in aggregate by country. Since the underlying data is a critical component to calculating the indices as well as the complexities of these supply chains in measuring and monitoring post-harvest losses, a strategy for collecting is needed.

FAO has been piloting how to incorporate existing food loss data, how to prioritize and target data collection efforts within a strategy working paper, which is still in draft form and is being generalized and expanded upon with country experiences. The document illustrates that countries will want to assess the critical loss points as primary step³. The document will further address how to incorporate existing information and data from disparate sources, in order to build an information system to measure and track losses at the national level. These sources include the administrative and sectoral data, expert opinion across various stages, and survey data from various data collection instruments. Both the guidelines and the strategy documents aim to improve the data in cost-effective ways.

There is no single ideal method of collecting loss data for all commodities and countries in a cost-effective way. Therefore, a wide range of instruments is needed to address this challenge. Several sources of data can be used and different data collection methods should be combined to collect the losses percentages that feed into the indices. These can include:

- Preliminary assessments to identify the critical loss points
- Full-sample surveys to construct national loss estimates by crops, that can be used as a benchmark
- Experimental designs to go in-depth into a specific aspect
- Qualitative approaches (e.g. focus groups) to better understand the socio-economic dynamics underpinning post-harvest management practices
- 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

The strategy for combining and measuring losses are covered in the “Strategy for Measurement of Post-Harvest Food Losses”, the *FAO- Global Strategy “Guidelines on the measurement of post-production losses: Recommendations on the design of a harvest and post-harvest loss statistics system for food grains (cereals and pulses)”*⁴ and the *Annexes on Fruits and Vegetables; Animal and Animal products (Milk, Meat); and Fish and Fish Products*. Moreover, FAO can provide technical assistance in improving the collection of data.

The FAO has developed a loss imputation model to support the initial estimates of loss percentages by commodity and country for the purpose of informing the GFLI and Food Balance

⁴ GSARS and UNFAO, *Guidelines on the Measurement of Harvest and Post-Harvest Losses Recommendations on the Design of a Harvest and Post-Harvest Loss Statistics System for Food Grains (Cereals and Pulses)*.

Sheets. The model estimates at the country level first, addressing trends in the data and carryover factors that may have been reported by countries and then estimates the remaining observations at the global level, both applying the same methodology and principles laid out herein.

As previously stated, the reported data in the SUA/FBS database is insufficient to produce reliable estimates without incorporating external information. The loss percentage data available has been supplemented with information gathered from 300+ publications and reports (from academic institutions, international organizations such as the World Bank, GIZ, FAO, IFPRI, and other sources). Although there is a lot of variability in the measurement of these sources, they provide additional information on the causal factors for various stages along the supply chain.

The sources that countries should use to compile the FLI and the loss percentages for the ten key commodities in the commodity baskets will come from a variety of sources. As part of the work underlying the SDG Process has been to collect the available data for countries in the following three sources:

- 1) Production and Price Information for the selected commodities
- 2) Data officially reported in the Food Balance Sheets/ Annual Agricultural Production Questionnaire
- 3) Modeled estimates at the country and global level, following the methodology outlined in the main document
- 4) The supplemental information collected from all sources.

Within the excel documents provided to countries, these three sources are included where appropriate in the subnational and national phases. These are stored in a centralized data management system within the FAO Statistics Division and is being supplemented with estimates from the case study and rapid appraisal work done through the Nutrition Division to create a body of knowledge that can improve the technical assistance that FAO provides to countries.

Data Available for the Pilot

When considering the challenges of getting nationally representative data, countries that have already undertaken post-harvest losses studies were considered. The case study presented herein is India, where post-harvest loss surveys have been undertaken in 45 commodities and repeated to date twice. The organization of the surveying and analysis has been done by Indian Council of Agricultural Research-Central Institute of Post Harvest Engineering and Technology (ICAR-CIPHET), Ludhiana in collaboration with ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI), New Delhi. The sampling methodology for estimation of post harvest losses of major crops and commodities was developed by ICAR-IASRI.

Data for estimating their losses were collected from 120 districts of India covering 14 agro-climatic zones. Stratified multistage random sampling design was used to select the respondents. The data were collected through inquiry and by actual measurements visiting the fields by staff of AICRP on PHT centers. Data were cross-checked, scrutinized and randomly validated as described. Data which were found unfit for further analysis were discarded and finally data of 107 districts covering harvesting, collection, sorting/grading, threshing, winnowing, drying, packaging and transportation as well as storage loss at household, warehouse/cold stores,

wholesaler, retailer and processing unit level were analyzed⁵. The initial baseline studies were undertaken during 2005-2007 and then repeated in 2013-14.

Based on the information available from these two national level studies, a reliable national loss percentage could be obtained for the default basket selected from FAO for the country of India. It should be noted that as this is a pilot of the Index, and that the FLI calculated within this case study is to be considered within the domain of this study only. The country assistance in choosing the baskets of commodities and the national and international monitoring will be part of the Tier II programmatic work in supporting countries.

Food Loss Index

Step 1: Select the basket of commodities

The default commodity selection for India can be found in Table 1. The default selection criterion followed at international level to select the priority commodities and impute missing loss data and the related FLI is commodities ranking by value of production in within each country and commodity group. The default process is to:

- Compile value of production for every commodity
- Group commodities by category and rank them
- Select the top 2

The default selection process is based on the international dollar value of the commodity in the base year. At national level countries can use their own set of values or quantities and prices or use different policy based criteria, as long as the main headings are covered.

The index contains 10 commodities by economic value are within the five main headings, with two commodities per heading (1. Cereals & Pulses, 2. Fruits & Vegetables, 3. Roots & Tubers and Oil-Bearing crops, 4. Animals Products, 5. Fish and Fish Products).

The loss percentages for the commodities from this basket were then compiled from the available data. As the information was available in the years preceding the 2015 base year set by the SDG committee, the estimates for losses were carried over from the 2014 extrapolation. These loss percentages can be found in Table 2.

In the default basket for India, for this example the top other crop was Anise, badian, fennel, coriander, but loss percentages were not available for this crop, therefore it was replaced with Chillies and peppers.

⁵ ICAR-All India Coordinated Research Project on Post-Harvest Technology, "Assessment of Quantitative Harvest and PostHarvest Losses of Major Crops/Commodities in India."

Table 1. Top ten key commodities for India with production, prices and the percent of total value for the country in terms of production

Heading	CPC	Item Name	Production (Average 2014-2016)	Price	Percent of total value of Production
Cereals & Pulses	0111	Wheat	90,015,000	157.78	0.22
Cereals & Pulses	0113	Rice, paddy	157,648,436	278.66	0.38
Fish & Fish Products	0	Inland fish	5,992,401	0	0
Fish & Fish Products	0	Marine fish	2,900,030	0	0
Fruits & Vegetables	01312	Bananas	29,172,500	281.63	0.07
Fruits & Vegetables	01316	Mangoes, mangosteens, guavas	18,653,000	599.17	0.04
Meat & Animals Products	02211	Milk, whole fresh cow	75,530,620	312.06	0.18
Meat & Animals Products	21121	Meat, chicken	3,331,311	1425.71	0.01
Roots, Tubers & Oil-Bearing Crops	0142	Groundnuts, with shell	6,814,000	451.14	0.02
Roots, Tubers & Oil-Bearing Crops	01510	Potatoes	45,889,500	168.78	0.11
Other	01652	Chillies and peppers, dry	1,495,333	470.76	
Other	01802	Sugar cane	355,390,500	32.84	0.86

Table 2. Loss percentages for the top ten commodity basket for India

Group	Item Code	Commodity	On the basis of study conducted during 2005-07							On the basis of study conducted during 2012-14		
			2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cereals & Pulses	0111	Wheat	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05
Cereals & Pulses	0113	Rice, paddy	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06
Fish & Fish Products	0	Inland fish	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.05	0.05	0.05
Fish & Fish Products	0	Marine fish	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.11	0.11	0.11
Fruits & Vegetables	01312	Bananas	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08
Fruits & Vegetables	01316	Mangoes, mangosteens, guavas	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.09	0.09	0.09
Meat & Animals Products	02211	Milk, whole fresh cow	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Meat & Animals Products	21121	Meat, chicken	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.07	0.07	0.07
Roots, Tubers & Oil-Bearing Crops	0142	Groundnuts, with shell	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.06	0.06	0.06
Roots, Tubers & Oil-Bearing Crops	01510	Potatoes	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.07	0.07	0.07
Other	1652	Chillies and peppers, dry	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07
Other	01802	Sugar cane	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08

As can be seen in the loss measurement over the period of the different studies (Figure 1), there were decreases in losses over the previous periods for some of the key commodities. Overall, as the country has sought improvements in their food system over this period, the variation on loss estimates over all the headings has decreased, indicating that there are likely spillover impacts across all supply chains.

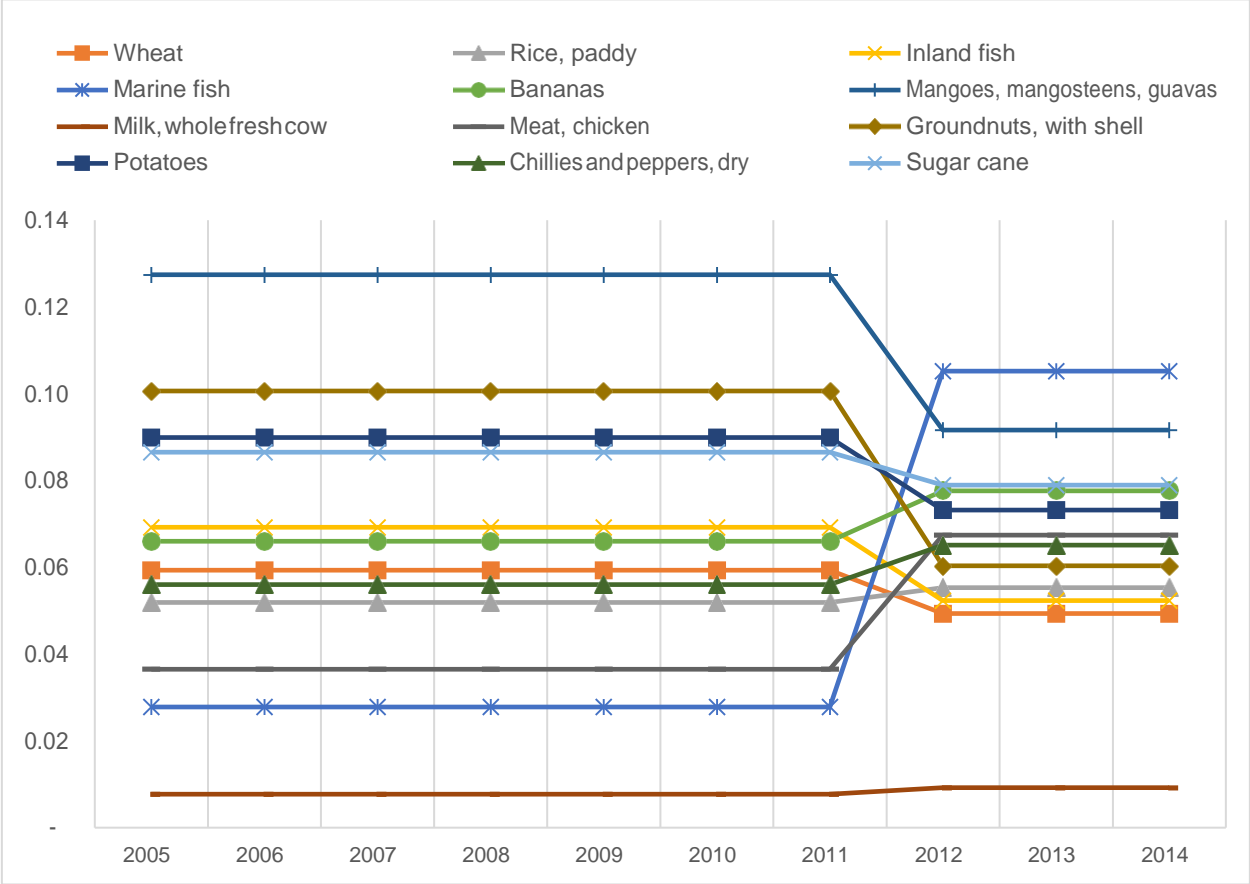


Figure 1. Changes in the loss percentages from 2005-2014

The 2014 percentages will be carried over into the FLI reporting years for 2015 to 2017. Using carryovers, instead of modeling the intermediate years means that they percentages will not change, and thus the FLI will be flat until the next study is undertaken.

FAO can work with countries to model these loss percentages in the intervening years based on factors that the countries consider critical to the policy making process, in addition to those in the loss model at the global level. This was not done in this pilot, given that these are unofficial estimates and the objective is to pilot the Food Loss Index.

Step 2: Compile the Food Loss Percentage of a country (FLP)

The second step, once countries have assessed the loss percentages over the commodity baskets is to compile the food loss percentages. The Food Loss Percentage (FLP) for a country (i), in a year (t) is defined as follows:

$$FLP_{it} = \frac{\sum_j (L_{ijt} * P_{ij0})}{\sum_j (Q_{ij0} * P_{ij0})} \quad (2)$$

Where:

- L_{ijt} is the loss percentage (estimated or observed) i = country, j = commodity, t = year
- P_{ij0} is the base year (set at 2005 for the moment)
- Q_{ij0} is the production plus import quantities by country, commodity in the base period
- P_{ij0} is the international dollar price by commodity for the base period

The FLP gives the average level of losses and will help countries assessing the magnitude of the problem relative to other countries or the international context.

The Loss percentages from Table 2 are applied to the total value of the commodity basket from Table 1. The sum of the total value of losses is divided for each year by the base year's production value to calculate an annual Food Loss Percentage (FLP).

If the monitoring period for India was 2005 to 2014, based on the losses in the data above, then the Food Loss Percentage for the country would have decreased from 5.8% to 5.5%. For the start of the SDG monitoring, the base year was set as 2015. The loss percentages from 2014 were carried over to the following years and the resulting Food loss Percentage for the country was estimated at 5.5%.

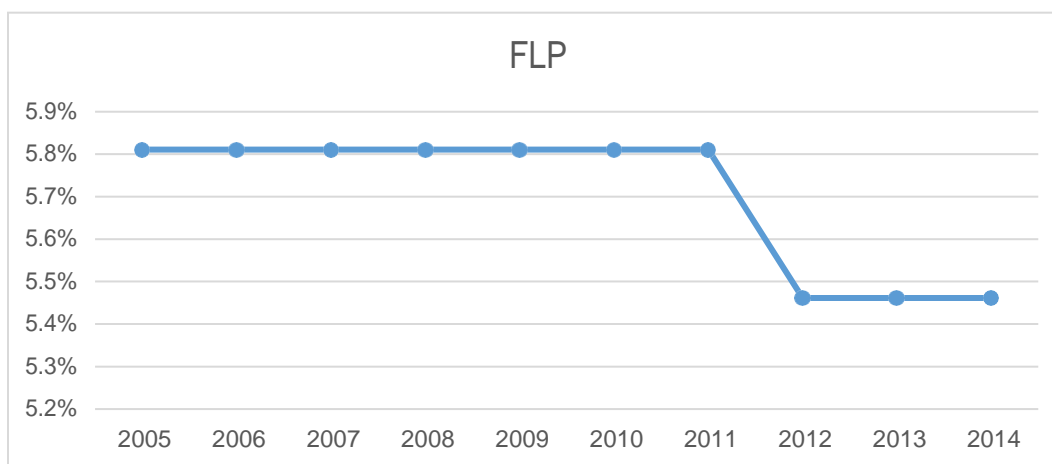


Figure 2. The Food Loss Percentage for India 2005-2014

Step 3: Compile the FLI as the ratio between two Food Loss Percentages

The country-level indices (FLI), are simply equal to the ratio of the Food Loss Percentage in the current period and the FLP in the base period multiplied by 100:

$$FLI_{t} = \frac{FLP_{t}}{FLP_{0}} * 100 \quad (3)$$

Where:

FLP_{t} is the country's Food Loss Percentage

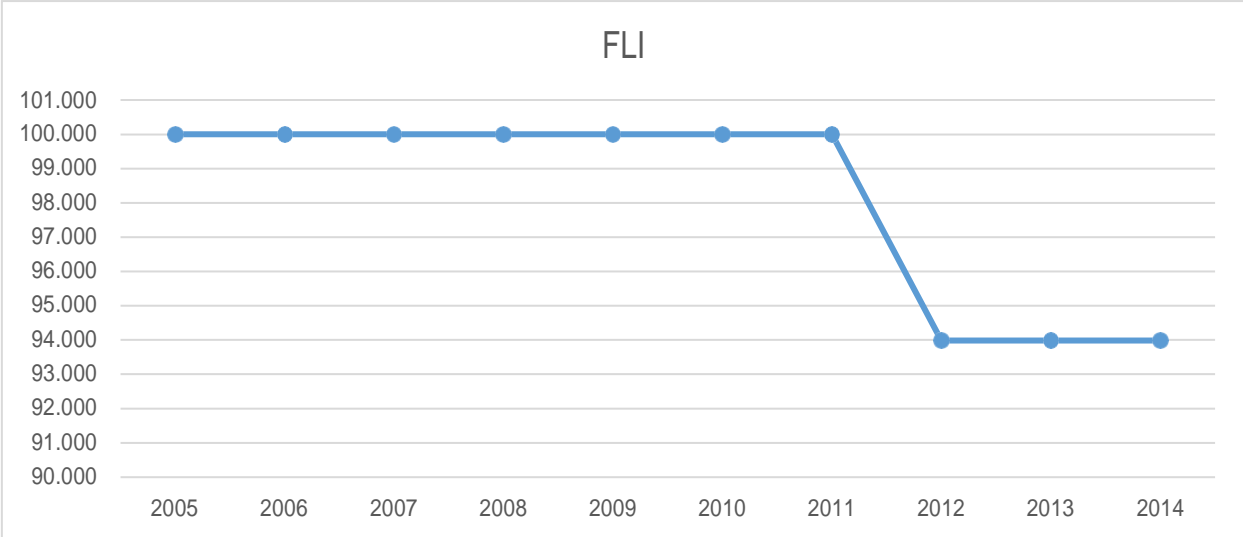


Figure 3. The Food Loss Index for India 2005-2014

The Food Loss Index for the 2005-2014 period, with 2005 as a base year, would mean that the Food Loss Index over the ten year period would decrease from 100 to a value of 94. Indicating that the country would have met the objectives of the SDG 12.3.1 if the monitoring period would have fallen between 2005-2014.

Discussion

The calculation of the Food Loss Percentage and Index (FLP/FLI) were designed to be a simple tool to monitor food losses from production to retail under the SDG Indicator 12.3.1. Although the calculation is simple, the greatest amount of effort is for countries in collecting the percentages for the key commodities.

Several countries when approached to pilot the Index, had a variety of information for losses, but not perhaps for all key commodities. In addition, the organization of the data under the loss percentages for many countries is carried over from years in which studies had been undertaken. Though, even within this example the usefulness of using carry-over estimates is limited in monitoring losses through time.

The other challenge apparent is that several countries have been undertaking loss reduction strategies, prior to measurement as well as in this case, prior to the start of the SDG monitoring process. The gains of a 0.3% decrease in food losses for India over the period of 2005-2014 may

have significant impacts on and as a result of key policies. Further analysis would be needed to see what other factors should be measured in parallel (e.g. food security and nutrition) and how to assess the efforts that were needed for even this decrease.

In addition, the policies of the countries in selecting the baskets will have an impact on where the FLI starts. It may be that other commodities, which have higher than 14% losses may be more useful for a country such as India to focus. These key commodities may be operating already as efficiently as possible and efforts are better taken elsewhere.