



Food and Agriculture Organization  
of the United Nations

>> FAO Statistics Division

# Food Loss Measurement Under SDG 12.3.1

Measuring Food Losses at the farm/harvest stages

12 RESPONSIBLE  
CONSUMPTION  
AND PRODUCTION



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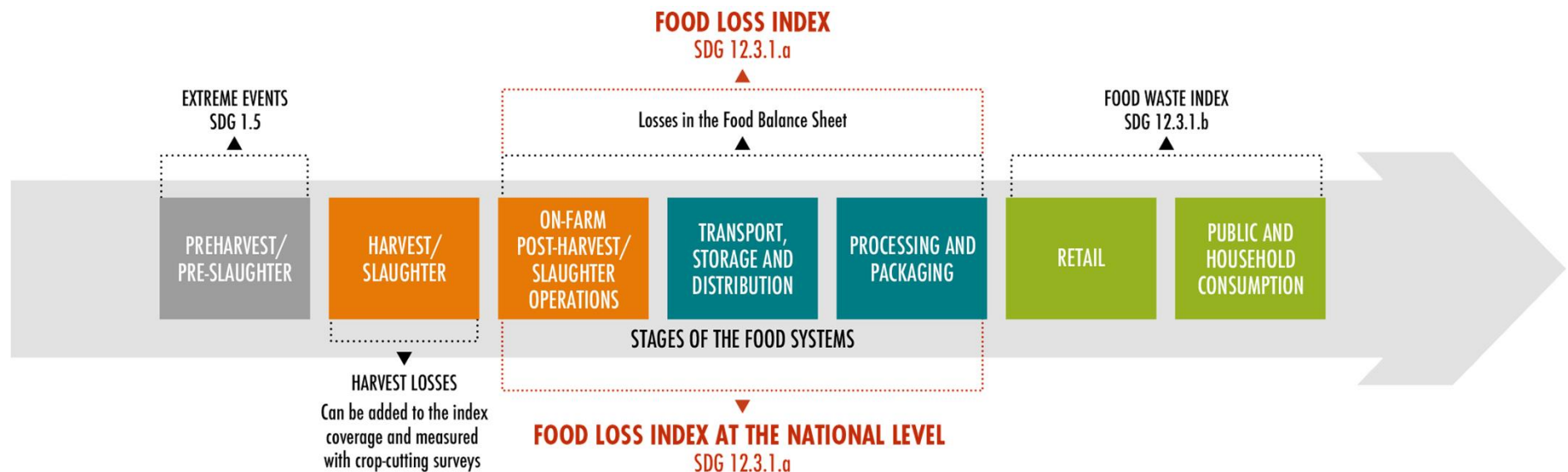
SUSTAINABLE  
DEVELOPMENT  
GOALS

# Outline

- Background/Boundaries
- Definitions
- SDG 12.3.1.a Food Loss Index
- Policy Objectives & Structuring Data Needs
- Recommendations & Guidelines by stage
- State of Knowledge
- Strategy & Recommendation
- Resources
- Reporting



## Food Loss Indices under SDG 12.3.1



*“By 2030 halve per capita global food waste at the retail and consumer level, and reduce food losses along production and supply chains including post-harvest losses”*

## Definitions

- **Food Loss in agricultural statistics (FBS)**
- Food Losses Crop and livestock product losses cover *all quantity losses* along the supply chain for all utilizations (food, feed, seed, industrial, other), up to the retail/consumption level. Losses of the commodity as a whole (including edible and non-edible parts) and losses, direct or indirect, that occur during storage, transportation and processing, also of relevant imported quantities, are therefore all included.
- **Important to keep consistency in what is being measured. Otherwise there will be comparability issues later.**

### KEY POINTS

- quantities
- that leave the chain for any reason
- all supply stages
- non-food utilizations are NOT losses
- edible + inedible parts
- waste occurring on the supply side is measured under losses
- Losses are tracked by commodity starting on the production site
- Causes collected irrespective of intention and are sorted out later

## Operational Definitions of Harvest and pre-harvest losses

	Grains & Pulses	Fruits & Vegetables	Milk & Meat	Fish
Harvest loss	These occur during the harvesting process and may be due to shattering, mechanical damage and shedding of the grain from the ears to the ground.	Quantity of produce lost during harvesting operations. These include losses from economic conditions (crops not harvested due to low prices or contract limits)	Quantity of produce i.e. meat/milk lost during slaughtering/milking operations respectively.	Harvest loss occurs mainly due to discard in good condition juveniles and low value fish. Harvest loss is the loss at the time of catch occurring at ponds/landing centres/boats/fishing crafts/trawlers etc.
Point of Maturity				
Post-harvest losses	Any losses occurring after the separation of the product from the site of immediate growth (harvest) to the moment it reaches the consumer	Post-harvest loss can be defined as reduction in available quantity of produce which becomes unfit for human consumption i.e. the degradation in quantity of a food production from harvest to consumption.	Post-harvest loss in meat/milk can be defined as reduction in available quantity of produce i.e. meat/milk which becomes unfit for human consumption. Post-harvest sector in meat/milk includes all points in supply chain from slaughtering/milking to consumption. Post-harvest activities in meat/milk include slaughtering/milking, storage, processing, packaging, transportation and marketing.	Post-harvest losses occur immediately after the catch from ponds/landing centres/boats/fishing crafts/trawlers etc. to various marketing channels till reaches to the consumer level due to improper handling, insufficient icing, insufficient containers used for transportation of fish, delay in transportation, physical damage and chemical changes leading spoilage making it unavailable and unacceptable for human consumption.

## FLI - Main principles and methodology

- Focuses on 10 key commodities in 5 main groups
- Measures Food Loss Percentages (FLP) and not on total losses
- Monitors changes in the Food Loss Percentage over time
- Based on nationally representative loss percentages along the supply chain

### COMPARABILITY

Build the international basket under 5 headings, by selecting two commodities under each:

- Cereals & Pulses;
- Fruits And Vegetables;
- Roots, Tubers & Oil-Bearing Crops;
- Animals products;
- Fish and fish products
- Other crops (stimulants, spices, sugar, etc.)



# Building the FLI- Food Loss Percentages (FLP)

6

**Food Loss Percentage (FLP)** of a country is the average percentage losses of key items weighted with their value of production:

$$FLP_{it} = \frac{\sum_j l_{ijt} * (q_0 * p_0)}{\sum_j (q_0 * p_0)} = \text{average loss (\%)} \text{ for the main products}$$

- 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.



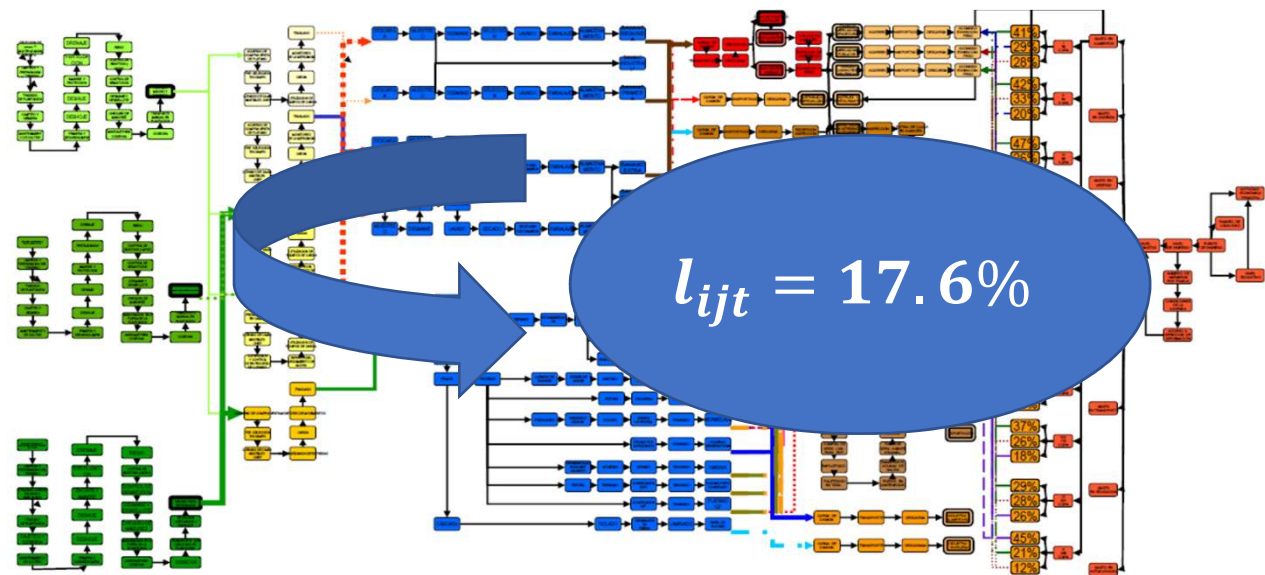


# Policy Objectives & Structuring Data Needs



## Supply Chain – Broad picture

- FAO Needs a single nationally representative number for reporting (or a range)
- Countries need to understand the dynamics of their supply system and typologies of actors at various stages



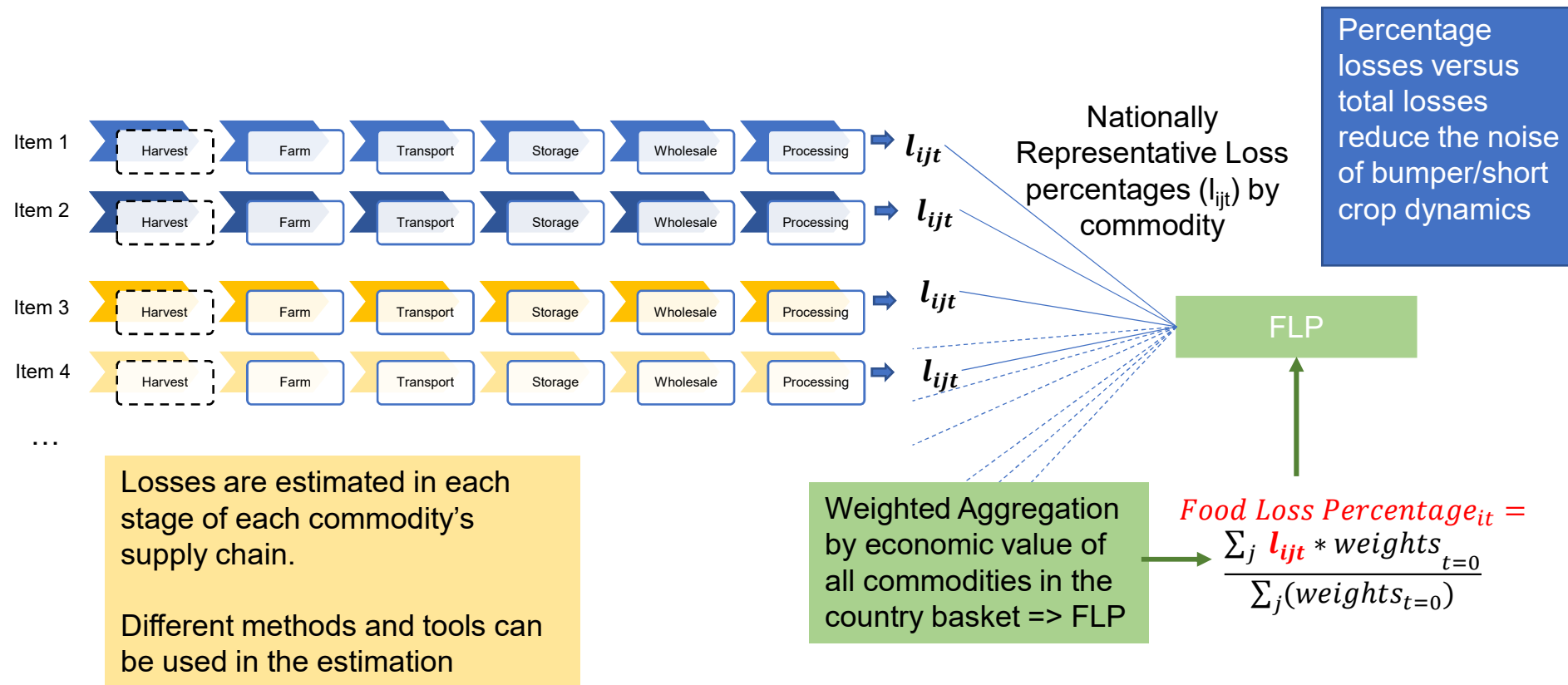
## Supply Chain – Broad picture

- 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

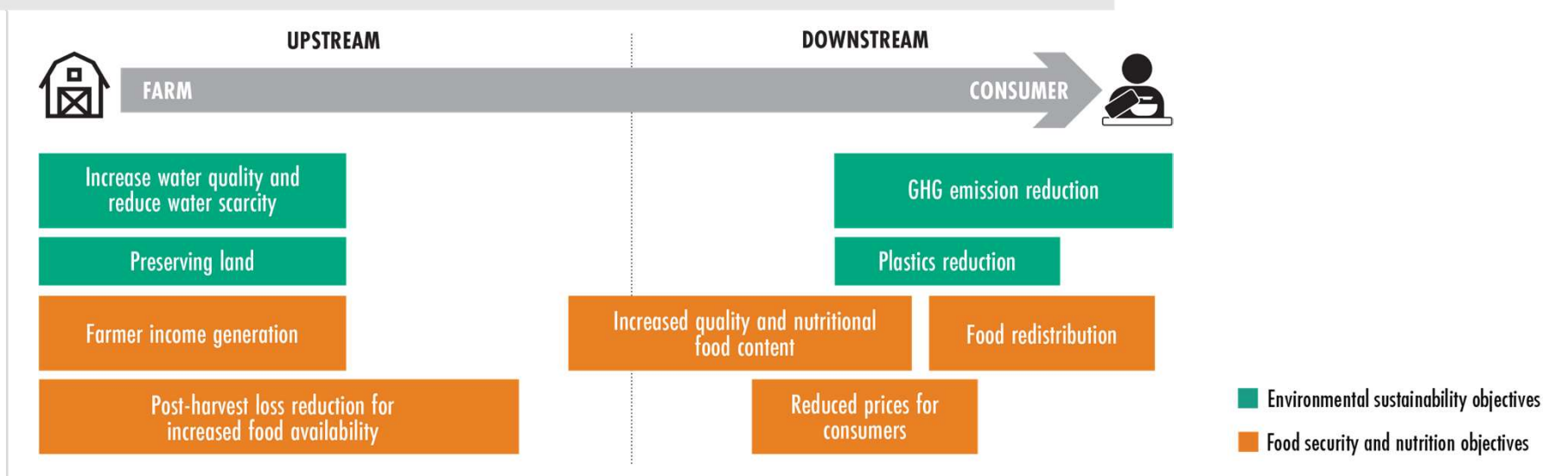
## Building the Food Loss Index: national loss data



# Policy Consideration: Adapting Strategies to Country Context

Objectives are different from country to country.  
They should formulate strategies in line with their objectives.

## ALIGNING OBJECTIVES AND INTERVENTION ENTRY POINTS ALONG THE FOOD SUPPLY CHAIN

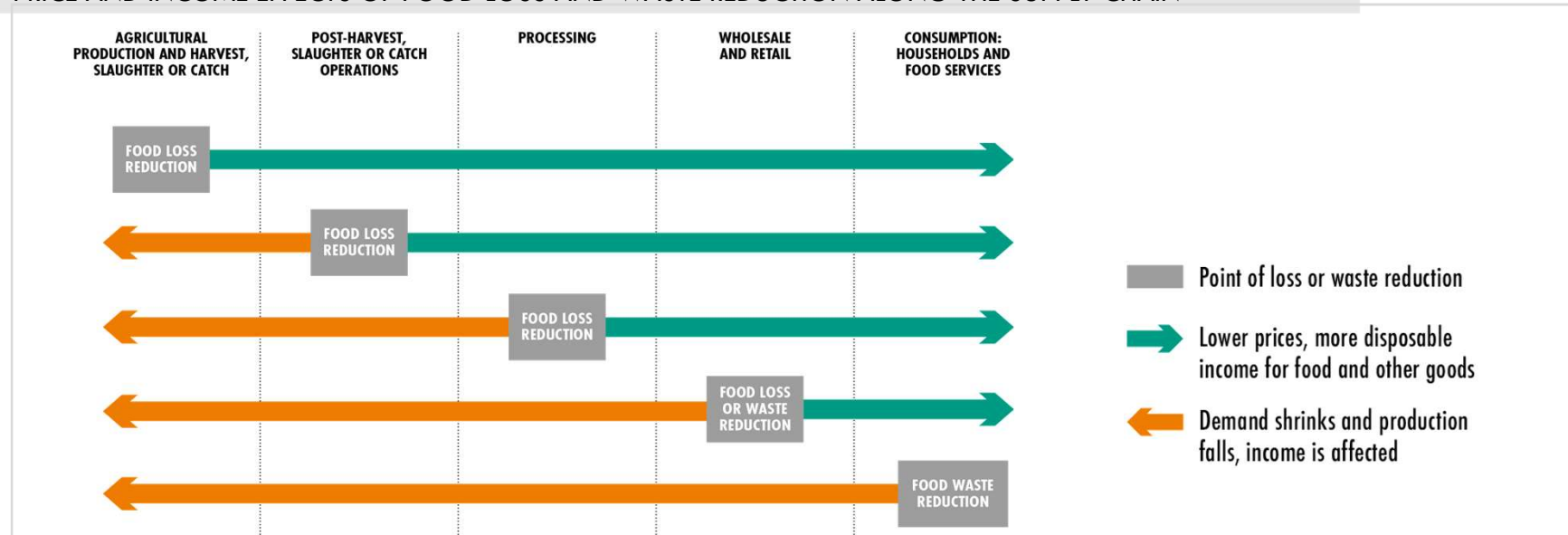


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# Policy Consideration: Impact of reduction on Food Security & Nutrition

Reductions should occur early on in the supply chain and in highly food-insecure countries

## PRICE AND INCOME EFFECTS OF FOOD LOSS AND WASTE REDUCTION ALONG THE SUPPLY CHAIN



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# Recommendations & Guidelines by stage



# Importance of Measurement Where Loss Occurs

Measurement occurs at the stage of the supply chain.

- Grading and Sorting are critical points (along all of the chain, but esp, at the farm)
- Can be a result of contracting agreements

## Result of the pilots:

Downstream participants often come to the point of production to do grading and selection before the product left the field or left the farm

- ***The Measurement Methodology include how to capture and measure these losses***



## 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 choose 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?



## 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)



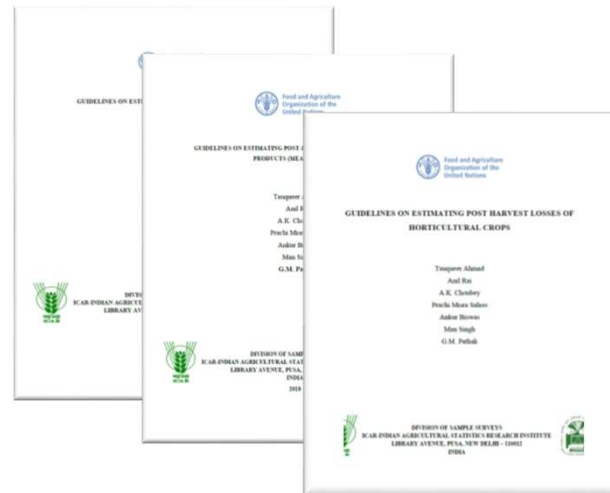
# Guidelines on the measurement of harvest and postharvest losses

## Grains

Published and tested



Draft Annexes:  
Fruits and Vegetables,  
Milk and Meat, Fish and  
products



- All along the supply chain
- No one-size-fits all (surveys, administrative data, experimental design)
- Integrated in the national statistics systems
- Partnerships with the private sector
- Strategic documents on integrating sources will be added

PHL : Baseline survey for 2-3 Years  
Survey frequency: every 5 Years  
Model in the in-between years

## Maximizing use of existing data sources

- Use administrative data, Includes but not limited to:
  - Registers on stakeholders, market interactions
  - Veterinary records
  - Transport records
  - National Industry Processing questionnaires to ascertain technical conversion factors, input and output quantities
- Inventory existing survey instruments covering supply chains
- Strategize where necessary to collect information
  - Start with expert opinion and move to measurement

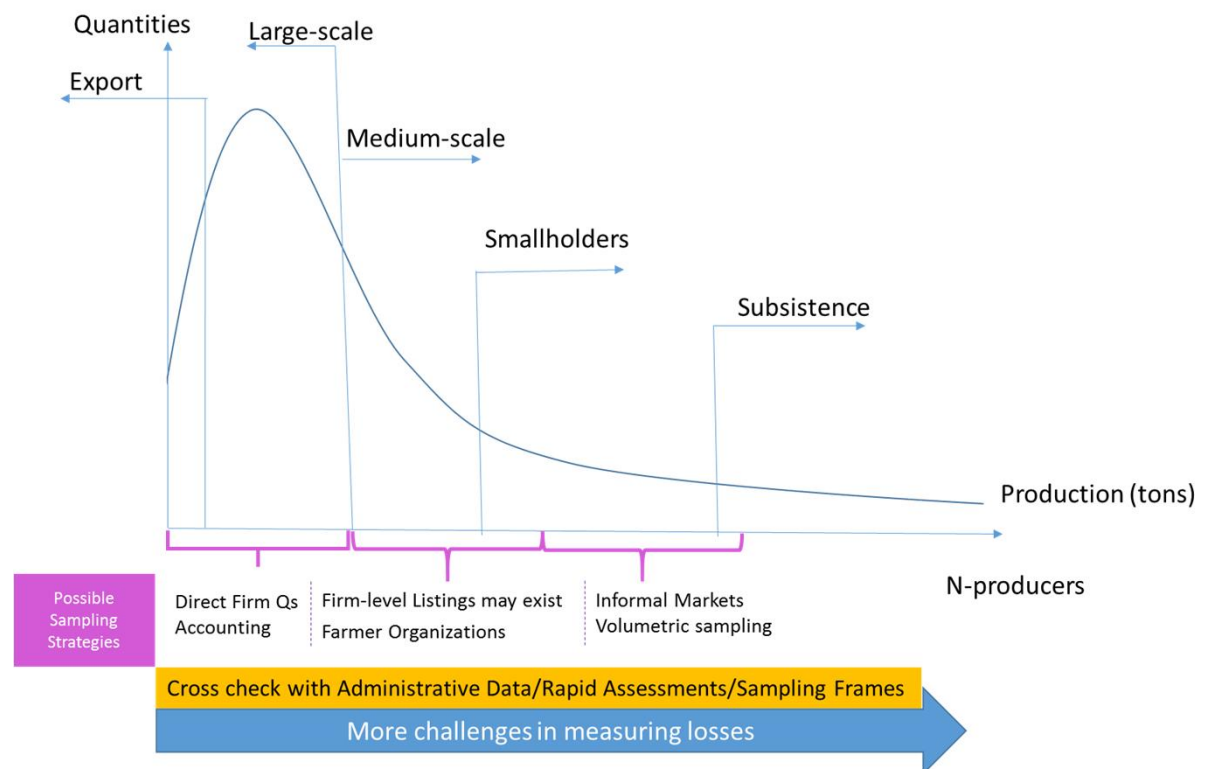


# Linking the instruments to cover all actors

## Farm/Producers

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





## Guidelines prescriptions – At Harvest

- Harvest losses - Crop-cutting surveys
  - Different yield, different definition of production
- Questions are included to measure what is mature and left in the field
  - Measured and inquiry based
  - Data can be included outside of the Agricultural Production Questionnaires
- For relevant Commodities, questions on conversion factors are also included (e.g. livestock to meat ratios)



## Guidelines prescriptions – Farm level

- Post-harvest losses – Sample surveys
  - Relevant when there are very many small actors
  - May cover on-farm storage, on farm transportation
  - Can be complemented by experimental design or two-stage sampling on farm practices
  - Cover all activities after the commodity is harvested on-farm
    - Sorting and Grading
    - Storage
    - Transport, etc.
- Post-harvest losses – complete enumeration
  - Large commercial farms that keep accounting records (few)

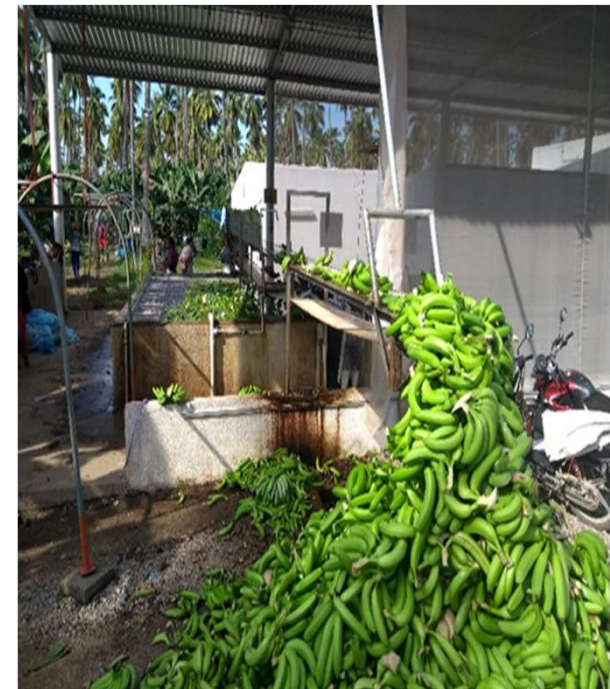


## Pilots on the Measurement Guidelines

- Recommend to use CAPI,
  - Base Survey instruments have already been programmed
  - Allows for logical validations
  - Skips unnecessary sections (allows for complexity)
  - Quicker results and GPS capabilities

### Questionnaire application times from the pilot on Fruits and Vegetables

- Survey to producers (without actual measurement), average 10 to 15 minutes.
- Survey with actual measurement to producers, average 1 hour.
- Cold warehouses and wholesalers, average 2 hours, includes actual measurement.
- Retailers average 15 minutes only with survey and 30 with actual measurement.



## Minimum Set of Loss Questions

Based on the experiences in the pilots there are a minimum set of loss questions needed.

These include

- Causes of losses
- The total volume of loss (in standard or non-standard units)
- The connection of the total volume to different activities
- The total volume related to grading standards (currently piloting to capture qualitative loss)
- Questions specifically related to harvest & price/economic effects

LOSSES	
For the Enumerator: I am going to ask you about the causes of losses after you have harvested the	
Causes of losses for %rosteritle%	PHL_Fr0_FH_I_CausePH
12 Total quantity lost during all activities - excluding storage from the selected growe	PHL_Fr0_FH_I_QLoss
Unit for quantity	PHL_Fr0_Loss_I_Qwt_Unit
AB Please specify the unit for other (bamboo baskets,bags, tins, etc.)	PHL_Fr0_Loss_I_Qwt_Unit_O
12 Please specify the how many kg are in the NSU	KgPerOther_FL_I
12 Percentage of loss for Plucking / Harvesting	PHL_Fr0_FL_I_QLoss_perPH
12 Percentage of loss for Collection / Grading / Packaging	PHL_Fr0_FL_I_QLoss_perCGP
12 Percentage of loss for Transportation	PHL_Fr0_FL_I_QLoss_perT
12 Percentage of loss for Transformation/Processing	PHL_Fr0_FL_I_QLoss_perTP
12 Total quantity (tons or NSU) during storage during the year	PHL_Fr0_FS_I_QwtLoss
Unit for quantity	PHL_Fr0_FS_I_QwtLoss_Unit
AB Please specify the unit for other (bamboo baskets,bags, tins, etc.)	PHL_Fr0_FS_I_QwtLoss_Unit_O
12 Please specify the how many kg are in the NSU	KgPerOther_QwtLoss_I
fx Standard Conversion	PHL_Fr0_QwtLoss_I_WtKg
fx Prod_Nonstd_Unit	PHL_Fr0_FS_I_QwtLossKg_NSU
12 How much (tons) did you not harvest due to economic effect?	PHL_Fr0_FS_I_QwtLoss_preH

## Additional Data

For the SDG, the definition of losses include only what leaves the supply chain and is not consumed. Industrial use and feed are not counted as loss.

In the questionnaires additional questions were added for policy making above and beyond:

- Direction/Flow of commodities
- Market and utilization flows
- Prices
- Weather
- Typology of actors (small scale vs export)



Guava damaged and going to juice processing



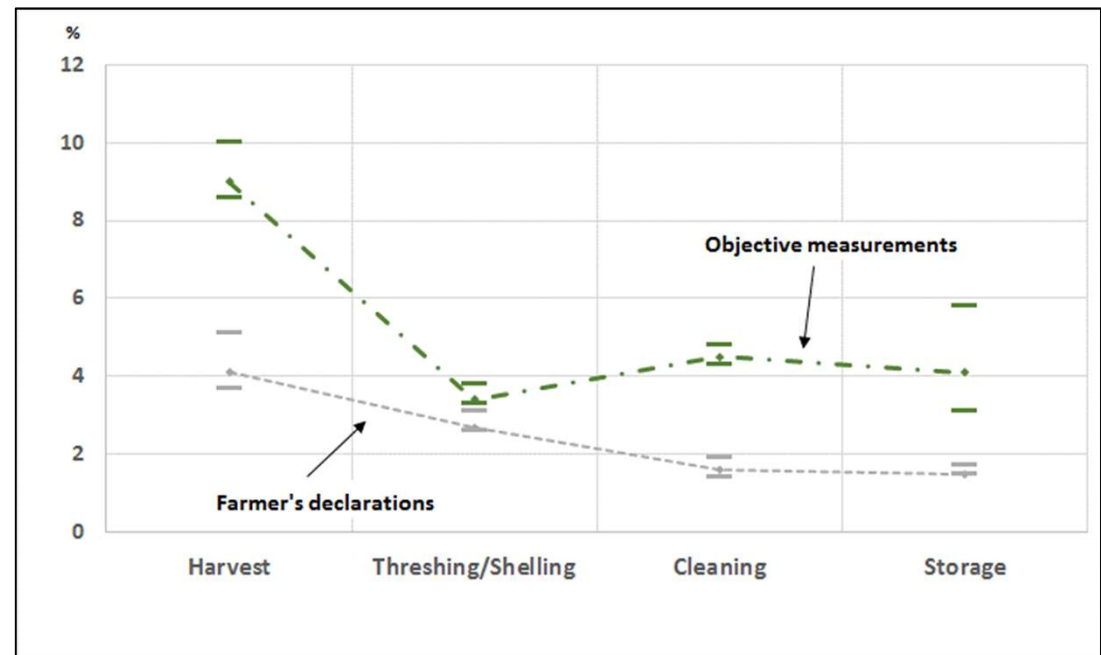
Guava damaged and is a complete loss

## Recommendation: Benchmark inquiry based questionnaires with direct measurement

Pilots in the grains (Malawi) and In fruits and vegetables indicated that loss levels were higher when measured than when only inquiry based

The methodology covers all on-farm postharvest operations

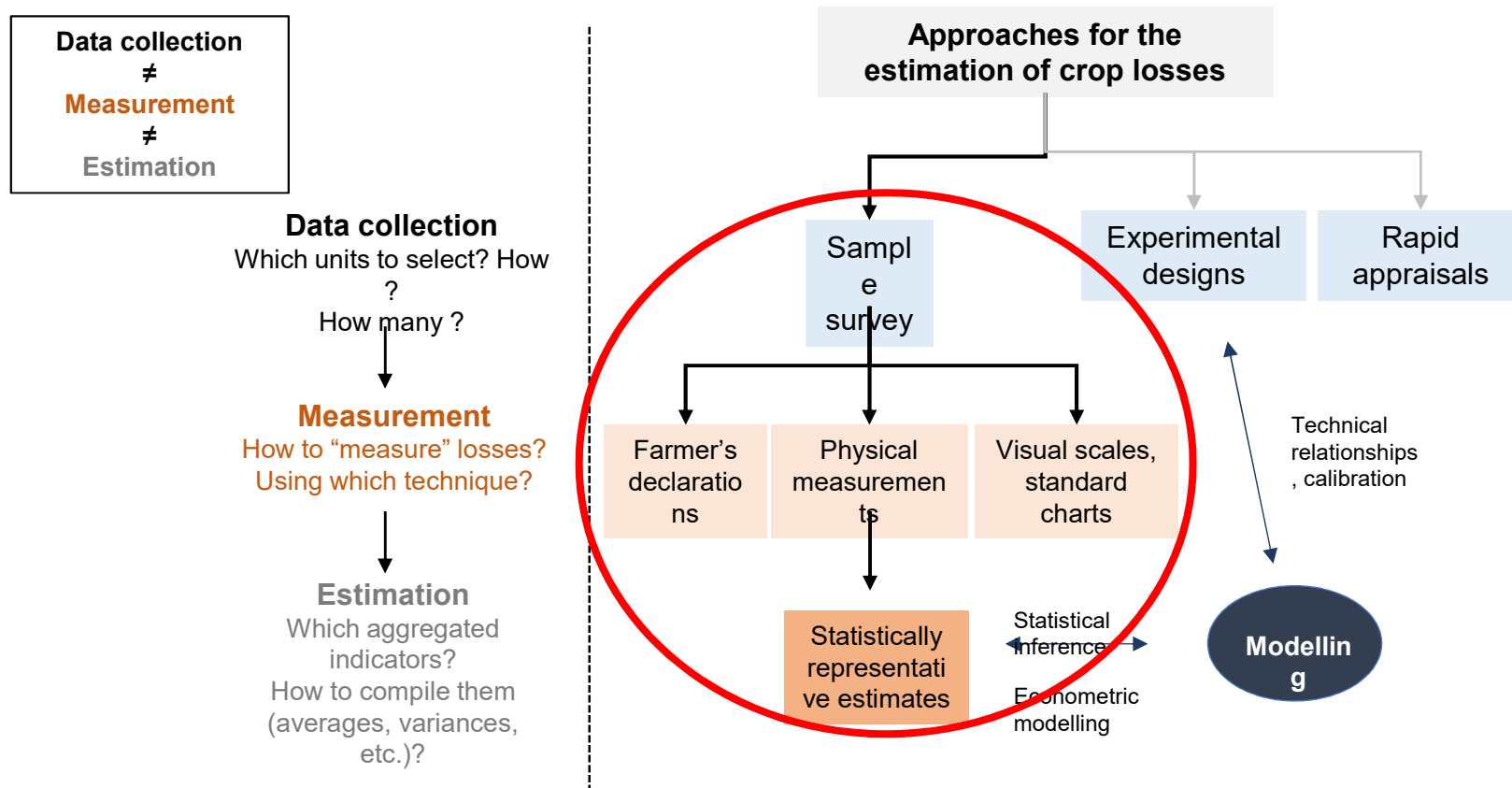
A similar phenomenon can be observed in EU countries where reported losses (FBS) are lower than what studies suggest.



**Farmer's declarations** < **Objective measurements**



# Guidelines for tools to use in new data collection





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# State of Knowledge

# State of Knowledge

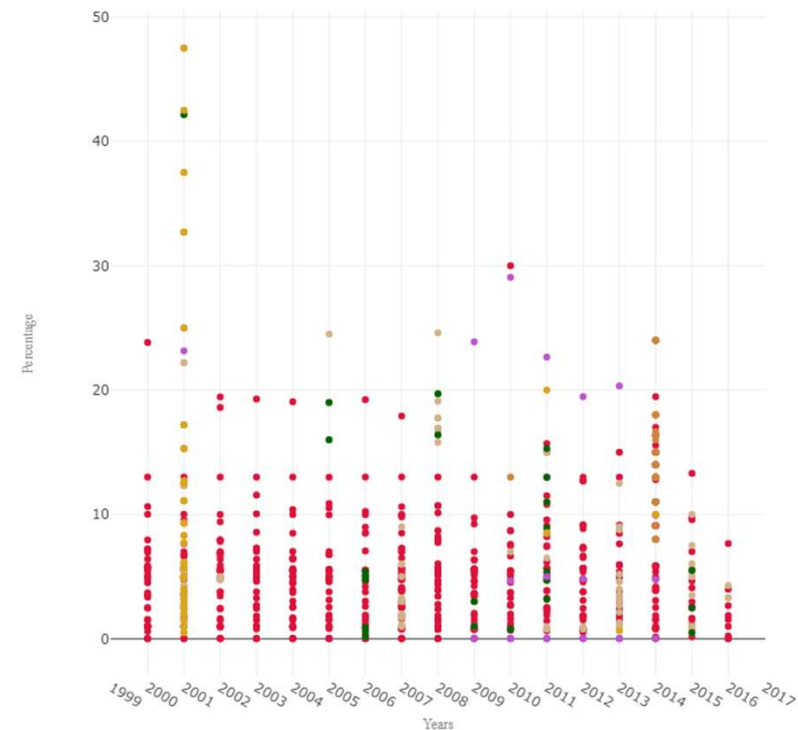
## Range of Losses in Eastern & South Eastern Asia

FAO is aggregating studies across countries and commodities, with the objective of finding where decreasing losses can have the greatest impact.

These studies can be found at:

<http://www.fao.org/food-loss-and-food-waste/flw-data/en/>

And countries can further contribute to these efforts through reporting in the annual production questionnaire or directly to the focal points.



Source: FAO  
Date: 2019-10-15 13:58:46  
Aggregation: sdgregion\_code  
Aggregation Option: Eastern Asia (M49) and South-eastern Asia (MDG=M49)  
Country : All  
Commodity Aggregation: All

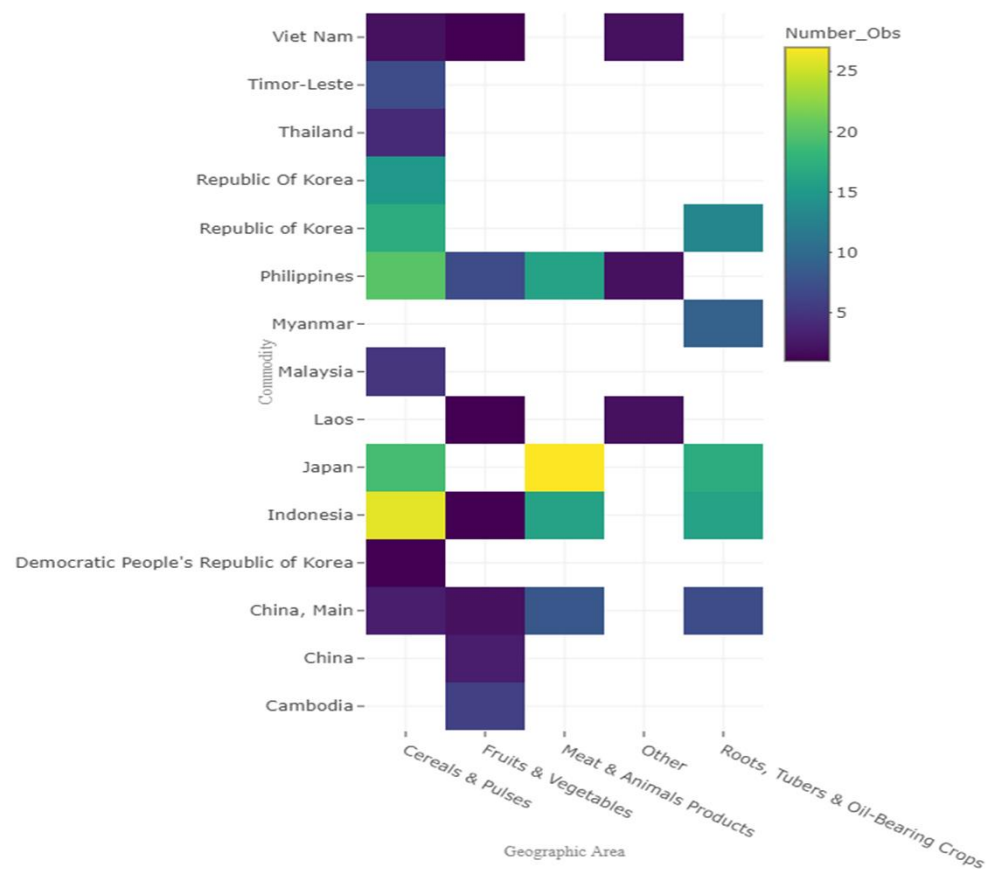
## State of Knowledge

### Heatmap of existing data in Eastern & South Eastern Asia by basket

There are several commodity groups where there are no estimates within the region.

These blanks are then estimated using a global and regional model

The objective in the SDG is to make sure that there are more commodities reported in the region by commodity group,

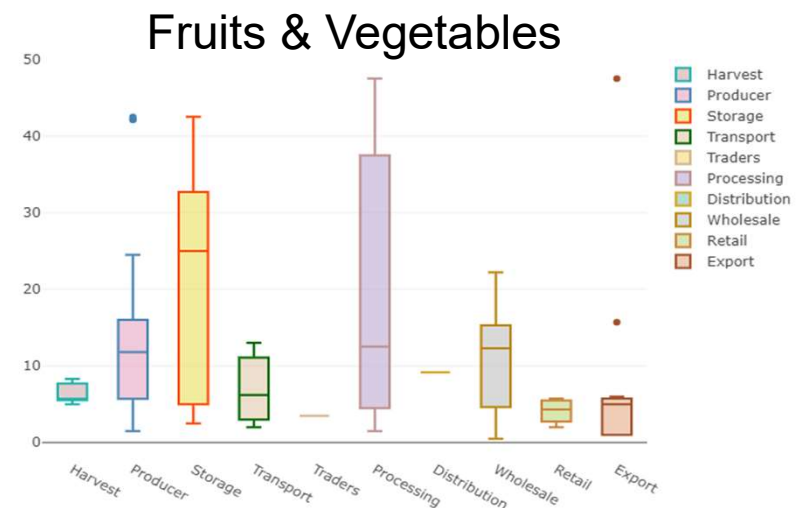
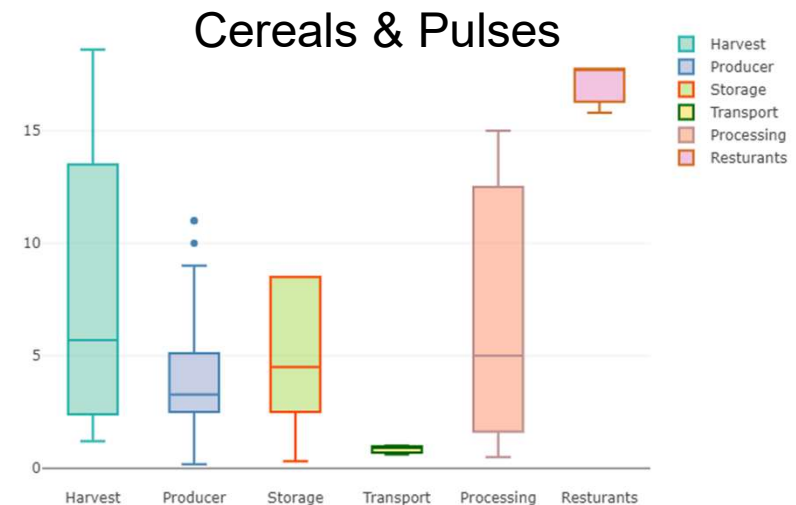


## State of Knowledge

### Range of Losses in Eastern & South Eastern Asia by Stage of the Value Chain

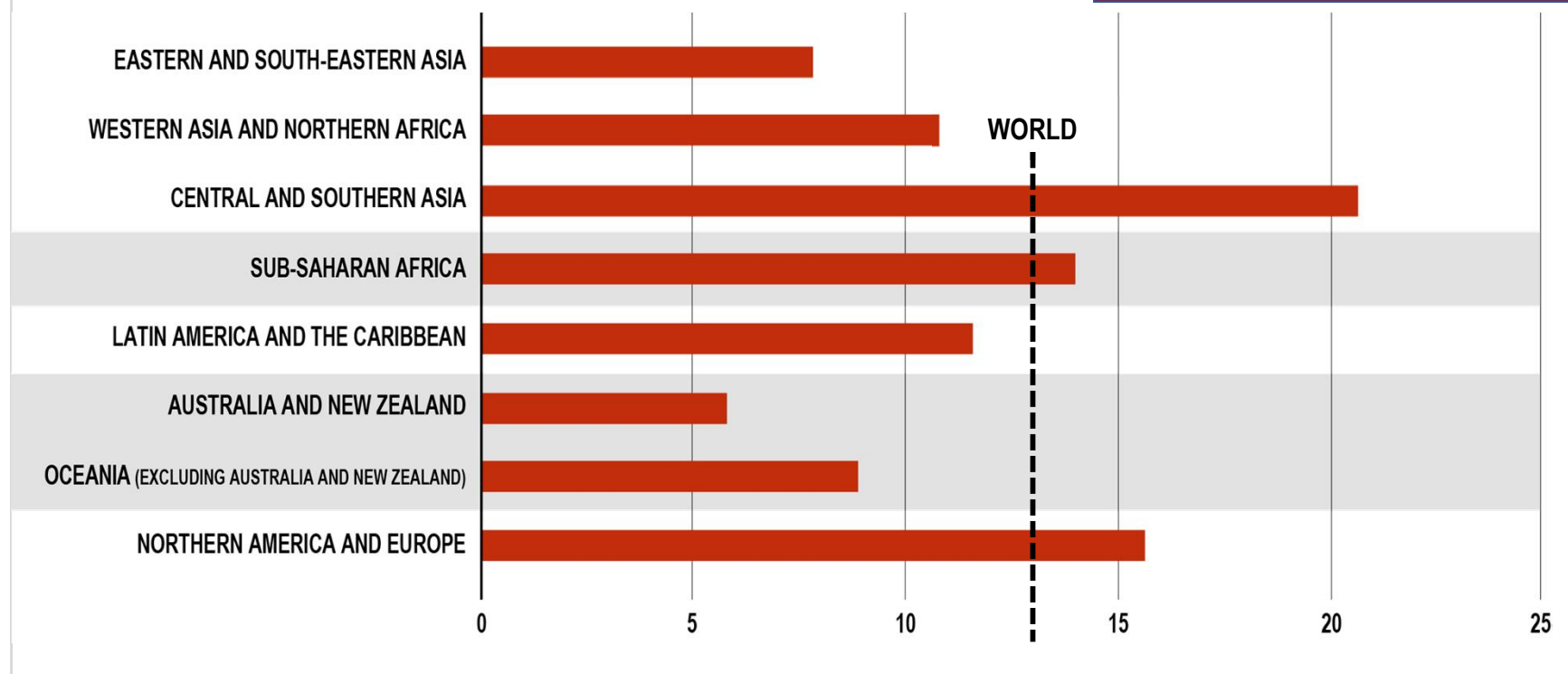
One of the initial steps of finding the critical loss points within a commodity group is to analyse existing data

The dataset has estimates (with different measurement, estimations, expert opinions, etc.) which point towards the critical loss points



## Preliminary Estimates of the FLI

PERCENTAGE OF FOOD LOSS GLOBALLY AND BY REGION



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## Differences in the FLI & the 2011 Study

These new estimates are an improvement from the estimates released in 2011 for three main reasons:

- Firstly, the lack of data forced the authors of the 2011 study to make a number of assumptions on FLW levels, especially relating to distribution and consumption, making the study difficult to replicate (FAO tries exactly to overcome this caveat by using a transparent estimation model that produces replicable results for the FLI)
- Secondly, the new estimation model can incorporate new information as it becomes available. This means that, as more countries start reporting on losses, the FLI estimate is expected to change and improve over time
- And thirdly, unlike the FLI, the 2011 study did not take into account the different economic values of different commodities which is certainly relevant when devising interventions to reduce food loss





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# FAO Data Collection for Reporting



## FAO Data Collection for Reporting

- Regular annual Agricultural Production Questionnaires
  - Section on Utilizations of main commodities
  - Asking for loss quantities
  - Technical assistance to countries to strengthen national statistics
- SDG reporting
  - Countries drive many of the FLI decisions: basket of goods, loss percentages, validating estimates

Example: Afghanistan, 2016

COMMODITY		ELEMENT		2014	2015	2016
0111	Wheat	Food	t	4,461,000	4,570,000	4,721,000
		Seed	t	349,000	298,000	371,000
		Feed	t			
		Loss	t	803,000	701,000	684,000
		Industrial Utilization	t			

## Resources

Resource	Link
FAO Food Loss and Waste Theme Page	<a href="http://www.fao.org/food-loss-and-food-waste/en/">http://www.fao.org/food-loss-and-food-waste/en/</a>
2019 State of Food & Agriculture: Moving Forward on Food Loss and Waste Reduction	<a href="http://www.fao.org/3/ca6030en/ca6030en.pdf">http://www.fao.org/3/ca6030en/ca6030en.pdf</a>
Food Loss & Waste Data Set	<a href="http://www.fao.org/food-loss-and-food-waste/flw-data/en/">http://www.fao.org/food-loss-and-food-waste/flw-data/en/</a>
SDG 12.3.1.a Food Loss Index Official Page (methodology, guidelines, etc.)	<a href="http://www.fao.org/sustainable-development-goals/indicators/1231/en/">http://www.fao.org/sustainable-development-goals/indicators/1231/en/</a>
Global Strategy Guidelines for Grains	<a href="http://gsars.org/en/training-course-on-post-harvest-losses-english/#more-3855">http://gsars.org/en/training-course-on-post-harvest-losses-english/#more-3855</a>
E-Learning Course on the Case Study Methodology	<a href="http://www.fao.org/elearning/#/elc/en/course/FLA">http://www.fao.org/elearning/#/elc/en/course/FLA</a>



# THANK YOU

## contact us!

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