



Food and Agriculture Organization
of the United Nations

Collecting Data to Monitor SDG Target 12.3

FAO Workshop on: Monitoring SDG 12.3.1 Global Food Loss Index
September 2019

Presenters:

Dr. Alicia English
FAO Statistics Division

Outline

- 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

Building the FLI- Food Loss Percentages (FLP)

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

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

- 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

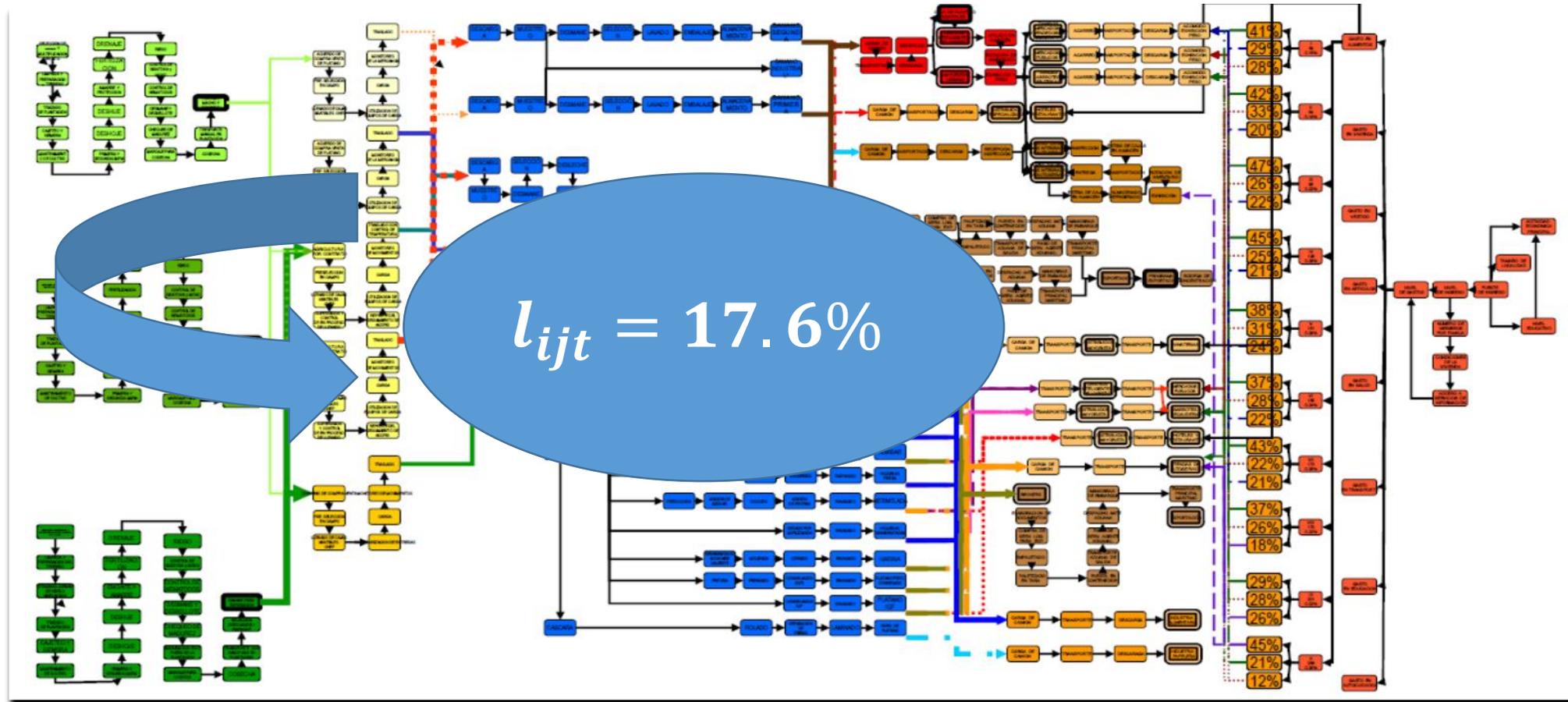
FAO 30% Loss Study

- 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).
 - Conversion 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



Supply Chain – Broad picture

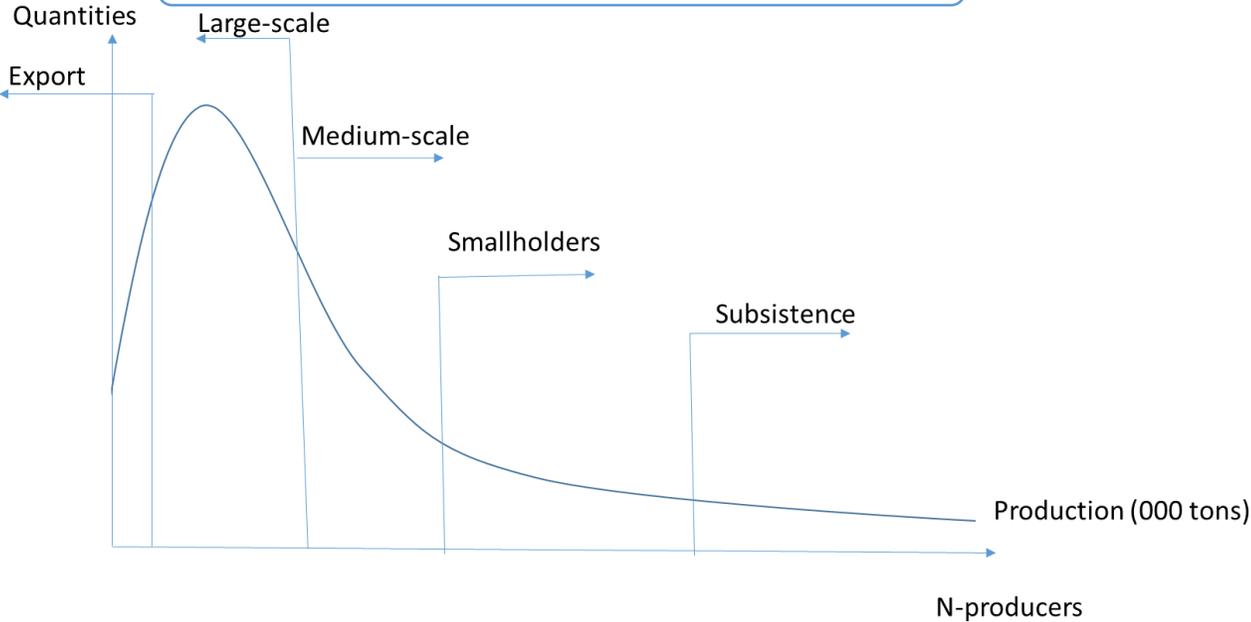
- Break down the problem into structured parts – stages
 - Simplify the supply chain to main stages



- 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

Different actors on the chain – Broad picture

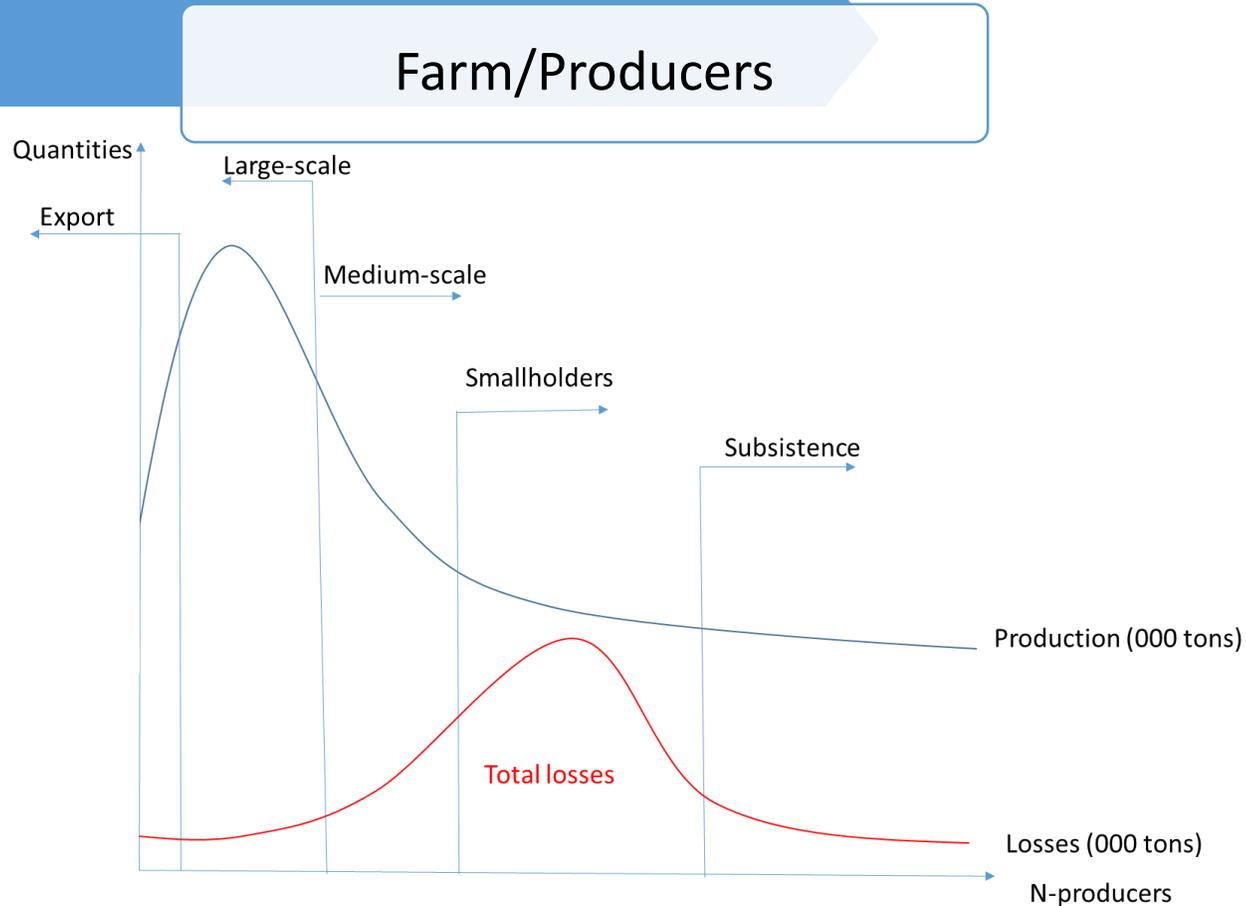
Farm/Producers



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 =
 $\text{Total losses} / \text{Total production} * 100$

Different actors on the chain – Broad picture

Farm

Export sector

Large commercial

Medium scale

Small Holder

Subsistence

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 through 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 – difficulty 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

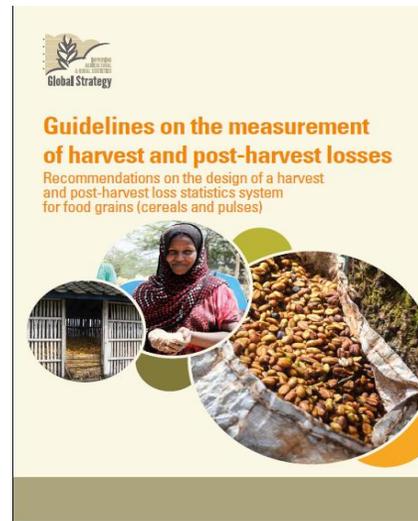
- No single solution, the choice depends on the:
 - Purpose of the measure: preliminary estimate for quick assessment, national figure for policy purposes, etc.
 - Resources available (financial, human, technical)
 - Prior experience in loss assessments
 - Time available, etc.
- Strategy to choose the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

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

Grains

Published and tested



Fruits and Vegetables, Milk and Meat, Fish and products



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

E-Learning Course on the Case Study Methodology

Nutrition and food systems

Course: Case study method of food loss analysis



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.

<http://www.fao.org/elearning/#/elc/en/course/FLA>

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)



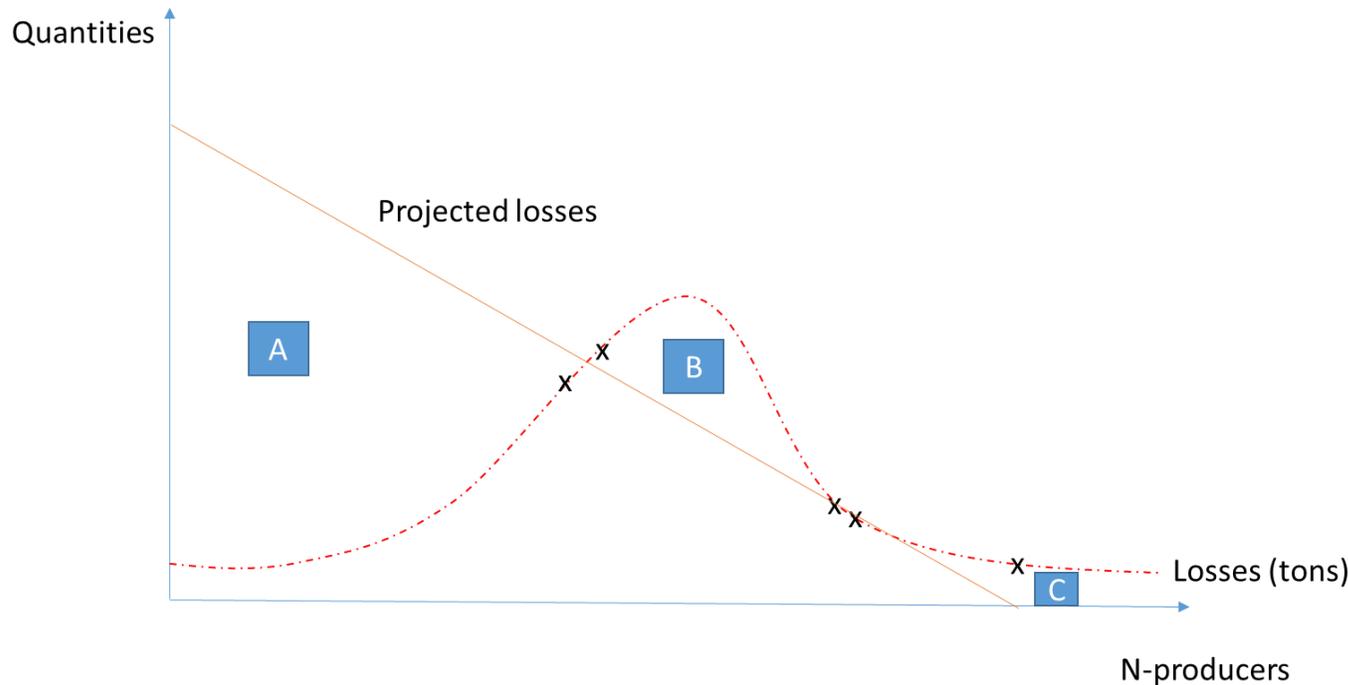
Metal and plastic silos, hermetic bags
(Uganda)

Scaling up efforts

Moving to the National Level estimates for losses

Expand causes of losses to other instruments

Farm/Producers



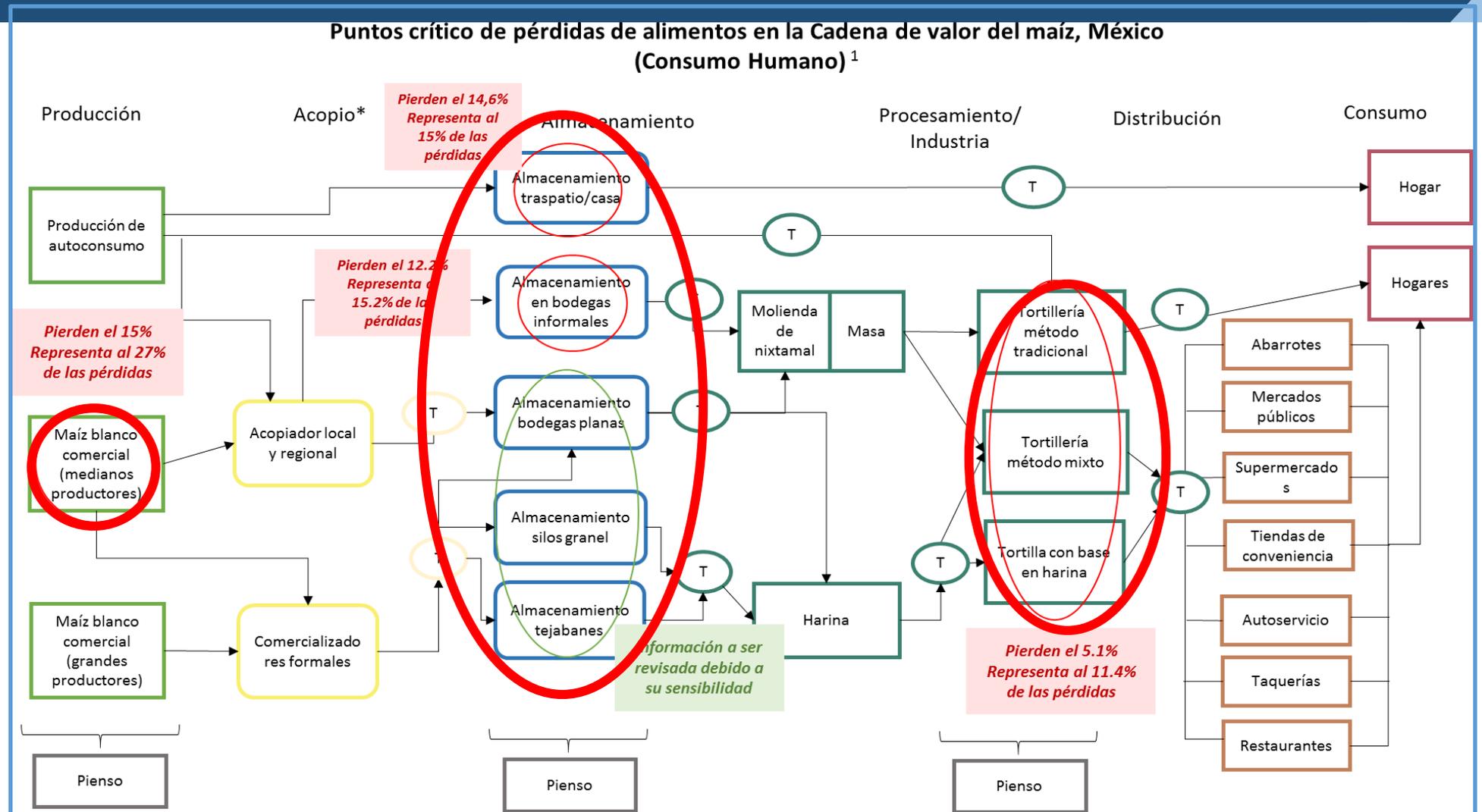
Rapid Appraisals/Case studies are typically limited to few observations and **may not be representative but are useful for strategizing critical loss points**

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.



Tipología en la cadena del maíz blanco					
Fase	Tipo	Número	Volumen (mil ton)	Pérdidas en %	Pérdidas en Volumen
<i>Cosecha y post-cosecha</i>	Producción de tecnología y producción alta	248,000	13,016	4%	521
	Producción de tecnología y producción media	519,000	4,722	12.2%	581
	Producción de autoconsumo	2.3 millones	4,875	14.6%	572
Total producción			21,693	7.3%	1,673
<i>Acopio y transporte</i>	Comercializadores formales		12,000	1.5%	263
	Acopiadores y comercializadores informales		6,058		
Total acopio			18,058	1.5%	263
Total sin acopio			3,635		
<i>Almacenamiento</i>	Nivel 1 – Instalaciones mecanizadas	190	7,559	3%	189
	Nivel 2 – Semi-mecanizadas	286	2,268	4%	91
	Nivel 3 – Interperis	152	394	4%	15.7
	Nivel 4 – Patios y terrenos baldíos	540	772	8%	61
	Almacenamiento informal	??	6,081	15%	1020
Total almacenamiento			19,378	7.7%	1,377
Total sin almacenamiento			2,315		
<i>Procesamiento</i>	Industria de harina de maíz	55	2,487	2%	50
	Industria de la masa y la tortilla	85,924	5,146	5.1%	262
	Tortillerías tradicionales de tortillas		3,783	4.6%	174
	Consumo en granos o masa		1,998	1%	20
Total industria			13,414	3.5%	506
Total sin procesamiento			8,279		
Total de pérdidas				17,6%	3,820

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		
Non intentional storage on farm	<i>Indicator on food loss due to not proper storage at farm level</i>	No information existing, but pilot of INEGI – Supply Chain Survey where details on storage at farm level is asked
	<i>Indicator on types of storage facilities used or storage services paid for</i>	INEGI – Agriculture Statistics Survey: includes a question if product is stored INEGI – Agricultural Census: includes a question if product is stored, but no details on types of storage Pilot of INEGI – Supply Chain Survey where details on storage at farm level are asked
	<i>Indicator on the amount stored and time of storage (short term - medium term?)</i>	No information existing
Market linkages	<i>Indicator on the destination of the product (animal feeding, selling, own consumption)</i>	INEGI – Agriculture Statistics Survey: exists the indicator, but needs to be disaggregated by medium sized products INEGI – Agricultural Census: exists
	<i>Indicator on commercialization linkages</i>	INEGI – Agricultural census: question on type of buyer (middlemen, direct to consumer, industry, etc.) but has to be disaggregated for small scale farmers
	<i>Timing of harvesting and commercialization (access to machinery services, enforcement of middleman agreements)</i>	No information existing CIMMYT might have information
	<i>Secondary market dynamics (the role of animal feeding as lower quality market)</i>	No information existing CIMMYT might have information
	<i>No markets available/market accessibility constraints</i>	No information existing CIMMYT might have information ASERCA – World Bank Project will include a study on local and regional/informal markets
Harvest and post-harvest handling	<i>Indicator on processing of the product applied (drying, shelling, cleaning, packaging)</i>	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

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

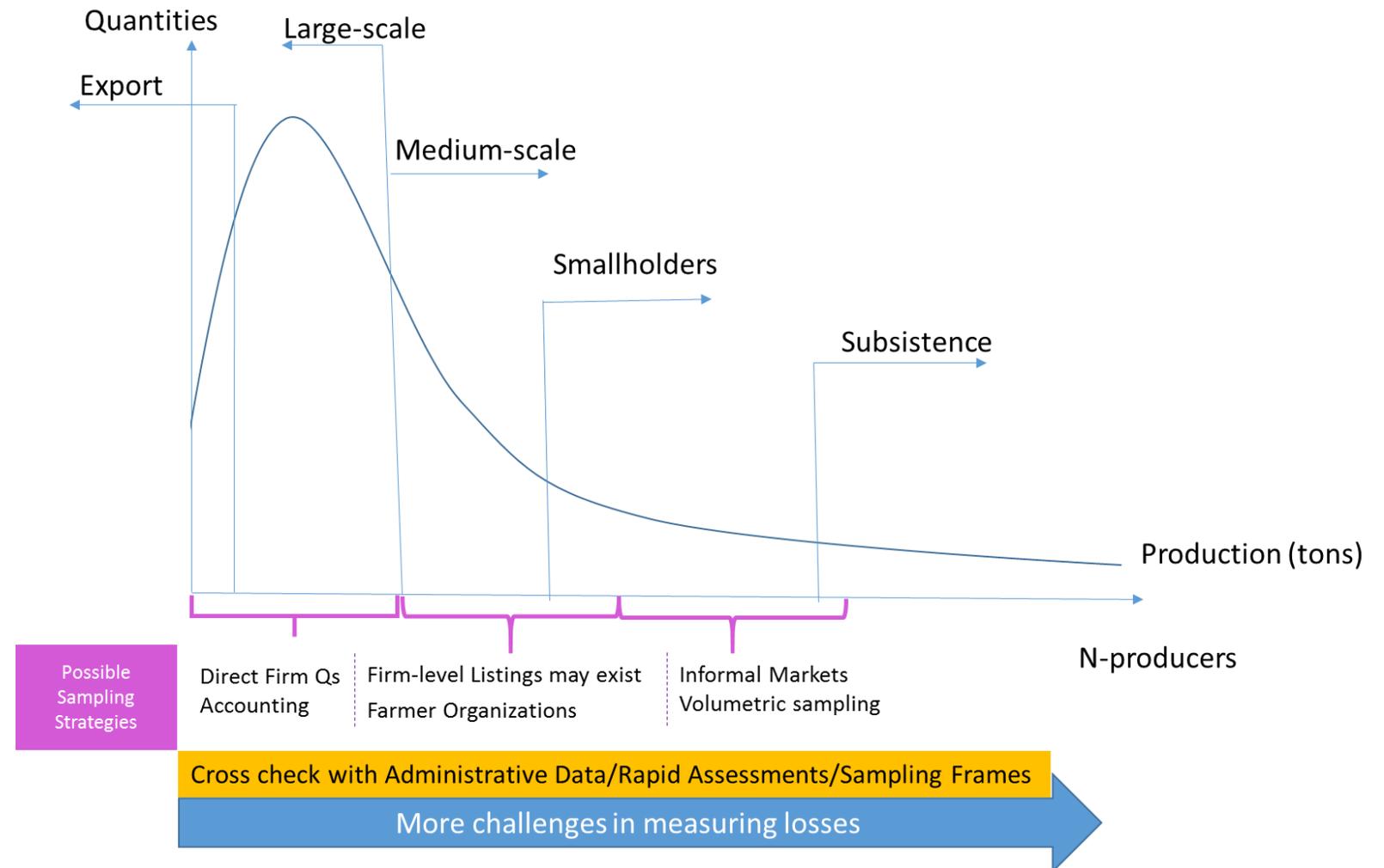
- **Monitor the efficiency of supply chains through food losses**
 - **Integration of losses into the national statistics – collect data at a marginal cost**
 - from sector-specific data collection to general food system across the whole supply chains
 - identification of cross-cutting data gaps to understand 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

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



Cost-effective Data Sources for each objective

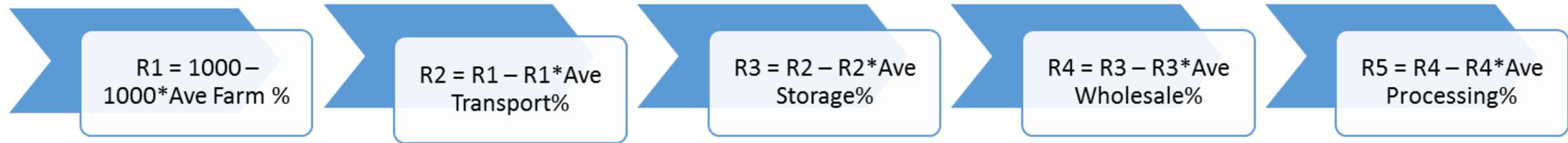
- **Design concrete policy interventions through Indicators at micro level**
 - **product specific indicators that require detailed information and an additional survey**
 - To inform questions, model losses or adjust policies
 - Focus on the principal causing factors or intervention strategies
 - Ex. 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 can not 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



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