

# Collecting Data to Monitor SDG Target 12.3

FAO Workshop on: Monitoring SDG 12.3.1 Global Food Loss Index  
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Food and Agriculture  
Organization of the  
United Nations



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## 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



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# Food Loss Measurement - What is the problem?

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## Data needs are huge

- Data by country, by commodity, by stage and OVER TIME for international monitoring
- Much available information is based on expert opinion and old technical factors
- Loss and Waste data is costly and complex
- Even more granular data is needed at the country level:
  - Sub-sector, sub-regions, specific value chains, economic losses, quality and food safety

The whole world knows that 1/3 of food is not consumed but is lost or wasted along the food chain

Many countries are regions are establishing postharvest loss or food waste reduction policies and programs



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# Definitions

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## 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.**



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# Building the FLI- Food Loss Percentages (FLP)

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**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.



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## Framing the Perspective: How the data feeds the SDG 12.3.1



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# FAO 30% Loss Study

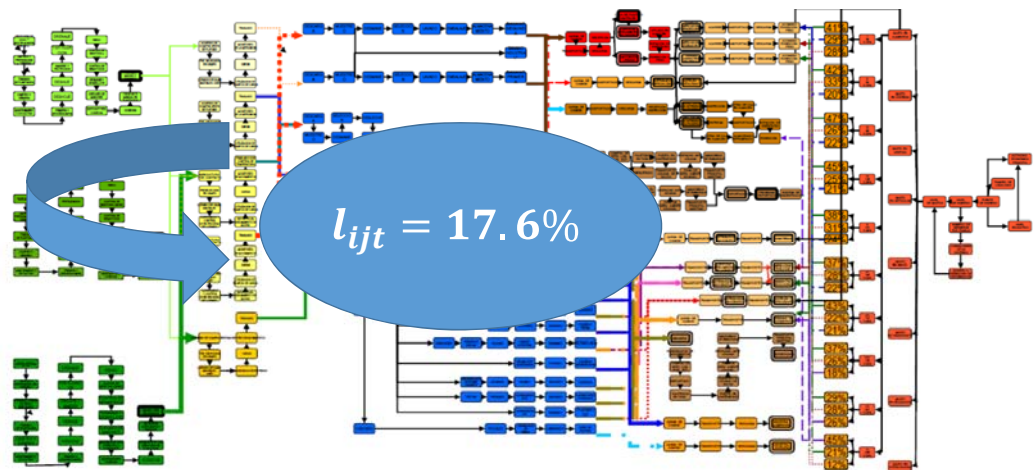
- The Global Food Loss and Waste – extent, causes and prevention
- FAO (SAVE FOOD) to the Swedish Institute of Food and Biotechnology (SIK) from August 2010 to January 2011. The estimates from this paper conclude that the global food loss and waste is approximately 30% of all food produced.
- The study 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

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



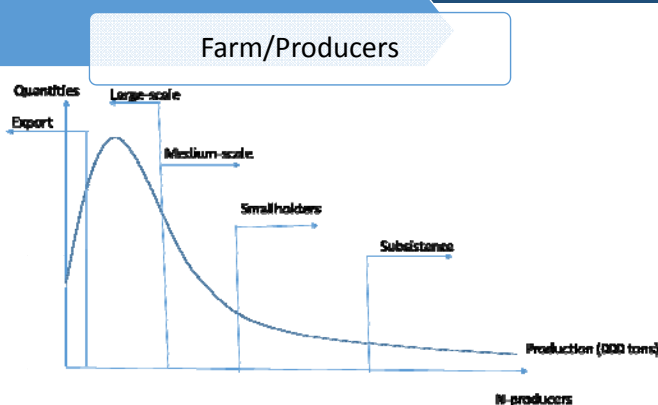
- Get to loss estimates for each stage
  - then aggregate to the whole chain (**do not add percentages across the value chain**)
  - Each stage will have different measurement challenges in terms of tracking loss quantities over time
- Evaluate where the information comes from at each stage
  - How to think about layering information to keep this cost-effective



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# Different actors on the chain – Broad picture

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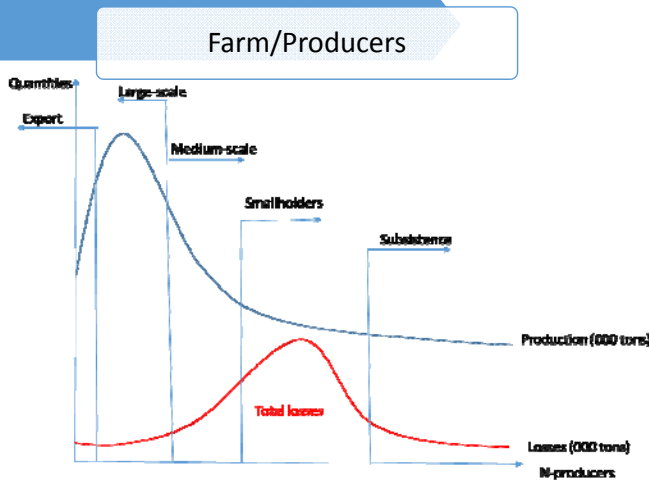
Let's assume a production curve for a country and then segment out the supply chain.

*(start simple and then add complexity where needed)*



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# 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.

$$\text{National loss \% for the farm stage} = \frac{\text{Total losses}}{\text{Total production}} * 100$$



# Different actors on the chain – Broad picture



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



# Strategy & Recommendations



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# 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)



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# 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



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



# FAO Food Loss Analysis (FLA) methodology

and links to SDG 12.3 monitoring at the national level



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## E-Learning Course on the Case Study Methodology



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Nutrition and food systems

Course: Case study method of food loss analysis



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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>

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## 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.*)



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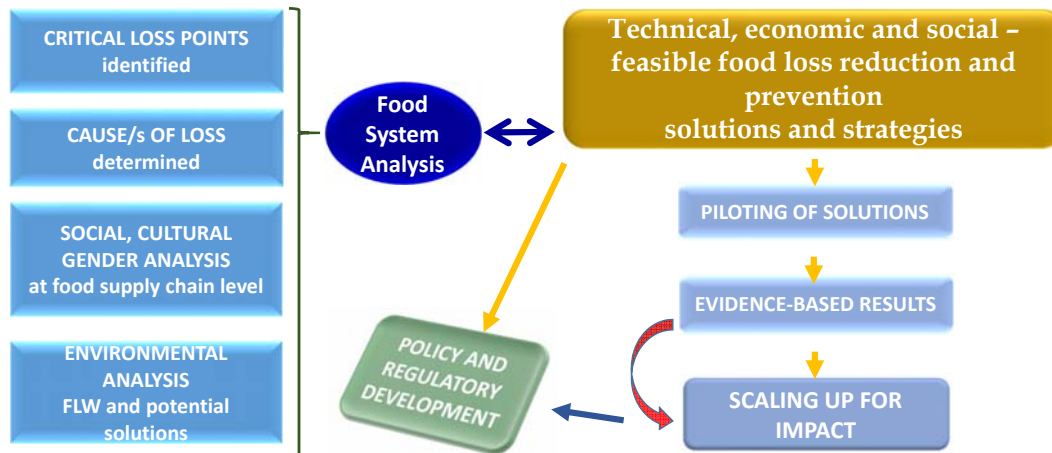
## Objectives of the Food Loss Analysis (FLA) Case study methodology and uses of FLA outputs

- 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



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## A comprehensive Food Loss Analyses (FLA) case study methodology and outputs



**Context-based approach** : local, national, regional, global

**LEVEL OF DEVELOPMENT OF SELECTED VALUE CHAINS - CATEGORY OF PRODUCTS (Incl. PERISHABLE, NON PERISHABLE) / AGRO-ECOLOGY...**

## Food Loss Analyses (FLA) Methodology : a set of approaches

- **Screening** : secondary information, literature review, key informant interview (KII)
- **Survey** : KII, focus groups, observation in the field of **practices**, access and use of equipment, infrastructure (Causes of losses), Critical Loss Points and causes of losses, perception of losses and their causes
- **Load tracking:**
  - real causes vs. symptoms of losses
  - indicative levels of losses (quantity losses),
  - quality losses (nutritional losses, losses in value)
  - identification of appropriate feasible sustainable solutions, strategies, policy recommendations
- **Synthesis and solution finding, reporting for different audiences:**
  - development organisations, private sector, decision makers, policy makers,
  - research and academics in agro-food sector, etc.

## 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

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LIFAD  
Investing in rural people



WFP  
World Food  
Programme



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra  
Direction du développement  
et de la coopération DDC

## 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



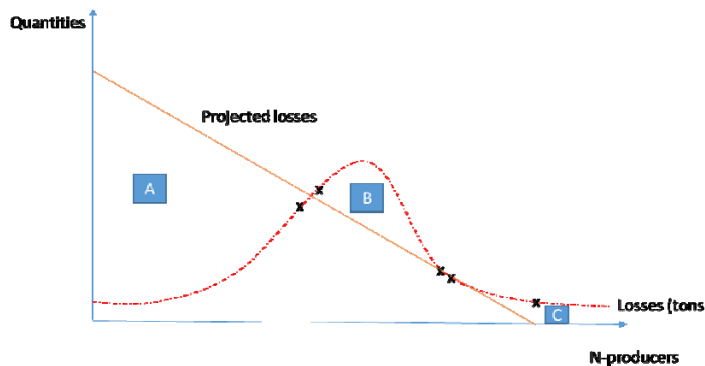
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## Expand causes of losses to other instruments

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



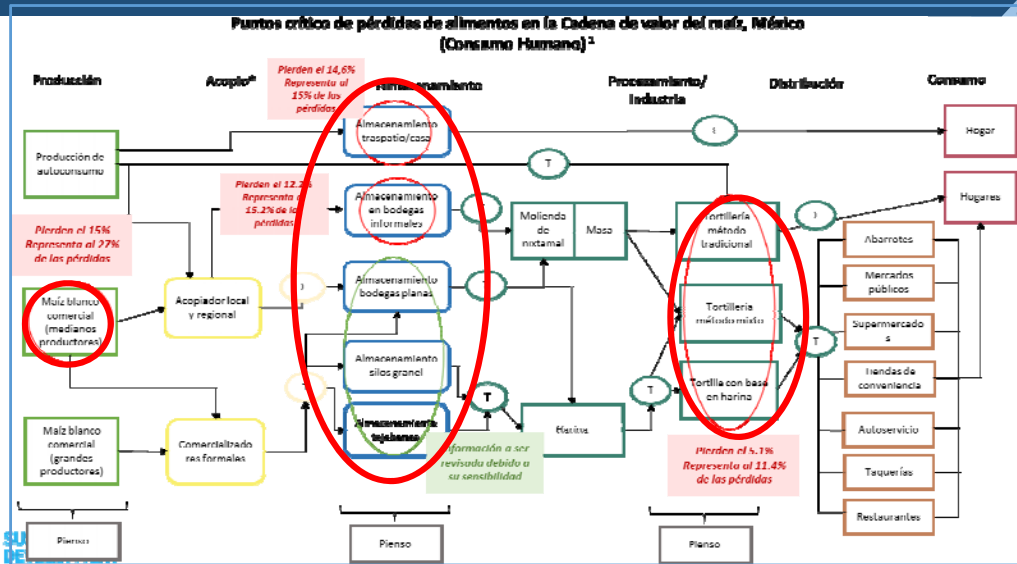
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# Using supply chain analysis to identify the critical loss points

- 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	
Cosecha y post-cosecha	Producción de tecnología y producción alta	218,000	13,016	4%	521	
	Producción de tecnología y producción media	519,000	4,722	12.2%	581	
	Producción de autoconsumo	2.3 millones	4,872	14.6%	712	
	<b>Total producción</b>		<b>21,693</b>	<b>7.3%</b>	<b>1,673</b>	
Acopio y transporte	Comercializadores formales		12,000	1.5%	263	
	Acopiadores y comercializadores informales		6,058			
	<b>Total acopio</b>		<b>18,058</b>	<b>1.5%</b>	<b>263</b>	
Almacenamiento	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	
	<b>Total almacenamiento</b>		<b>19,378</b>	<b>7.7%</b>	<b>1,377</b>	
Procesamiento	Industria de harina de maíz	55	2,487	2%	50	
	Industria de la masa y la tortilla		5,146	5.1%	262	
	Tortillerías tradicionales de tortillas	85,974	3,783	4.6%	174	
	Consumo en granos o masa		1,998	1%	20	
	<b>Total industria</b>		<b>13,414</b>	<b>3.5%</b>	<b>506</b>	
<b>Total de pérdidas</b>				<b>17.6%</b>	<b>3,820</b>	



# Measurement approaches - recommended

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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.



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# Measurement approaches – range of tools

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- 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



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



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# Linking Rapid Appraisals to Existing Instruments

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- 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?



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# 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

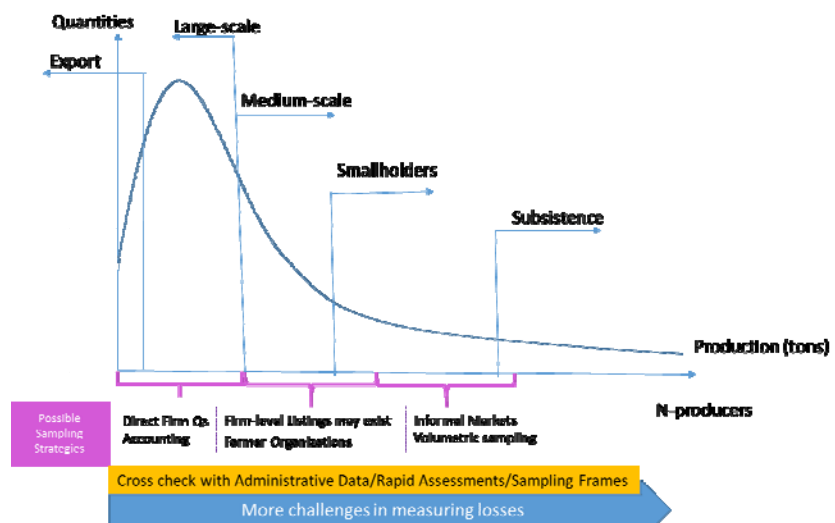


# Linking the instruments to cover all actors

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

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- **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



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## Aggregating data- Across the Value Chain

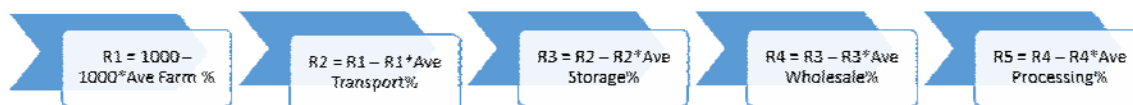


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# Aggregating Subnational Data

- 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				
Average Losses (%)	Farm 7.3	Transport 1.5	Storage 7.7	Wholesale 0	Processing 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				