Food and Agriculture Organization
of the United Nations

>> FAO Statistics Division

Food balance sheets: Overview, Methodology and Country support

SESRIC / FAO Webinar on
"Enhancing Food Security in OIC Countries:
An Overview of the Food Balance Sheet"

Stucture of presentation:

Part 1: Overview of the Food Balance Sheets (FBS)

Part 2: Uses of the Food Balance Sheets (FBS)

Part 3: Interpreting FBS data

Part 4: New Methodology highlights

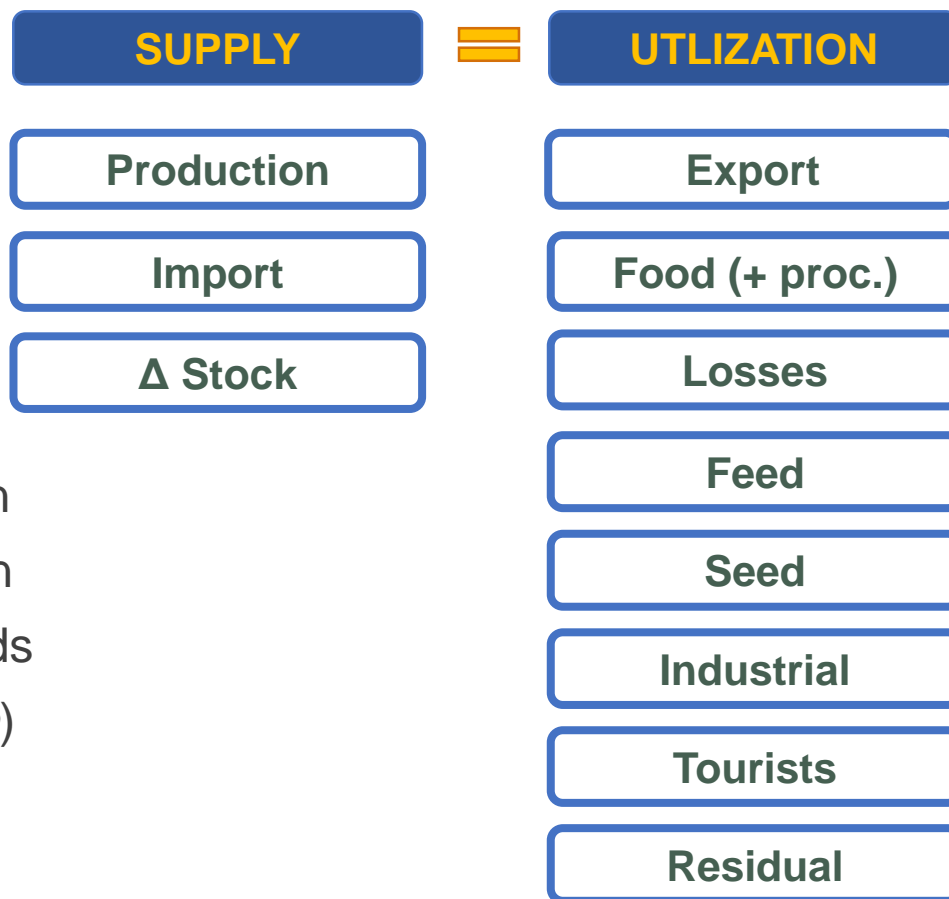**Part 5:** Capacity development and new country Compilation Tool

Part 1: Overview of the Food Balance Sheets (FBS)
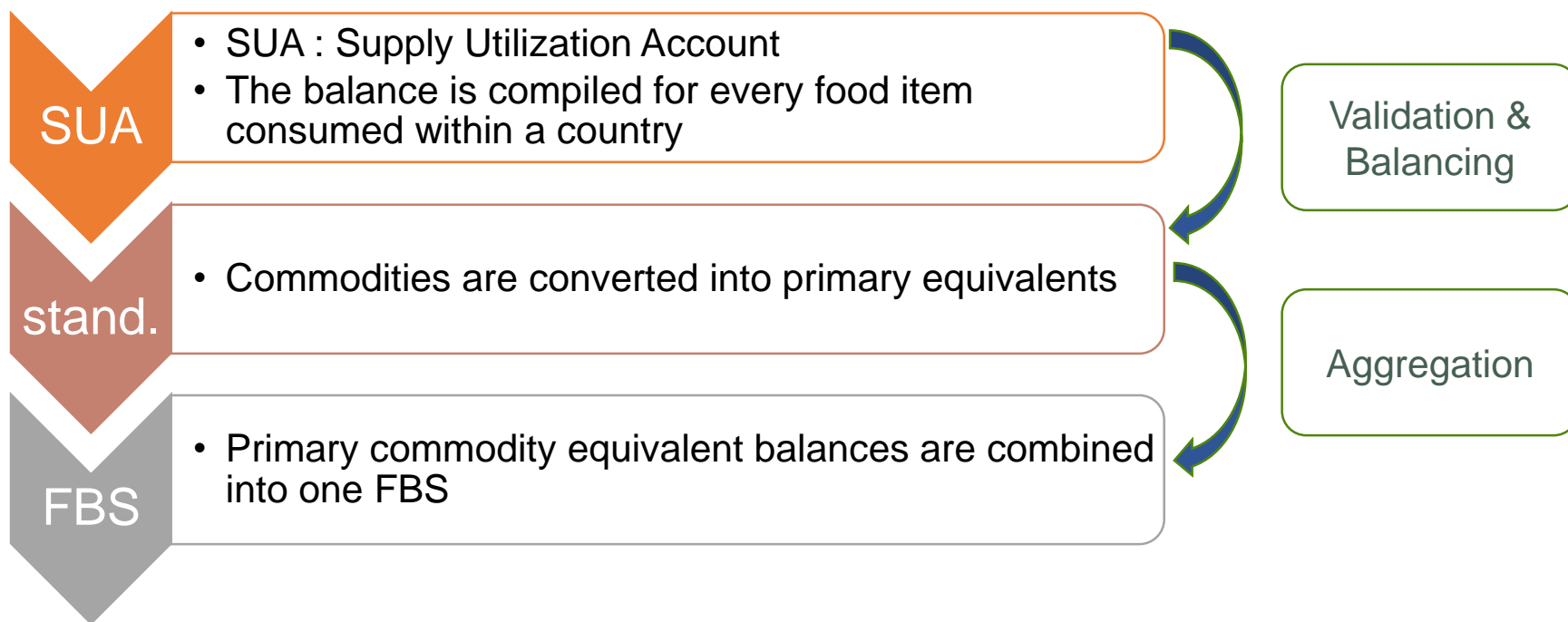
1.1 Supply and Utilization variables

What is an FBS ?

- a national accounting/ statistical framework

- a **quick** and **cheap tool** to obtain a picture of the agri-food situation of a country, and to analyze trends across years. (e.g. *Marshall Plan*)
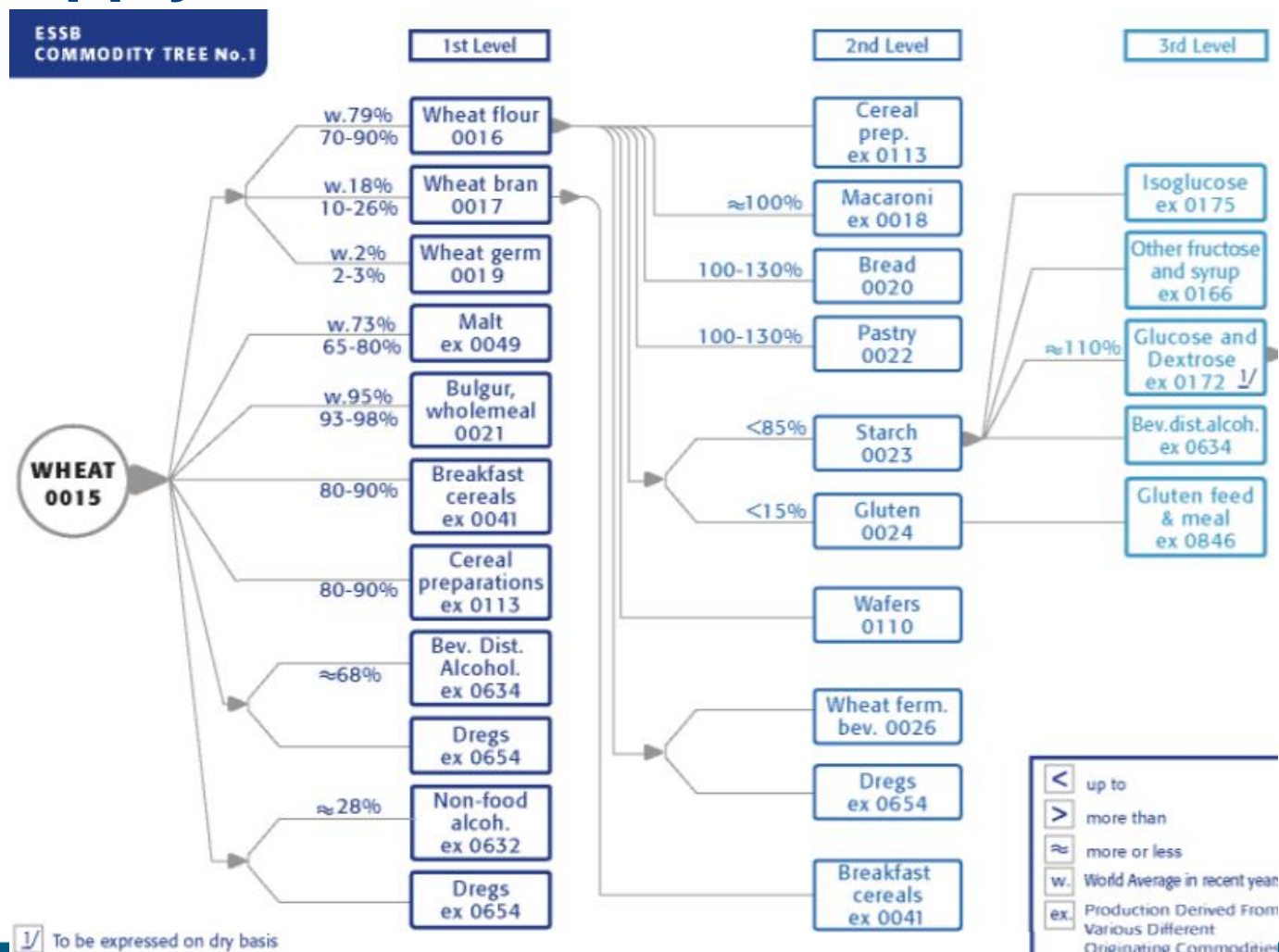
SUPPLY	=	UTLIZATION
Production		Export
Import		Food (+ proc.)
Δ Stock		Losses
		Feed
		Seed
		Industrial
		Tourists
		Residual

1.1 Supply and Utilization variables

FBS are standardized aggregations (by commodity trees) of the SUAs

SUA
- SUA : Supply Utilization Account
- The balance is compiled for every food item consumed within a country

Validation & Balancing

stand.
- Commodities are converted into primary equivalents

Aggregation

FBS
- Primary commodity equivalent balances are combined into one FBS

1.1 Supply and Utilization variables

1.2 Data sources & reliability of the data

Production & Trade, being frequently official, are the two pillars of the SUA/FBS. These data include **crop & livestock, primary** & **derived** (food) commodities.

Main sources
- FAO Annual Production/Utilisation Questionnaire
- NSOs
- Customs offices thru UN COMTRADE
- EUROSTAT
- Other unofficial (e.g. ISO, ICCO, Oil World, Barth, ICO…)
- Academic papers and web research

For **missing data: Production** imputations based on time-series models and availability for processing. **Trade** mirror statistics are used.

Data quality and validation
- outlier detection routines;
- expert knowledge (socio-economic, political stability, natural disaster);
- intensive communication and peer review by countries.

1.2 Data sources & reliability of the data

Questionnaire on Crop and Livestock Production and Utilization

Response rate 2010-2020

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Response rate
Bangladesh	1	0	1	1	0	1	1	1	1	1	1	82%
Djibouti	0	0	0	0	0	0	0	0	0	0	0	0%
Indonesia	1	0	0	1	1	1	1	1	1	1	1	82%
Jordan	1	1	1	1	1	1	1	1	1	1	0	91%
Oman	1	1	0	0	0	0	1	1	1	1	1	64%
Palestine	1	1	1	1	1	1	1	1	1	1	1	100%
Saudi Arabia	1	0	0	0	0	1	1	1	1	1	1	64%
Senegal	1	1	1	1	1	1	0	0	0	1	1	73%
Sudan	1	1	1	1	1	1	1	0	1	1	1	91%
Suriname	0	1	0	1	1	1	1	0	1	1	1	73%
Turkey	1	0	0	1	1	1	1	1	1	1	1	82%
Uganda	0	1	1	0	1	1	0	0	0	0	0	36%

1.3 Additional parameters

- **Population (de facto) numbers**
  Source: UNPD, used to calculate the per capita food & nutrient availability

- **Nutrient Factors**
  Provide calories/proteins/fats of each commodity (adjusted for refuse factors)

- **Extraction Rates (ER)**
  Reflect the quantity loss (or gain) during food processing.
  ER may vary by country according to efficiencies and technology.

- **Processing shares**
  Reflect the amounts allocated to produce the various derived products.

1.4 FBS - FAOSTAT example

Item	Pop.	Domestic Supply					Domestic Utilisation								Per Capita Supply		
		Prod.	Imp.	Stock Var.	Exp.	Total	Food	Proc.	Feed	Seed	Losses	Oth. Use	Tourist	Resid.	Total	Prot.	Fat
	(1000)	(1000 tonnes)													Kg/Yr / KCal/Day	g/Day	
Population	81,116																
Grand Total															3,540	101	126
Vegetal Products															3,002	65	92
Animal Products															538	36	34
Cereals - Excl. Beer		36,178	8,590	2,629	7,298	34,840	14,791	510	12,899	2,000	2,621	2,018	0	182	1,366	42	5
Wheat and products		21,500	5,178	2,599	6,449	17,630	11,655	20	2,093	1,380	1,205	1,276	0	144	1,086	36	4
Rice and products		900	448	-88	93	1,343	1,294		1	14	33	1	0	16	98	2	0
Barley and products		7,100	460	147	9	7,404		174	5,608	520	1,065	38	0				
Maize and products		5,900	2,492	-39	694	7,737	1,643	221	4,898	47	224	704	0	20	162	4	1
Rye and products		320		15	0	305	198		39	20	48		0	2	20	1	0
Oats		250	1	0	0	251	1	95	103	15	37		0	0	0	0	0
Millet and products		5	7	0	0	11			11	0	0		0				
Sorghum and products		0		0	0	0					0		0				
Cereals, Other		203	4	-5	54	159	0		146	4	9		0	0	0	0	0
Starchy Roots		4,801	305	1	285	4,820	3,801	0	259	264	486	10	0	47	91	2	0
Cassava and products			259		0	259	0		259			0	0	0	0	0	0
Potatoes and products		4,800	46	1	285	4,560	3,800	0	0	264	486	10	0	47	91	2	0
Sweet potatoes		0	0	0		0			0		0		0				
Roots, Other		1	0	0	0	1	1		0		0		0	0	0	0	0

1.5 FBS: recap

The SUA/FBS is an analytical dataset that :

- shows the sources of supply and its utilization for each food item (SUA) or food group (FBS);

- provides the **availability** for human consumption (in quantity & kcal);

- shows the changes in the types of food consumed;

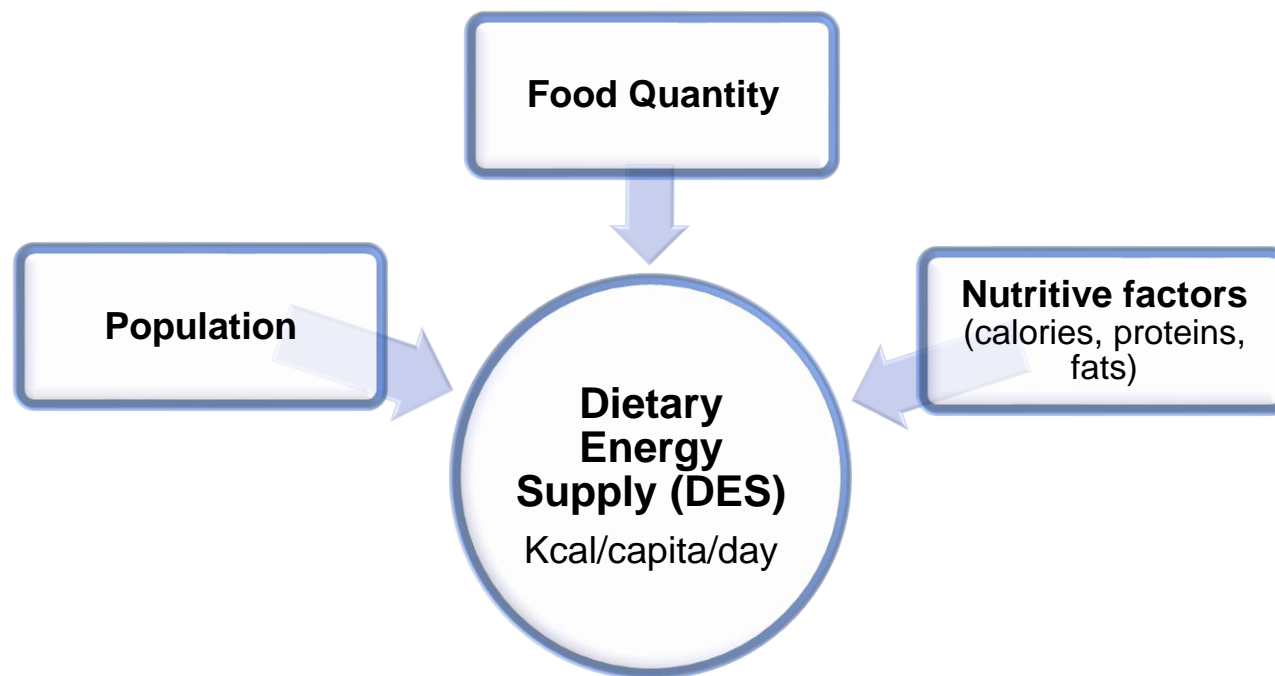- Future: micronutrient information (minerals & vitamins).

Part 2: Uses of the Food Balance Sheets (FBS)

2.1 Uses of the Food Balances (FBS)

Calculate the Dietary Energy Supply

(proxy of food consumption)

2.1 Uses of the Food Balances (FBS)

- Calculate the **Dietary Energy Supply** (Kcal/capita/day)

- Derive indicators (e.g. self-sufficiency ratio, import dependency)

- Eligibility for food aid

- Analyze livestock policies (e.g. allocations to animal feed)

- Harmonization of in-country data collection efforts

- Cross-check the different data variables & factors

- Comparison of food availability (from FBS) and food consumption (from HH surveys). e.g. waste analysis, access analysis.

- Input to National Accounts

2.1 Uses of the Food Balances (FBS)

🌱 **Calculate indicators**

- Dietary Energy Supply Adequacy

$$\text{DES adequacy} = \frac{\text{DES}}{\text{ADER}}$$

- Dietary Energy Consumption (DEC)

DEC = DES - (incidence of caloric losses at retail distribution level)

- Self-sufficiency ratio (SSR)

$$\text{SSR} = \frac{\text{Production}}{\text{Prod. + Imports - Exports - } \Delta \text{ Stock}}$$

- Import dependency ratio (IDR)

$$\text{IDR} = \frac{\text{Import - Export}}{\text{Production + Imports - Exports}}$$

- Apparent consumption

(Production + Import) ≥ Export

2.2 The FBS and the SDGs

Linked to three key SDG indicators:

Food Balance Sheets

DES
(Dietary Energy Supply)

Post-harvest losses

Health related quantities

INDICATOR 2.1.1
Prevalence of Undernourishment (PoU)
SDG 2 TARGET 1

INDICATOR 12.3.1a
Global Food Loss Index
SDG 12 TARGET 3

INDICATOR 3.5.2
Harmful use of alcohol
SDG 3 TARGET 5 (WHO)
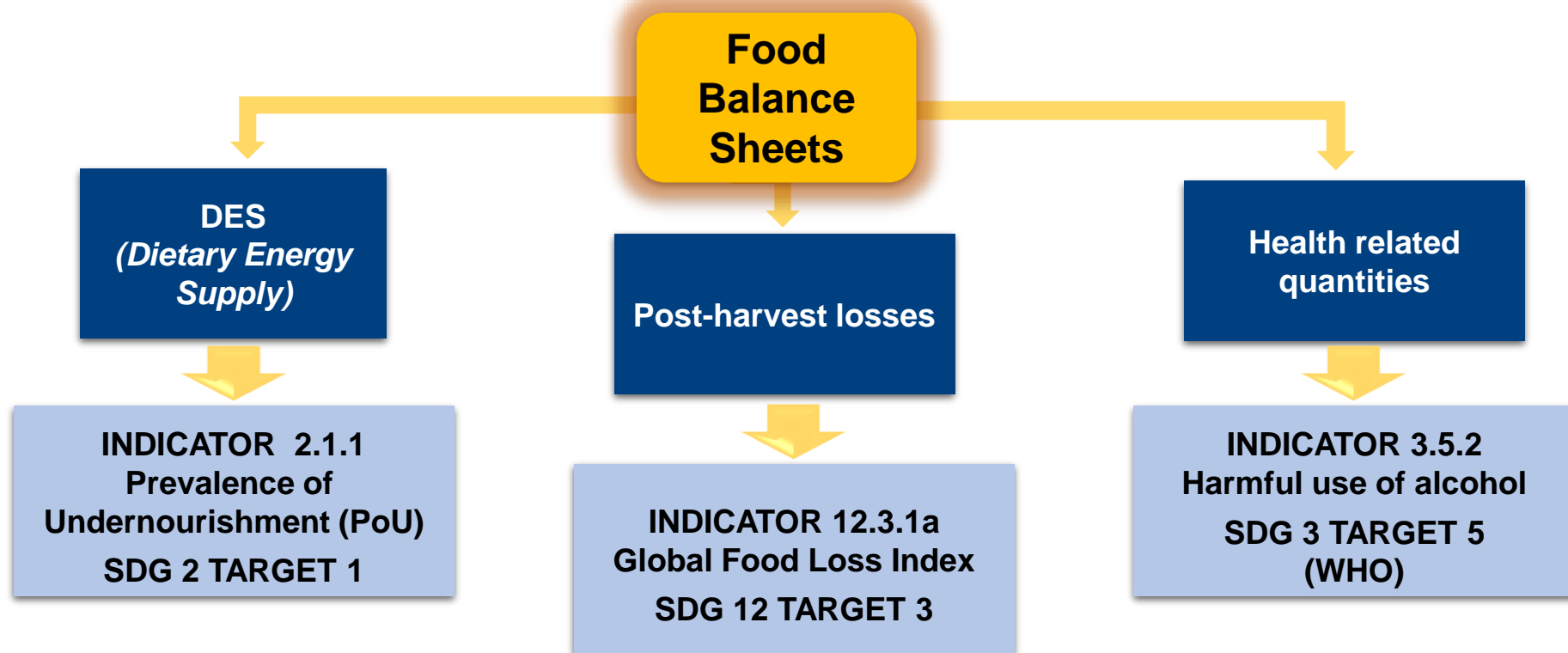
2.3 Comparison to household surveys

FBS		HH survey
Concept used	Food available for human consumption	Food consumption
PROS	• Not expensive • Snapshot of overall agri-food situation • Annual basis (comparable over time)	• Attempts measuring actual consumption • More detailed in sub-national, gender, economic-strata breakdown
CONS	• Sub-national level & population groups not taken into account • Doesn't measure actual consumption	• Relatively expensive • Not frequently conducted/readily available • Need to have institutional capacity & trained personnel • Data may not be fully captured (e.g. food consumed outside the house) • Data may not be representative • Frequently are expenditure surveys

Part 3: Interpreting FBS data

3. Interpreting FBS data

🌱 **" Food availability", not "food consumption"**

- DES is likely to overestimate the amount of food actually consumed

- FBS food availability takes into accounts all consumption within a country (HH, schools, hospitals….)

🌱 **Average of food/nutrient availability**

- Distribution among different groups of people is not considered

3. Interpreting FBS data

Commodity Balances ≠ FBS

- FBS : only food-related commodities (e.g. rubber is not included)

- FBS : the quantity estimates of food must be reported in their caloric equivalent

- FBS : contains aggregated estimates of both a primary commodity and all of its derived products (expressed at the primary commodity equivalent level)

  - many countries produce commodity balances for primary products, but do not account for goods derived from those primary products → underestimate total consumption

Part 4: New Methodology highlights

4.1 New FBS methodology: rationale

Past: The one-balancer approach
In the past, one of the components of the FBS (often stocks, industrial utilization or feed) would take on the outstanding unbalanced amounts thus inheriting all the statistical errors.

Present: Proportional balancing
With the new methodology, the imputations for the FBS components (for which data are not provided by countries) are generated by dedicated modules; a balancing mechanism will then **spread the imbalances out among all the components, proportionally to their historic weight**

4.2 Elements of innovation

1. Food Module

- First, food is estimated for all items as:

$$Food_{t1} = Food_{t0} * \frac{Pop_{t1}}{Pop_{t0}} * e^{\left(elasticity * \log\left(\frac{GDPPC_{t1}}{GDPPC_{t0}}\right)\right)}$$

Where:

$Food_{t0}$ is food at time t_0,

Pop_{t0} is population at time t_0,

$GDPPC_{t0}$ is GDP per capita at time t_0

- then during balancing, if food is the only utilization it becomes the balancer of the equation (*food residual*)

4.2 Elements of innovation

2. Losses (up to retail level)

- linear hierarchical algorithm based upon commodity and country groups
- make use of web scraping, text mining and academic/research articles and publications
- Annual Questionnaire will be expanded to cover losses in more detail

3. Feed

- generates values matching **feed requirements** and **feed commodity availability**
- feed requirements are based on actual animal numbers and species and on the typology of livestock farming (intensive vs pasture grazing)

4.2 Elements of innovation

4. Stocks (farm, enterprise, strategic)

- wider use is made of AMIS, USDA and specialized commodity institution stock data (such as OilWorld). Past approach: used stock as a balancer resulting in unrealistic levels and variations

- module imputes stock variations vis-a-vis supply

- mathematical constraints to check the effect of a stock variation on the corresponding opening stock levels, which:
    i.   cannot be unrealistically high
    ii. cannot be negative (negative stock variation greater than opening stock)

- a more realistic reference file has been created for potentially stockable commodities (e.g. fresh meats can be expensively stocked only in certain rich countries).

4.2 Elements of innovation

The **stock variations** are calculated as:

$$\Delta stock_t = Supply\_excluding_t - \widetilde{supply\_pred}_t$$

Where:

$\Delta Stock_t$ = stock variation during t,

$Supply\_excluding_t = Production_t + import_t - export_t$

$\widetilde{supply\_pred}_t$ = Predicted supply including stock, modelled as a smoothing function of supply including stock in the past

Constraints:

$\Delta stock$ if negative: **Δstock ≤ opening stock**

               if positive: **Δstock+opening stock ≤ supply**

4.2 Elements of innovation
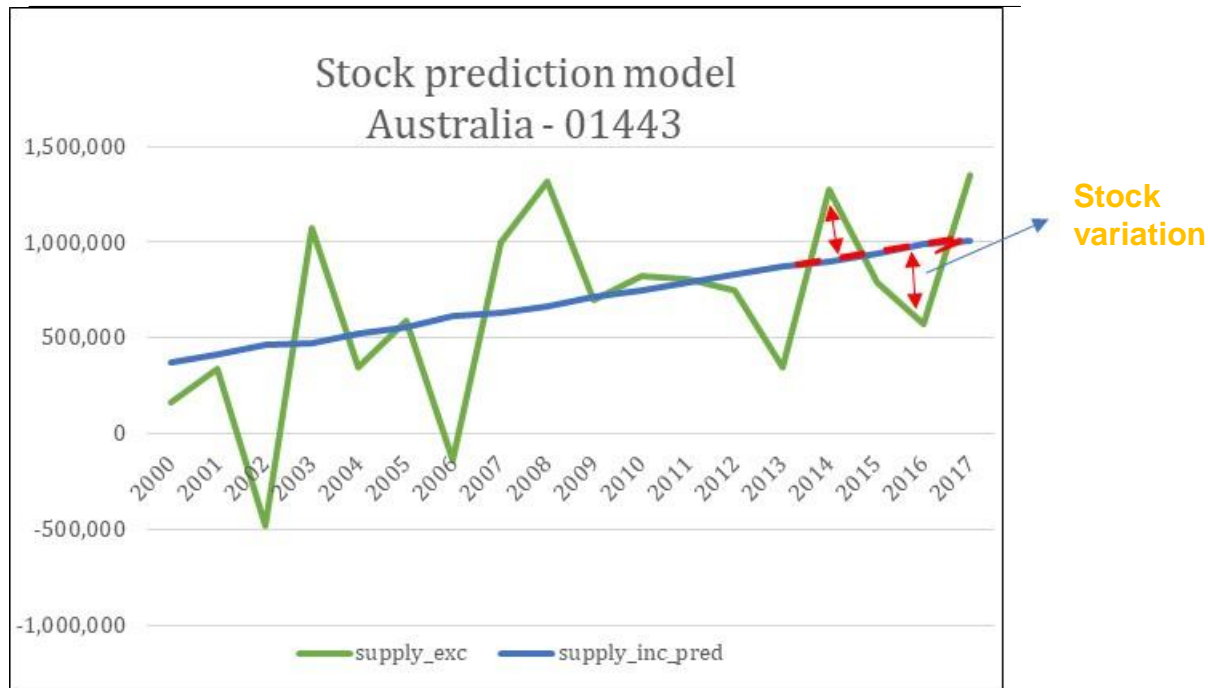
4.2 Elements of innovation

5. New element: Tourist allocation

- food available for consumption by non-resident visitors
- expressed in net terms (as food available for consumption by incoming visitors minus the food that would have been consumed by outgoing residents). Tourist data from UNWTO.
- presently, calculated only for selected countries (such as Small Island Developing States), where tourism has a significant impact on the food supply

6. New element: Industrial use

- non-food transformation or manufacturing, covering biofuels, cosmetics, detergents, medicinal, etc.
- Sources: USDA, NSO websites, scientific papers, intensive web research

4.2 Elements of innovation

7. Proportional balancing mechanism

- based upon a 3-year moving average of the share of each variable in the total utilizations
- several re-iterations to solve all imbalances
- upper and lower boundaries for the different utilizations (based on the max/min over the time series of the ratio over supply)

Constraints:

$$\min_t \left(\frac{Value_k}{supply_k} \right) \leq \left(\frac{\mathbf{Value_k}}{\mathbf{supply_k}} \right) \leq \max_t \left(\frac{Value_k}{supply_k} \right)$$

Where:

$$t = \{2000, \dots, 2013\}$$

4.3 New function of Residual variable

Approach of the past: balance "at all costs"!

In the past, imbalances were allocated mainly to stocks, feed or other utilizations. This created unrealistic fluctuations and stock levels.

Our new "transparent" approach

Given the constraints to proportional balancing, unsolved imbalances will go to Residuals. This new variable :

- Represents, as yet, unidentified utilization or supply (e.g. it may represent uncaptured/non-reported trade; unidentified industrial uses)
- Avoids unrealistic and discretional imputations
- Indicates where more research is needed
- Accounts for statistical errors

Part 5: Capacity development and new country Compilation Tool

5.1 The FBS capacity development standard workplan

Preparatory work	1° mission	2° mission	3° mission	4° mission	Optional 5° mission

Establishment of the TWG

Assessment

Training in methodology

Design & compilation of the national SUA/FBS

Review/ analysis of national SUA/FBS

Finalization & dissemination of results

FAO remote support
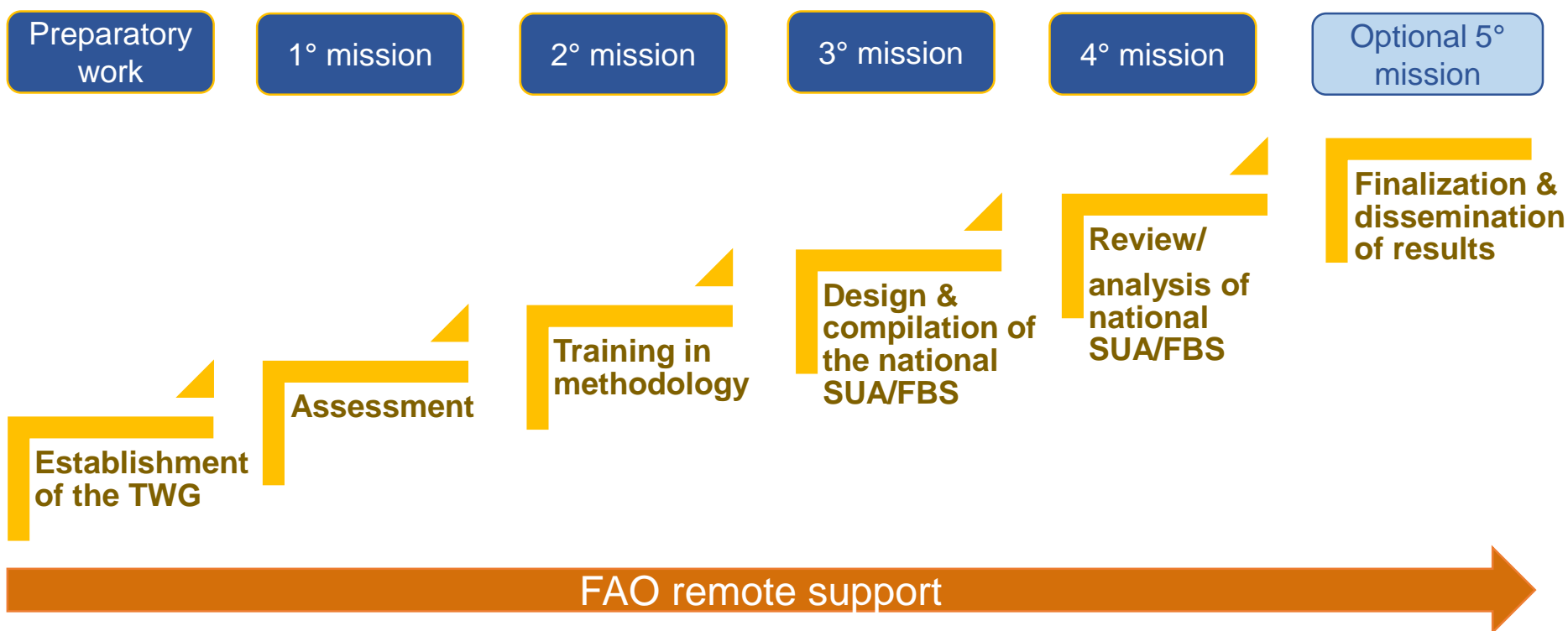
5.2 The FBS capacity development package

Guidelines for the compilation of Food Balance Sheets
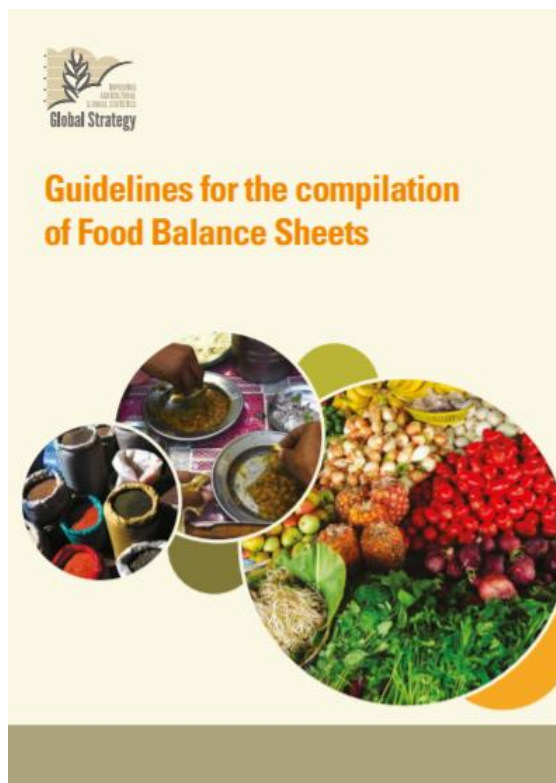
- Guidelines
- Presentations
- Practical exercises
- **New** country **Compilation Tool**
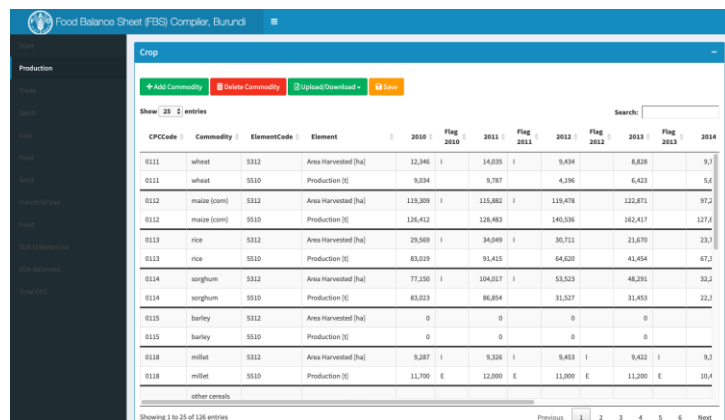
5.3 The New FBS country Compilation Tool

Incorporates new methodology

Downloadable outputs

Updated remotely

Stand alone

Country specific

5.3 The New FBS country Compilation Tool

Functions available

- Enter relevant data

- Impute missing utilizations (based on FAO models)

- Standardize derived commodities into primary equivalents

- Generate FBS from detailed balanced SUAs

- Micronutrient functions will be added soon

Food and Agriculture Organization of the United Nations

Thanks for your attention !

Our new FBS data can be found on FAOSTAT :
http://www.fao.org/faostat/en/#data/FBS