Sampling Errors and Assessment of Survey Quality

September 2025

1. Sampling-Related Considerations

a) Sample Size and Precision

- The survey aimed for **national and regional representativeness**, focusing on **area planted** and **livestock (TLU)** as key precision indicators.
- Based on the quantity produced, Some crops recorded a **Coefficient of Variation (CV) above 35%**, reflecting regional crop diversity (Table 1).
- **Table 1: Number of Regions with a Coefficient of Variation (CV) Above 35 Percent Based on Quantity Produced**

Crop	Short Rainy Season	Long Rainy Season	Agricultural year
Maize	11	5	5
Paddy	13	17	15
Sorghum	14	21	23
Bulrush Millet	3	7	8
Cassava	7	23	19
Sweet potatoes	12	20	21
Irish potatoes	12	12	13
Cocoyams	9	10	14
Onion	11	17	20
Ginger	1	-	1
Garlic	1	2	2
Beans	14	10	7
Cowpeas	17	24	25
Pigeon pea	-	-	11
Sunflower	18	13	14
Sesame	9	13	16
Groundnut	16	19	18
Cashew nut	-	-	8
Cotton	5	12	11

Coffee	-	-	7
Sugar cane	-	-	18
Cardamon	-	-	3
Cinnamon	-	-	1
Clove	-	-	5
Banana	-	-	20
Avocado	-	-	14
Mango	-	-	20
Pineapple	-	-	11
Orange	-	-	19
Grapes	-	-	1
Cabbage	8	11	13
Spinach	9	12	15
Carrot	4	7	7
Amaranths	13	22	23
Cucumber	5	11	11
Water mellon	11	18	20
Okra	13	19	21
Tomatoes	23	27	27
Bitter tomato	12	12	16
Sweet/bell pepper	12	13	17

- lack of data/Not applicable

The results of CV based on the quantity produced, show that staple crops such as maize, paddy, beans, groundnuts, and cassava recorded low coefficients of variation, generally ranging between 3 and 10 percent, lower standard deviation relative to the mean. In contrast, horticultural and spice crops such as garlic, cardamom, clove, cinnamon, and grapes showed high variability, with coefficients ranging between 60 and 85 percent, reflecting fluctuations in production due to climatic variations, market conditions, and limited cultivation areas. Overall, the findings suggest that major food crops are more stable in production, while cash and horticultural crops experience greater variability across seasons (Table 2).

Table 2: Coefficient of Variance of crop production by crops and season

Crop	Short Rainy Season	Long Rainy Season	Agricultural year
Maize	5	4	3
Paddy	8	7	6
Sorghum	27	16	14
Bulrush Millet	56	21	21
Cassava	10	10	7
Sweet potatoes	11	17	13
Irish potatoes	35	18	18
Cocoyams	39	36	30
Onion	51	23	22
Ginger	52	-	52
Garlic	100	73	66
Beans	8	8	7
Cowpeas	16	39	28
Pigeon pea	-	-	9
Sunflower	33	8	9
Sesame	30	11	11
Groundnut	11	8	7
Cashew nut	-	-	25
Cotton	25	25	22
Coffee	-	-	14
Sugar cane	-	-	6
Cardamon	-	-	85
Cinnamon	-	-	62
Clove	-	-	84
Banana	-	-	11

Avocado	-	-	30
Mango	-	-	55
Pineapple	-	-	52
Orange	-	-	45
Grapes	-	-	69
Cabbage	43	76	53
Spinach	60	55	56
Carrot	54	42	41
Amaranths	34	32	31
Cucumber	48	68	57
Water mellon	40	45	35
Okra	37	61	48
Tomatoes	23	33	26
Bitter tomato	37	42	34
Sweet/bell pepper	49	37	37

- lack of data/Not applicable

2. Survey Calendar Considerations

a) Change of Survey Calendar

- Originally, AASS 2023/24 was planned as a **two-visit survey**, but **funding constraints** led to a **one-visit design**.
- **Recommendation:** Strengthen **coordination** between technical, financial, and administrative teams to align **technical plans with funding timelines**.

b) Data Collection Timing and Duration

- Data collection began **in November 2023 instead of October** and ran until **February 2024**.
- Late fieldwork coincided with **heavy rains and floods**, causing logistical challenges.
- **Recommendation:** Separate the **listing operation** from the main survey and provide **adequate time and supervision** for listing activities.

3. Data Collection Considerations

a) Use of Conversion factors

- With FAO's support under the **50x2030 Initiative**, AASS 2023/24 introduced improvements such as:
- Use of crop **conversion factors** derived from a dedicated **Non-Standard Units (NSU) of Measurement Survey** as farmers in Tanzania largely use **local units** instead of standard weights.
- The resulting conversion factors were used in AASS 2023/24 to **standardize the quantities of production for crops**, thus enhancing estimate accuracy.

Overall Key Recommendations

i. **Segment large EAs** and maintain an **updated sampling frame** for future surveys.

ii. **Separate household listing** from data collection, with adequate time and supervision.

iii. **Align survey planning with funding availability** to prevent delays.

iv. **Continue integrating NSU conversion factors** to improve data quality and comparability.

Annex 1: The Concept of Sampling Errors and Quality Assessment of Surveys

The concepts of sampling errors and assessment of survey quality originated from the development of modern survey sampling theory, which dates back to the early 20th century, particularly in statistics and official government statistics. Here is a concise historical overview:

- **Early Foundations (1890s–1930s):**
  - The ideas of sampling instead of full enumeration were introduced to make surveys more efficient and less costly.
  - **Jerzy Neyman (1934)** formalized the concept of **stratified random sampling** and introduced the theoretical framework for **estimating sampling errors**, which allows statisticians to measure the precision of survey estimates.
- **Development in Official Statistics (1940s–1960s):**
  - National statistical offices, particularly in the **United States and Europe**, began systematically applying sampling in agricultural, labor, and economic surveys.

    - The recognition that surveys produce both **sampling errors** (from observing a sample rather than the entire population) and **non-sampling errors** (like measurement errors, nonresponse, and data processing mistakes) became central to survey quality assessment.

- **Formalization of Survey Quality Assessment (1960s–1980s):**
    - Concepts of **total survey error (TSE)** and **quality assessment frameworks** were introduced to evaluate both sampling and non-sampling errors systematically.
    - Key organizations like the **United Nations Statistical Division**, **OECD**, and **U.S. Census Bureau** helped standardize survey quality guidelines.
- **Modern Practice:**
    - Today, **sampling errors** are routinely quantified using measures such as **standard errors, coefficients of variation, and confidence intervals**.
    - **Survey quality assessment** considers multiple dimensions: accuracy, reliability, timeliness, coherence, and relevance.
    - International standards (e.g., **UN Fundamental Principles of Official Statistics**) emphasize transparent reporting of both sampling and non-sampling errors for high-quality survey results.

In short, the idea originated from **statistical theory on sampling** (Neyman, 1930s) and evolved through **official statistics practices** to include **comprehensive survey quality assessment**.