Second Regional Training Course on Sampling Methods for Producing Core Data Items for Agricultural and Rural Statistics

Module 2: Review of Basics of Sampling Methods

Session 2.8: Sampling Frames – Types, Sources and Uses

9 – 20 November 2015,
Jakarta, Indonesia

UNITED NATIONS
SIAP
Statistical Institute for
Asia and the Pacific

IMPROVING AGRICULTURAL STATISTICS
Global Strategy

BPS, Statistics Indonesia

Contents

- Sampling Frames – Purpose
- Structure of Sampling Frames
- Types of Sampling Frame
- Construction, Maintenance, updating
- Master Sample Frame

UNITED NATIONS
SIAP
Statistical Institute for Asia and the Pacific

Sampling Frame

- Purpose

3

Probability Sampling

Statistical Survey Design – Issues involved

1. Determining survey objectives and data requirements
2. The population of interest or the target population
3. Reference period; Geographic and demographic boundaries
4. **Sampling frame** and sampling unit
5. Sample design
6. Selection of the sample (at different stages)
7. Survey management and field procedures
8. Data collection
9. Summary and analysis of the data
10. Dissemination

Main focus

Content of the present course

4

Sampling frame

Sampling frame: A list of *sampling units* from which selection of sample is made.

➢ Essential for selecting the elements of the target population

➢ Provides information for locating and identifying the units

➢ Provides quantitative information for estimation of population parameters based on sample observations.

5

Sampling Units

Sampling units may be different from the *Observational units* comprising the target population

Examples:	sampling unit	observational unit
	holdings	plots
	landing ports	trawlers & boats
	orchards	trees
	dairy farms	milch animals

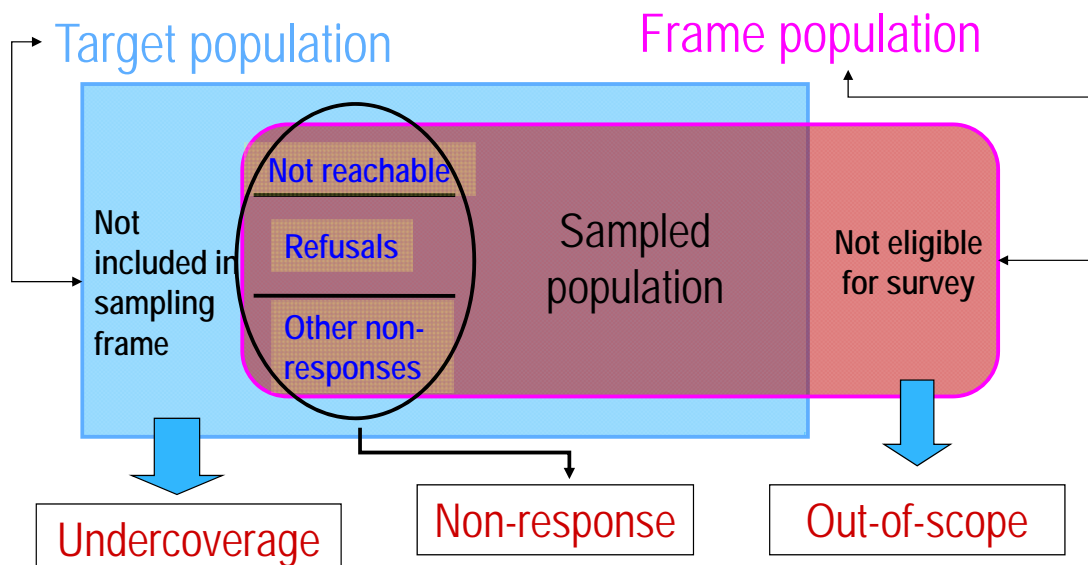6

Target Population

- Collection of elements of interest as defined by survey objectives
- Needs to be clearly specified:
  - Content- type and characteristics of elements
  - Extent in space- boundaries of geographical coverage
  - Extent in time- period over which survey measurements are valid

7

Coverage Error

Target population

Frame population

Not included in sampling frame

Not reachable

Refusals

Other non-responses

Sampled population

Not eligible for survey

Undercoverage

Non-response

Out-of-scope

Structure of Sampling Frame

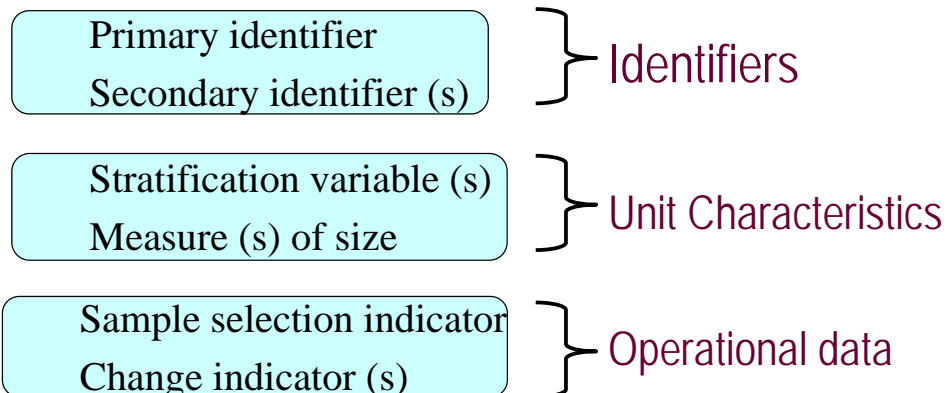---

Structure

Desirable Properties

- Completeness and accuracy
- Being up-to-date
- Having unique identification
  - ➢ For physically locating a unit
  - ➢ For selection of sample
- Having supplementary information for sample selection and estimation

Sampling Frame – Broad Structure

Each unit is a record in the database and consists of

| Primary identifier |
| Secondary identifier (s) |

⎫ Identifiers

| Stratification variable (s) |
| Measure (s) of size |

⎫ Unit Characteristics

| Sample selection indicator |
| Change indicator (s) |

⎫ Operational data

Contents of Each Record

Information	Purpose
Primary identifier	Uniquely identifies frame unit
Secondary identifiers	Aid in locating unit
Stratification variable(s)	For grouping of units prior to sample selection
Measure(s) of size	For use of stratification, selection estimation, etc.
Sample selection indicator	Show which unit has been selected
Change indicator	Keep track of nature and sources of changes

Supplementary Information

- For Selection of sampling units
  - ➢ Stratification
  - ➢ Size variable for PPS
  - ➢ Variable for arranging the population for systematic sampling
  - ➢ Domain delineation
- For estimation of population parameter
  - ➢ Population size (N)
  - ➢ Total of size variable (Z)
  - ➢ Totals of variables for ratio estimation

13

Types of Sampling Frame

14

Types of Sampling Frame

- ➤ List Frame
- ➤ Area/Area-based Frame
- ➤ Multi-stage Frame
- ➤ Frames for series of surveys

15

List Frame

- ➤ Consists of a list of observational unit
- ➤ Usually used for single stage sampling or complete enumeration
- ➤ Often covers only the large units, which are few in number but have substantial share in the population total.

Examples:

- List of households from Population census or population registers
- List of (cadastral-surveyed) plots from land records
- List of large plantations and orchards
- List of marine fishing companies

16

Area Frame

❖ A list of geographical units of a country in a hierarchical arrangement that are usually used as sampling frame at the first stage of selection.

❖ The entire country be covered

  – Boundaries are well delineated.

  – Population figures are available.

  – Geographical Units are mapped.

Examples:
- List of villages / urban enumeration blocks
- Satellite images and cover
- Arial photographs

17

Multi-Stage Frame

These are used for multi-stage sample selection and refer mainly to frames used at Second and later stages of sampling.

Examples:
- **FSU: Villages**
  ➢ SSU frame: listing of households
  ➢ list of holdings
  ➢ list of plots from village land records

- **FSU: Forests**
  ➢ SSU frame: list of beats (smaller area unit) from records
  ➢ listing of trees

18

Frame for Series of Surveys

- These are used for multi-stage sampling, usually consisting of second and subsequent sampling units.

- Next stage units may be same or different

Example:

Master sample for different surveys consisting of

- ➤ A fixed sample of FSUs that are used for different surveys
- ➤ Lists of SSUs in the selected FSUs [often called *Master Sample Frame* (*MSF*)] : These could be
  - – List of households
  - – List of holdings
  - – List of plots
  - – List of dairy farms

19

Construction Maintenance and Updating

20

Construction

Choice of frame units
- ♦ Cost consideration in establishing and maintaining
- ♦ Availability of type of information for frame units
- ♦ Stability of frame units over time
- ♦ Time needed to construct frame

Development of frame
Construction of database including maps for area frames

Validation of frame
Coverage achieved
Quality of information

21

Maintenance and Updating

Maintenance

- ▶ Removing duplicates
- ▶ Removing 'deaths', such as—
  - ♦ Closed establishments
  - ♦ Burned down or demolished housing units
- ▶ Incorporating 'births', such as
  - ♦ New establishments
  - ♦ New housing units in enumeration areas
- ▶ Updating auxiliary information

Updating Master Samples

To reflect population changes so it continues to be 'representative'
- ➢ Prepare new listings of households in sample clusters
- ➢ Periodical update of entire frame to account for post-censal high-growth areas

Master Sample Frame

MSF - Desirable Structure

Master Sample Frame

* **Master Sample:** Sample of units designed for multiple use (different surveys or same surveys repeated over time)

* **Main objective:** Economize on costs of developing sampling frames and materials and for sample design and selection

* Typically, a *Master Sample* for surveys for collection of agricultural activities and rural statistics consists of a sample of FSUs.

Desirable Structure of a MSF

For such master samples,

* the MSF consists of lists of *holdings* or some other appropriate units within a selected FSU.

* the lists of *holdings* ought to be updated periodically .

* the MSF thus have provision of recording details of updating.

25

Identifiers

For each record,

* Primary identifiers of the selected FSU

* Secondary identifiers of the selected FSU

* Sampling particulars of the FSU, such as

   First-stage stratum, FSU order of selection, in case of PPS selection, FSU-size, stratum size etc.

* Primary identifier of the SSUs and USUs – identification particulars of the holder, type of holder, ID numbers of constituent plots, etc.

26

Unit Characteristics

Different characteristics of the holdings that could be used for sample selection and estimation, such as

- Operated area classified by agricultural and non-agricultural use
- No. of plots and parcels in the holding
- *Agricultural activities* of the holding
- Number of livestock and poultry by kind
- etc.

27

Operational Data

- Sample selection indicator
- Change indicator

28

Integration of Sampling Frames
- Selection and *Creation* of MSF

Integration for MSF

Two Main Components

Integration for

* selection of *Master Sample* of FSUs.

* creation of *Master Sampling Frame* (*MSF*) of SSUs – holdings or households – for subsequent stages of selection.

Integration for Selection of Master Sample

Integration for selection of Master Sample of FSUs requires -

* linking FSU-level (i.e. *village-* or *cluster-level*) data from different sources – such as

  ➢ Population Census,

  ➢ Agricultural Census,

  ➢ Livestock Census,

  ➢ Administrative land use data, etc.

31

Integration for MSF

Integration for creation of MSF for selection of SSUs requires

  ➢ Linking SSU-level (i.e. holding- or household-level) data from different sources

  ➢ Usually, reference periods of censuses (sources) are different. If SSUs are the same, their IDs may be developed chronologically in different censuses

  ➢ If SSUs be different (for example households, agricultural holdings, livestock holdings etc.), there should be provision of establishing links between different types of units. [An illustrative format is given on the next slide]

32

Integration for MSF

MSF format - An Illustration

FSU ID	SSU ID			Agricultural activities			
	Hhd. ID	Holding ID	Holding type code	crop	Vege.	fruits	livestock
			(indiv.,				
			int,				
			iple,				

Popula... ma...

Using Population

From Agricultural Census, in which each holding should have the updated HHd. ID from Pop. Census, and holding type code.

33

Thanks

_____

Group Work:

➢ Identify suitable Sampling frames for the agricultural surveys and

➢ develop a structure of a Master Frame for them, clearly identifying the source of data.

34