

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

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Country Report – Indonesia

Sampling Design for 2014 Survey on Livestock-Farming Household (STU 2014)

1.1. Sampling Frame

There are two types of sampling frame used in the 2014 Survey on Livestock-Farming Household or, in *Bahasa Indonesia*, *Survei Rumah Tangga Usaha Ternak* 2014 (STU 2014). The first type is sampling frame for the selection of census blocks/BS (enumeration area unit), defined as a list of census blocks that consists of ordinary census blocks and charged preparatory census blocks of the coverage of ST 2013 (2013 Agricultural Census), stratified by main livestock type and sorted by strata of commodities. The eligible census block on STU 2014 is as census block that has ten or more eligible livestock-farming households.

The second type is sampling frame for the selection of livestock-farming household samples, defined as the head name list of the livestock-farming household for each of selected census block, sorted by main type and number of livestock farming by the household at the time of enumeration and has been giving production over a year ago. The variables for sorting are derived from the result of the Farming Profile of the Selected Commodities (ST2013-UKPT Block II detail 201.F1 Column (4) of the main field). The eligible livestock-farming household on STU 2014 is a household that holding husbandry activities (farming) of selected livestock type. Specifically for broiler livestock type, eligible broiler-farming household is defined as a household farming more than 100 broilers. Here, as for implicit stratification, the number of livestock is used as farming scale approach.

1.2. Census Blocks Stratification

The stratification of census blocks is intended to classify census blocks into groups based on the relative number of households according to the main livestock type farmed. Each census block can only be classified into one particular stratum of commodity. The formed stratifications are used as the basic for sampling census blocks per main livestock

type. For each main livestock type, concentration stratum corresponds to the main livestock type is defined as a group of census blocks with the composition of households holding husbandry activities of the main livestock type which is dominant. Stratification is done in the provincial level. Strata (subpopulations) are divided into follows:

1. buffalo stratum
2. milk cow stratum
3. beef cattle stratum
4. pig stratum
5. sheep stratum
6. goat stratum
7. native chicken stratum
8. broiler stratum
9. laying chicken stratum
10. duck stratum
11. manila duck stratum
12. rabbit stratum
13. non-concentration stratum

1.2.1. Notations

To facilitate understanding of the census blocks stratification process, the following notations are used:

h : the census block ($h = 1, 2, \dots, k$),

i : the main livestock type ($i = 1, 2, \dots, 12$),

N_{hi} : the number of household farming the main livestock type i in the census block h ,

A_i : the number of census block that contains at least one household farming the main livestock type i ,

$N_{.i}$: the number of household farming the main livestock type i .

1.2.2. Stratification Process

Census block stratification process is constructed as follows:

- 1). If $N_{hi} = 0$ for all i , then the census block is classified as non-concentration stratum.
- 2). Calculate the average number of household farming the main livestock type i in the census block with the formula:

$$B_i = \frac{N_i}{A_i}.$$

- 3). Calculate the concentration index for each census block and main livestock type i with the formula:

$$I_{hi} = \frac{N_{hi}}{B_i}.$$

- 4). Rank I_{hi} amongs all of I_{hi} ($i = 1, 2$) for all census blocks as follows:

$R_{hi} = 1$ for the first highest value (rank) of I_{hi} ,

$R_{hi} = 2$ for the second highest value (rank) of I_{hi} ,

$R_{hi} = 0$ for all i with $N_{hi} = 0$.

- 1) Define $R_{1h} = i$ (first rank of census block h) in accordance with the main livestock type for $R_{hi} = 1$ in census block h , and $R_{1h} = 0$ if $N_{.h} = 0$.
- 2) Define $R_{2h} = i$ (second rank of census block h) in accordance with the main livestock type for $R_{hi} = 2$ in census block h , and $R_{2h} = 0$ if $N_{.h} = 0$.
- 3) Define stratum/substratum based on R_{1h} and R_{2h} combination.

The census block stratification process by stratum is illustrated in scheme belows:

Figure 1. Scheme of Constructing Strata of Concentration Census Blocks

BS	Number of household farming the main livestock type ($i=1, 2, \dots, 12$)					Concentration index (I_{hi})					R_{1h}	R_{2h}	Stratum
	1	...	i	...	12	1	...	i	...	12			
1													
2													
...													
h	N_{h1}		N_{hi}		N_{h12}	I_{h1}	...	I_{hi}	...	I_{h12}			
...													
K													
$N_{.i}$	$N_{.1}$		$N_{.i}$		$N_{.12}$								
A_i	A_1		A_i		A_{12}								
B_i	B_1		B_i		B_{12}								

Examples:

- $R_{1h} = 1$ and $R_{2h} = 0$, is a group of census blocks that containing husbandry holding of buffalo.

- $R_{1h} = 1$ and $R_{2h} = 2$, is a group of census blocks with husbandry holding of buffalo as the first rank concentration index, whereas milk cow-farming as its second rank concentration index.

1.2.3. Evaluation

Stratification process that has been carried out in the previous procedure will produce preliminary census block stratification that must be evaluated to produce make sense census block groups. The procedures of evaluation are as follows:

- 1) For simplicity, the change in notation is needed.

k : the census block

j : the first rank of concentration index with main livestock type j ($j = 1, 2, \dots, 12$).

j' : the second rank of concentration index with main livestock type j' ($j' = 0, 1, 2, \dots, 12$).

For $j' = 0$, the census block only containing main livestock type j

$N_{k(j,j')}^j$: the number of household farming the main livestock type j in substratum (j,j') .

$\bar{N}_j^j$: the average number of household farming the main livestock type j in stratum j .

- 2) Evaluation Procedure

For $j' = 0$

If $N_{k(j,j')}^j < \bar{N}_j^j$, then $j = n+1=12+1=13$, census block k classified as non-concentration stratum of main livestock type.

For $j' \neq 0$

- If $N_{k(j,j')}^j \geq \bar{N}_j^j$ and $N_{k(j,j')}^{j'} \geq \bar{N}_{j'}^{j'}$, then $j = j$
- If $N_{k(j,j')}^j < \bar{N}_j^j$ and $N_{k(j,j')}^{j'} \geq \bar{N}_{j'}^{j'}$, then $j = j'$
- If $N_{k(j,j')}^j < \bar{N}_j^j$ and $N_{k(j,j')}^{j'} < \bar{N}_{j'}^{j'}$, then $j = n+1=12+1=13$

- 3) Based on evaluation, each of census block classified into one only stratum.

1.3. Sample Allocation

The number of samples in STU 2014 is designed to estimate the provincial level. Allocation sample of households and census blocks by main livestock type performed for each district/municipal. Sample allocation method that is used will be tailored to the distribution of the number of households per stratum.

- The allocation sample of households for district/municipal level performed within the province for any kind of livestock husbandry with the power allocation as follows:

$$m_{sk} = \frac{M_{sk}^{\alpha}}{\sum M_{sk}^{\alpha}} \times m_s ,$$

with:

- m_{sk} : the number of household holding husbandry's sample target of subsector s (livestock type) in district/municipal k ,
- m_s : the number of household holding husbandry's sample target of subsector s in a province,
- M_{sk} : the number of household holding husbandry's population of subsector s in district/municipal k ,
- α : constanta of *power allocation* ($\alpha=0,5$).

- The allocation sample of households by stratum within district/municipal is performed with formula:

$$m_{skh} = \frac{M_{skh}^{\alpha}}{\sum M_{skh}^{\alpha}} \times m_{sk}$$

with:

- m_{skh} :the number of household holding husbandry's sample target of subsector s in district/municipal k stratum h ,
- m_{sk} :the number of household holding husbandry's sample target of subsector s in district/municipal k ,
- M_{skh} :the number of household holding husbandry's population of subsector s in district/municipal k stratum h ,
- α :constanta of *power allocation* ($\alpha=0,5$).

- The number of census block's sample by stratum determined as follows:

$$n_{skh} = \frac{m_{skh}}{10} ,$$

with:

- n_{skh} : the number of census block's sample of subsector s district/municipal k stratum h ,
- m_{skh} : the number of household holding husbandry's sample of subsector s district/municipal k stratum h .

1.4. Sampling Procedure

The sampling method used in STU 2014 is a two-stage stratified sampling design. Census block sampling for each stratum of livestock type in each district/municipal conducted separately with the following procedures:

- The first phase, some census blocks are selected from the sampling frame of census block with systematic probability proportional to size with number of household holding livestock husbandry as size.
- The second phase, some households are selected from the sampling frame of households with systematic sampling. As the implicit stratification are main livestock type and number of livestock farming by the household at the time of enumeration and has been giving production over a year ago. The variables for implicit stratification are derived from the result of the Farming Profile of the Selected Commodities (ST2013-UKPT Block II detail 201.F1 Column (4) of the main field).

In each of selected census block, households with large amount of livestock entirely taken as samples; whereas sampling procedure is implemented for households with relative small and medium amount of livestock. Special treatment for broiler-farming households: if it has under a hundred of broiler then the household is excluded from sampling frame of households (so it does not have a chance of being selected as a sample). Special treatment for laying chicken-farming households: cut-off point of farming scale for the sampling household is not required. The cut-off point for scaling the farming of household can be seen in the following table.

Table 1. Cut off point of livestock-farming household sampling

Livestock	Number of livestock Block II detail F1 column (4)			UKPT CODE
	Small (set for the sampling procedure)	Medium (set for the sampling procedure)	Large (take all as samples)	
Big/small livestock				
buffalo	1 – 2	3-9	≥ 10	4101
milk cow	1 – 2	3-9	≥ 10	4103
beef cattle	1 – 2	3-9	≥ 10	4104
pig	1 – 4	5-19	≥ 20	4201
sheep	1 – 4	5-19	≥ 20	4202
goat	1 – 4	5-19	≥ 20	4203
Other livestock				
native chicken	1-9	10-29	≥ 30	4301
broiler	> 100		-	4302

laying chicken	Any number of livestock		-	4303
duck	1-9	10-29	≥ 30	4304
manila duck	1-9	10-29	≥ 30	4305
rabbit	1-9	10-29	≥ 30	4406

The sampling procedure of census blocks was conducted by BPS RI, whereas sampling of households conducted by representative of BPS in district/municipal. List of selected census blocks included in ST2013-STU.DSBS, and a list of selected households included in ST2013-STU.DSRT.

1.5. Estimation Procedure

Estimation of characteristics conducted at the provincial level per subsector. Multiplier factor calculation procedure as follows:

Stage	Unit	Number of unit in stratum h		Sampling Method	Probability	Fraction
		Population	Sample			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Census block	N_{kh}	n_{kh}	$pps, size M_{khi}$	$\frac{M_{khi}}{M_{kh}}$	$n_{kh} \frac{M_{khi}}{M_{kh}}$
2	Household	M'_{khi}	$\bar{m}_{khi}=10$	Systematic	$\frac{1}{M'_{khi}}$	$\frac{\bar{m}_{khi}}{M'_{khi}}$

Based on above *sampling scheme*, *design weight* can be calculated with formula:

$$w_{khi} = \frac{M_{kh}}{n_{kh} M_{khi}} \frac{M'_{khi}}{\bar{m}_{khi}},$$

with:

M_{kh} : the number of farming households from entire census blocks in district/municipal k stratum h ,

M_{khi} : the number of farming households resulted from ST2013-P in district/municipal k stratum h census block i ,

M'_{khi} : the number of farming households resulted from ST2013-PBS in district/municipal k stratum h census block i ,

n_{kh} : the number of census block's samples in district/municipal k stratum h ,

$\bar{m}_{khi}$: the number of household's samples in district/municipal k stratum h census block i .

Estimation of Y characteristics for a commodity based on data collected from j -th household in census block i stratum h follows below formula:

$$\hat{Y}_s = \sum_{k=1}^K \sum_{h=1}^H \frac{M_{kh}}{n_{kh} M_{khi}} M'_{khi} \sum_{i=1}^{n_{kh}} \frac{1}{\bar{m}_{khi}} \sum_{j=1}^{\bar{m}_{khi}} y_{khij} ,$$

and the formula of variance as follows:

$$v(\hat{Y}_s) = \sum_{k=1}^K \sum_{h=1}^H \frac{1}{n_{kh}(n_{kh}-1)} \sum_{i=1}^{n_{kh}} (\hat{Y}_{hi}^* - \hat{Y}_h)^2 ,$$

with: $\hat{Y}_{hi}^* = \sum_{j=1}^{\bar{m}_{khi}} \frac{M'_{khi}}{\bar{m}_{khi}} y_{khij}$ and $\hat{Y}_h = \sum_{i=1}^{n_{kh}} \sum_{j=1}^{\bar{m}_{khi}} \frac{M_{kh}}{n_{kh} M_{khi}} \frac{M'_{khi}}{\bar{m}_{khi}} y_{khij} .$

1.6. Sample Code Number (NKS)

NKS for selected census block of STU 2014 consist of 8 digits:

- Digit 1 : code of survey subject, e.g. F for STU 2014.
- Digit 2-3 : code of stratum (stratum 1 to 13).
- Digit 4-8 : sequence number of census block within district/municipal.

