

# APPENDIX A

## METHODOLOGY

### 1. Sample design

A Stratified Two - Stage Sampling was adopted for the survey. Bangkok Metropolis and provinces were constituted strata. The primary and secondary sampling units were blocks for municipal areas / villages for non - municipal areas and private households / persons in the special households respectively.

#### **Stratification**

Bangkok Metropolis and provinces were constituted strata. There were altogether 76 strata. Each stratum was divided into two parts according to the type of local administration, namely municipal areas and non - municipal areas.

#### **Selection of primary sampling unit**

The sample selection of blocks / villages were performed separately and independently in each part by using probability proportional to size - total number of households. The total sample blocks / villages was 3,864 from 109,966 blocks / villages.

The total number of sample blocks / villages selected for enumeration by region and type of local administration was as follows :

<b>Region / Stratum</b>	<b>Total</b>	<b>Municipal Areas</b>	<b>Non - Municipal Areas</b>
Bangkok Metropolis	208	208	-
Central (Excluding Bangkok Metropolis)	1,312	720	592
North	824	464	360
Northeast	864	480	384
South	656	352	304
<b>Total</b>	<b>3,864</b>	<b>2,224</b>	<b>1,640</b>

### **Selection of secondary sampling unit**

Private households were our ultimate sampling units. A new listing of private households were made for every sample block / village to serve as the sampling frame. In each sample block / village, a systematic sample of private households were selected with the following sample size :

Municipal areas : 15 sample households per block

Non - municipal areas : 12 sample households per village

Before selecting sample private households in each sample block / village, the list of private households was rearranged by household ' s size - member of the household.

All special households located within the sample areas were included in the sample and the persons in the special household were systematically selected for the interviewing.

The total number of sample private households selected for enumeration by region and type of local administration was as follows :

<b>Region / Stratum</b>	<b>Total</b>	<b>Municipal Areas</b>	<b>Non - Municipal Areas</b>
Bangkok Metropolis	3,120	3,120	-
Central (Excluding Bangkok Metropolis)	17,904	10,800	7,104
North	11,280	6,960	4,320
Northeast	11,808	7,200	4,608
South	8,928	5,280	3,648
<b>Total</b>	<b>53,040</b>	<b>33,360</b>	<b>19,680</b>

## 2. Method of estimation

The survey results were presented at provincial level and regional level. At regional level, the results were presented separately for the Bangkok Metropolis and the remaining 75 provinces were classified by region, municipal areas and non-municipal areas.

$$\begin{aligned} \text{Let } g &= 1, 2, 3, \dots, 20 && \text{( age - sex group )} \\ k &= 1, 2, 3, \dots, m_{hij} && \text{( sample block / village )} \\ j &= 1, 2 && \text{( type of local administration )} \\ i &= 1, 2, 3, \dots, A_h && \text{( province )} \\ h &= 1, 2, 3, 4, 5 && \text{( region )} \end{aligned}$$

### Estimate of the total number of persons with characteristic $X$

1. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $g^{\text{th}}$  age - sex group,  $j^{\text{th}}$  area,  $i^{\text{th}}$  province,  $h^{\text{th}}$  region was based on the formula :

$$x''_{hijg} = \frac{x'_{hijg}}{y'_{hijg}} Y_{hijg} = r_{hijg} Y_{hijg} \dots\dots\dots (1)$$

where  $x'_{hijg}$  is the ordinary estimate of the total number of persons with characteristic  $X$  for the  $g^{\text{th}}$  age - sex group,  $j^{\text{th}}$  area,  $i^{\text{th}}$  province,  $h^{\text{th}}$  region.

$y'_{hijg}$  is the ordinary estimate of the total population for the  $g^{\text{th}}$  age - sex group,  $j^{\text{th}}$  area,  $i^{\text{th}}$  province,  $h^{\text{th}}$  region.

$Y_{hijg} \frac{1}{1}$  is the estimate, based on the population projection of the total population for the  $g^{\text{th}}$  age - sex group,  $j^{\text{th}}$  area,  $i^{\text{th}}$  province,  $h^{\text{th}}$  region.

$r_{hijg}$  is the ratio of the estimate of the total number of persons with characteristic  $X$  to the estimate of the total population for the  $g^{\text{th}}$  age - sex group,  $j^{\text{th}}$  area,  $i^{\text{th}}$  province,  $h^{\text{th}}$  region.

The formula of the estimate from a stratified two-stage sampling was as follows.

$$i) \quad x'_{hijg} = \frac{1}{m_{hij}} \sum_{k=1}^{m_{hij}} \frac{1}{P_{hijk}} \frac{N_{hijk}}{n_{hijk}} x_{hijkg} \quad \dots\dots\dots (2)$$

where  $x_{hijk}$  is the total number of persons with characteristic  $X$  for the  $g^{th}$  age-sex group,  $k^{th}$  sample block / village,  $j^{th}$  area,  $i^{th}$  province,  $h^{th}$  region.

$N_{hijk}$  is the total number of listing households in the  $k^{th}$  sample block / village,  $j^{th}$  area,  $i^{th}$  province,  $h^{th}$  region.

$n_{hijk}$  is the total number of sample households in the  $k^{th}$  sample block / village,  $j^{th}$  area,  $i^{th}$  province,  $h^{th}$  region.

$P_{hijk}$  is the probability of selection of the  $k^{th}$  sample block / village,  $j^{th}$  area,  $i^{th}$  province,  $h^{th}$  region.

$m_{hij}$  is the total number of sample blocks / villages in the  $j^{th}$  area,  $i^{th}$  province,  $h^{th}$  region.

$$ii) \quad y'_{hijg} = \frac{1}{m_{hij}} \sum_{k=1}^{m_{hij}} \frac{1}{P_{hijk}} \frac{N_{hijk}}{n_{hijk}} y_{hijk} \quad \dots\dots\dots (3)$$

where  $y_{hijk}$  is the total number of the population enumerated for the  $g^{th}$  age - sex group,  $k^{th}$  sample block / village,  $j^{th}$  area,  $i^{th}$  province,  $h^{th}$  region.

2. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $j^{th}$  area,  $i^{th}$  province,  $h^{th}$  region was based on the formula :

$$x''_{hij} = \sum_{g=1}^{20} x''_{hijg} \quad \dots\dots\dots (4)$$

3. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $g^{th}$  age - sex group,  $i^{th}$  province,  $h^{th}$  region was based on the formula :

$$x''_{hig} = \sum_{j=1}^2 x''_{hijg} \dots\dots\dots (5)$$

4. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $i^{th}$  province,  $h^{th}$  region was based on the formula :

$$x''_{hi} = \sum_{j=1}^2 x''_{hij} = \sum_{g=1}^{20} x''_{hig} \dots\dots\dots (6)$$

5. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $g^{th}$  age - sex group,  $j^{th}$  area,  $h^{th}$  region was based on the formula :

$$x''_{hjg} = \sum_{i=1}^{A_h} x''_{hijg} \dots\dots\dots (7)$$

where  $A_h$  is the total number of provinces in the  $h^{th}$  region and  $\sum_{h=1}^5 A_h = 76$

6. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $j^{th}$  area,  $h^{th}$  region was based on the formula :

$$x''_{hj} = \sum_{i=1}^{A_h} x''_{hij} = \sum_{g=1}^{20} x''_{hjg} \dots\dots\dots (8)$$

7. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $g^{th}$  age - sex group,  $h^{th}$  region was based on the formula :

$$x''_{hg} = \sum_{i=1}^{A_h} x''_{hig} = \sum_{j=1}^2 x''_{hjg} \dots\dots\dots (9)$$

8. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $h^{th}$  region was based on the formula :

$$x_h'' = \sum_{i=1}^{A_h} x_{hi}'' = \sum_{j=1}^2 x_{hj}'' = \sum_{g=1}^{20} x_{hg}'' \quad \dots\dots\dots (10)$$

9. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $j^{th}$  area was based on the formula :

$$x_j'' = \sum_{h=1}^5 x_{hj}'' \quad \dots\dots\dots (11)$$

10. Adjusted estimate of the total number of persons with characteristic  $X$  for the  $g^{th}$  age - sex group of the whole kingdom was based on the formula :

$$x_g'' = \sum_{h=1}^5 x_{hg}'' \quad \dots\dots\dots (12)$$

11. Adjusted estimate of the total number of persons with characteristic  $X$  for the whole kingdom was based on the formula :

$$x'' = \sum_{h=1}^5 x_h'' = \sum_{j=1}^2 x_j'' = \sum_{g=1}^{20} x_g'' \quad \dots\dots\dots (13)$$

**Estimate of Variance of the Total Number of Persons with Characteristic  $X$**

1. The estimate variance of  $x_{hijg}''$  was

$$\hat{V}(x_{hijg}'') = \left[ \frac{Y_{hijg}}{y'_{hijg}} \right]^2 \frac{m_{hij}}{m_{hij} - 1} \sum_{k=1}^{m_{hij}} z_{hijkg}^2 \quad \dots\dots\dots (14)$$

where

$$z_{hijkg} = \bar{x}'_{hijkg} - r_{hijg} \bar{y}'_{hijkg}$$

$$\bar{x}'_{hijkg} = \frac{1}{m_{hij}} \frac{1}{P_{hijk}} \frac{N_{hijk}}{n_{hijk}} x_{hijkg}$$

$$\bar{y}'_{hijk} = \frac{1}{m_{hij}} \frac{1}{P_{hijk}} \frac{N_{hijk}}{n_{hijk}} y_{hijk}$$

2. The estimate variance of  $x''_{hij}$  was

$$\hat{V}(x''_{hij}) = \sum_{g=1}^{20} \hat{V}(x''_{hijg}) \dots\dots\dots (15)$$

3. The estimate variance of  $x''_{hig}$  was

$$\hat{V}(x''_{hig}) = \sum_{j=1}^2 \hat{V}(x''_{hijg}) \dots\dots\dots (16)$$

4. The estimate variance of  $x''_{hi}$  was

$$\hat{V}(x''_{hi}) = \sum_{j=1}^2 \hat{V}(x''_{hij}) = \sum_{g=1}^{20} \hat{V}(x''_{hig}) \dots\dots\dots (17)$$

5. The estimate variance of  $x''_{hijg}$  was

$$\hat{V}(x''_{hijg}) = \sum_{i=1}^{A_h} \hat{V}(x''_{hijg}) \dots\dots\dots (18)$$

6. The estimate variance of  $x''_{hj}$  was

$$\hat{V}(x''_{hj}) = \sum_{i=1}^{A_h} \hat{V}(x''_{hij}) = \sum_{g=1}^{20} \hat{V}(x''_{hijg}) \dots\dots\dots (19)$$

7. The estimate variance of  $x''_{hg}$  was

$$\hat{V}(x''_{hg}) = \sum_{i=1}^{A_h} \hat{V}(x''_{hig}) = \sum_{j=1}^2 \hat{V}(x''_{hijg}) \dots\dots\dots (20)$$

8. The estimate variance of  $x''_h$  was

$$\hat{V}(x''_h) = \sum_{i=1}^{A_h} \hat{V}(x''_{hi}) = \sum_{j=1}^2 \hat{V}(x''_{hj}) = \sum_{g=1}^{20} \hat{V}(x''_{hg}) \dots\dots\dots (21)$$

9. The estimate variance of  $x_j''$  was

$$\hat{V}(x_j'') = \sum_{h=1}^5 \hat{V}(x_{hj}'') \dots\dots\dots (22)$$

10. The estimate variance of  $x_g''$  was

$$\hat{V}(x_g'') = \sum_{h=1}^5 \hat{V}(x_{hg}'') \dots\dots\dots (23)$$

11. The estimate variance of  $x''$  was

$$\hat{V}(x'') = \sum_{h=1}^5 \hat{V}(x_h'') = \sum_{j=1}^2 \hat{V}(x_j'') = \sum_{g=1}^{20} \hat{V}(x_g'') \dots\dots\dots (24)$$

**Estimate of Coefficient of Variation of the Total Number of Persons with Characteristic X**

1. The estimate coefficient of variation of  $x_{hijg}''$  was

$$cv(x_{hijg}'') = \frac{\sqrt{\hat{V}(x_{hijg}'')}}{x_{hijg}''} \times 100\% \dots\dots\dots (25)$$

2. The estimate coefficient of variation of  $x_{hij}''$  was

$$cv(x_{hij}'') = \frac{\sqrt{\hat{V}(x_{hij}'')}}{x_{hij}''} \times 100\% \dots\dots\dots (26)$$

3. The estimate coefficient of variation of  $x_{hig}''$  was

$$cv(x_{hig}'') = \frac{\sqrt{\hat{V}(x_{hig}'')}}{x_{hig}''} \times 100\% \dots\dots\dots (27)$$



4. The estimate coefficient of variation of  $x''_{hi}$  was

$$cv(x''_{hi}) = \frac{\sqrt{\hat{V}(x''_{hi})}}{x''_{hi}} \times 100\% \quad \dots\dots\dots (28)$$

5. The estimate coefficient of variation of  $x''_{h j g}$  was

$$cv(x''_{h j g}) = \frac{\sqrt{\hat{V}(x''_{h j g})}}{x''_{h j g}} \times 100\% \quad \dots\dots\dots (29)$$

6. The estimate coefficient of variation of  $x''_{h j}$  was

$$cv(x''_{h j}) = \frac{\sqrt{\hat{V}(x''_{h j})}}{x''_{h j}} \times 100\% \quad \dots\dots\dots (30)$$

7. The estimate coefficient of variation of  $x''_{h g}$  was

$$cv(x''_{h g}) = \frac{\sqrt{\hat{V}(x''_{h g})}}{x''_{h g}} \times 100\% \quad \dots\dots\dots (31)$$

8. The estimate coefficient of variation of  $x''_h$  was

$$cv(x''_h) = \frac{\sqrt{\hat{V}(x''_h)}}{x''_h} \times 100\% \quad \dots\dots\dots (32)$$

9. The estimate coefficient of variation of  $x''_j$  was

$$cv(x''_j) = \frac{\sqrt{\hat{V}(x''_j)}}{x''_j} \times 100\% \quad \dots\dots\dots (33)$$

10. The estimate coefficient of variation of  $x''_g$  was

$$cv(x''_g) = \frac{\sqrt{\hat{V}(x''_g)}}{x''_g} \times 100\% \quad \dots\dots\dots (34)$$

11. The estimate coefficient of variation of  $x''$  was

$$cv(x'') = \frac{\sqrt{\hat{V}(x'')}}{x''} \times 100\% \dots\dots\dots (35)$$

### 3. Data Collection

Labor force information for this survey quarterly which was conducted during the 1<sup>st</sup>-12<sup>th</sup> of July - August 2010 was obtained through interviews head or member of households of 3,120 households in the Bangkok, 30,240 households in other municipal areas and 19,680 households in non-municipal areas or a total of 53,040 households throughout the kingdom. Forty four enumerators with previous experience in survey operations were employed in the Bangkok, while in the other provinces (changwats), the field staff comprised 830 enumerators.

### 4. In round figures

In the statistical tables, all absolute figures are independently rounded to the nearest thousand; hence the group total may not always be equal to the sum of the individual figures.