

General Description of Statistical Methods for Manpower Survey

1. Objective

- (1) To gain an insight into supply of civilian manpower : Collect the data of civilians aged 15 and above in quantity, quality, geographical distribution and others to scheme manpower supply for socio-economic developments.
- (2) To know the employment status of labor force : Count the numbers of employed or unemployed persons in labor force by industry, occupation, class of worker, education, experience, capability, interests and others and provide such to the authority as a reference for their manpower planning, vocational training programs organizing and related decision-making in public employment service.
- (3) To perceive the developing trend of manpower : Based on theoretical viewpoints, practical experience and international/domestic information summarized from related data, project and analyze the developing trends of manpower in Taiwan Area and provide such to either public/private users as a reference or researchers as a data source of international comparison studies in manpower.

2. Historical Development

Period	Agency	Focuses
(1) April 1962 to June 1963	Labor Force Survey, Statistics, Research and Development Group, Taiwan Provincial Government.	(1) Mirroring experience from developed countries in manpower development by collecting related materials in their research studies. (2) Conducting a pilot survey to establish the labor force survey system.
(2) July 1963 to June 1966	Labor Force Survey and Research Group, Taiwan Provincial Government.	(1) Designing survey operations and establishing official survey organizations. (2) Officially doing research about labor force surveys and quarterly conducting 4 labor force surveys.
(3) July 1966 to Dec. 1977	Labor Force Survey and Research Institute, Taiwan Provincial Government.	(1) Improving efficiency of labor force survey by strengthening the function of survey organization. (2) Performing comparative studies on labor force surveys across nations.
(4) January 1978 to June 1983	Labor Statistic Survey and Evaluation Committee, Directorate-General of Budget, Accounting and Statistics, Executive Yuan.	(1) Increasing data accuracy by improving sampling techniques. (2) Conducting special surveys to meet user's needs. (3) Integrating survey results of households or establishments to complete the system of Manpower Survey.

Period	Agency	Focuses
(5) July 1983 to present	Department of Census, Directorate General of Budget, Accounting and Statistics, Executive Yuan.	(1) Enhancing interviewers' training. (2) Conducting posterior control survey for data quality. (3) Establishing an integrated statistical system for Manpower Survey. (4) Enhancing timeliness of report compilation and distribution by increasingly using computers to process data. (5) Since 1993, alternatively adopted county/city sampling scheme and issued their associated monthly statistics to meet administrative needs in regional developments. (6) Since January 2003 to March 2005, the cumulative averages for county/city important labor force indicators were quarterly issued, instead of results monthly publicized. (7) Since June 2005, the cumulative average for county/city important labor force indicators were semiannually issued, instead of quarterly publicized.

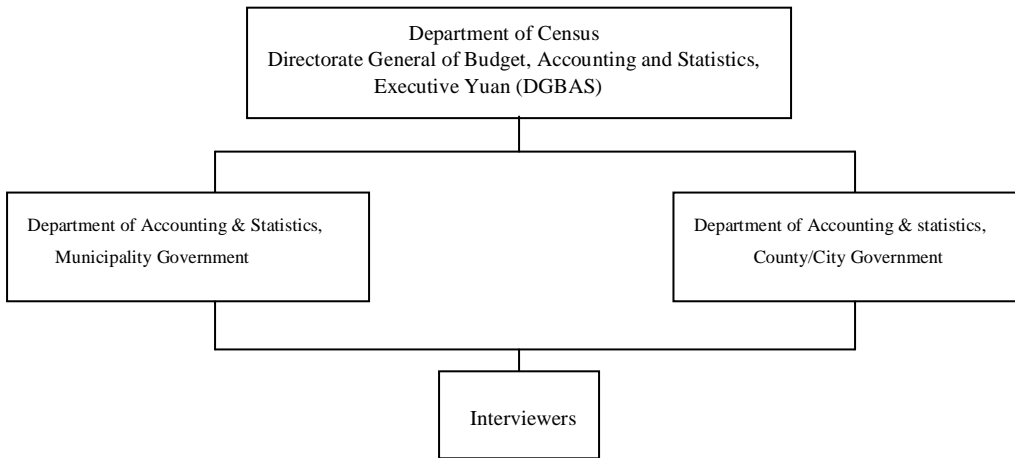
3. Survey regions or eligible objects

The geographic scope of this survey covers Taiwan Province and 6 municipalities (Taipei City, New Taipei City, Taoyuan City, Taichung City, Tainan City and Kaohsiung City). All civilian population aged 15 years and over, currently registering in ordinary household or institutional households, undertaking economic activities are included but those in military services or in prison are excluded.

4. Survey method and reference period

Through face-to-face interviews or telephone interviews, the sampled households are surveyed by well-trained interviewers who are recruited and assigned by local governments. Conducted once a month in the week right after a reference week, this survey is to record events occurred in the reference week covering the 15th day of the month. People who died or moved out of the sampled households during the reference week are excluded. Meanwhile, those who resided in the sampled households during the reference week but died or moved out of there later are still included.

5. Survey executive system



6. Sampling scheme

(1) Sample design :

- (a) Sample frames: the recent 1 year's TSUN/LIs household registration data file sorted by other register data.
 - (b) A stratified two-stage sampling is schemed to sample households for this survey : sample units drawn in the first stage of sampling are TSUN/LIs , while those drawn in the second stage are households.
 - (c) For first stage sampling, one must sort out with household registration data, the descriptive statistics of TSUN/LIs and then stratify TSUN/LIs according to the type of industrial structure, age and the level of education attainment. Each of 20 counties/cities in Taiwan Area is a single subpopulation for the stratification mentioned above.
 - (d) In the second stage, households are sampled inside TSUN/LIs drawn in the first stage conducted above.
- (2) Sample size: Approximately 520 TSUN/LIs were drawn in the first stage of sampling and about 20,660 households were than sampled in the second stage, overall sampling fraction is 2.4%. There are near 60,000 persons aged 15 and above in these sampled households.
- (3) Sample drawing : DGBAS conducted the first stage sampling. All TSUN/LIs were firstly stratified according to criteria proposed and then serialized them

with their households numbers. After that, a serial number was randomly selected as a start point to sample TSUN/LIs systematically with a given span. A systematic sampling method was also adopted in the second stage which was conducted by the Office of Accounting and Statistics in local governments, the results of second-stage sampling was later handed to survey interviewers who were to compile respective sample frames.

- (4) Sample rotation : TSUN/LIs stratified for the first stage of sampling is categorized into 4 groups named as A,B,C and D. These groups are further chopped into 8 subgroups and then sorted as two packs($A_1B_1C_1D_1$) and ($A_2B_2C_2D_2$) when one pack shift to another each year, three TSUN/LIs are drawn from each packed subgroup so that 12 TSUN/LIs available and are rotatively assigned to surveys in given year. It takes 4 months to exercise such rotation across subgroups in each pack so that each subgroup would be rotated 3 times. Generally speaking, January, May and September would be the months for group A (either subgroup A_1 or subgroup A_2 drawn); February , June and October for group B (either B_1 or B_2 drawn); March, July and November for group C (either C_1 or C_2 drawn): April, August and December for group D(either D_1 or D_2 drawn).From each TSUN/LI drawn in the first stage, two sets of households are sampled in the second stage. After consecutively surveyed for two months, the set of households would be alternatively shifted to another for next two months. After surveying for one year, the packed subgroups $A_1B_1C_1D_1$ would be alternatively shifted to $A_2B_2C_2D_2$; and vice versa next year.
- (5) Handing of institutional households : The population of institutional households in TSUN/LIs last year is taken as the sample frame to draw persons in there for institutional portion of this survey later on.

7. Methods of estimation

The surveyed data would be applied in proportional estimation. Such estimates are adjusted by household registration data of 20 counties/cities accordingly. These revised estimates of counties/cities are added up to generate the estimates of Taiwan Area.

Formulas used in estimation are interpreted as follows:

$$\hat{X}'_c = r_c Y \dots\dots\dots(1)$$

$$r_c = \frac{\hat{X}'_c}{\hat{Y}} = \frac{\sum_{h=1}^L \frac{N_h}{\sum_{i=1}^{m_h} N_{hi}} \sum_{i=1}^{m_h} \frac{N_{hi}}{n_{hi}} \sum_{j=1}^{n_{hi}} x_{c,hij}}{\sum_{h=1}^L \frac{N_h}{\sum_{i=1}^{m_h} N_{hi}} \sum_{i=1}^{m_h} \frac{N_{hi}}{n_{hi}} \sum_{j=1}^{n_{hi}} y_{hij}} \dots\dots\dots(2)$$

The symbols used are :

\hat{X}'_c : Estimate of a certain characteristic value of given sex-age group. (The number of persons working in the industries of electricity, gas water and mining are excluded)

Y : Characteristic value of given sex-age group adopted from the household registration data. (The number of persons working in the industries of electricity, gas, water and mining are excluded)

$x_{c,hij}$: Observed value of j-th household, i-th TSUN or LI in the h-th stratum

y_{hij} : Number of persons of given sex-age group observed in the j-th household, i-th TSUN or li, h-th stratum

n_{hi} : Number of sampled households in the i-th TSUN or LI, h-th stratum

N_{hi} : Number of households in the i-th TSUN or LI, h-th stratum

m_h : Number of sampled TSUN/LIs in the h-th stratum

N_h : Number of households in the h-th stratum

L : Number of strata.

The characteristic data such as sex and age status of employees working in the “Electricity and Gas Supply” and “Water Supply and Remediation Services” industries are directly reported, to DGBAS, by public enterprises. The estimation of r_c and Y should exclude the numbers of employees in “Electricity and Gas Supply”, “Water Supply and Remediation Services” and “Mining & Quarrying”

industry from sample. Therefore, \hat{X}_c is calculated by adding the reported data to \hat{X}' which has excluded the number of employees in such three industries.

8. Estimation Error

The statistical results of this manpower survey are summarized with sample figures through parametric estimation by stratum and sampling stage. Except the total population, referring to the statistics resulted from household registration in the same period, not affected by errors in estimation, the rest of parametric estimates were influenced by random factors so that results might be allowably deviated from their true values.

The formulas needed are listed as follows:

$$\hat{V}(\hat{X}'_c) = \hat{V}(r_c Y) = Y^2 \hat{V}(r_c) \dots \dots \dots (3)$$

$$\hat{V}(r_c) = \frac{1}{N^2 \hat{Y}^2} \left\{ \sum_{h=1}^L \frac{M_h (M_h - m_h)}{m_h} S_{c,h}^2 + \sum_{h=1}^L \left(\frac{M_h^2}{m_h^2} \right) \sum_{i=1}^{m_h} \frac{N_{hi} (N_{hi} - n_{hi})}{n_{hi}} S_{c,hi}^2 \right\} \dots \dots (4)$$

Besides notations as (1) and (2) cited, supplemental interpretation is added as follows:

$N (= \sum_{h=1}^L N_h)$, total number of households in the population

M_h : Number of TSUN/ LIs in the h-th stratum

$$\hat{Y} = \hat{Y} / N$$

$$S_{c,h}^2 = S_{hx}^2 + r_c^2 S_{hy}^2 - 2r_c S_{hxy} - \hat{S}_h^2$$

$$S_{hx}^2 = \frac{1}{m_h - 1} \sum_{i=1}^{m_h} (\hat{x}_{c,hi} - \hat{\bar{x}}_{c,h})^2$$

$\hat{x}_{c,hi} = N_{hi} \bar{x}_{c,hi}$, Estimate of certain characteristic in the i-th TSUN/LI, h-th stratum.

$\bar{x}_{c,hi} = \sum_{j=1}^{n_{hi}} x_{c,hij} / n_{hi}$, Average of a certain characteristic in the i-th TSUN or LI, h-th stratum.

$\hat{x}_{c,h} = \sum_{i=1}^{m_h} \hat{x}_{c,hi} / m_h$, Average of certain characteristic in the h-th stratum.

$$S_{hy}^2 = \frac{1}{m_h - 1} \sum_{i=1}^{m_h} (\hat{y}_{hi} - \hat{y}_h)^2$$

$\hat{y}_{hi} = N_{hi} \bar{y}_{hi}$, Auxiliary-data estimate of i-th TSUN or LI in the h-th stratum.

$\bar{y}_{hi} = \sum_{j=1}^{n_{hi}} y_{hij} / n_{hi}$, Auxiliary-data average of households in the i-th TSUN or LI,
h-th stratum.

$\hat{y}_h = \sum_{i=1}^{m_h} \hat{y}_{hi} / m_h$, Auxiliary-data average of TSUN or LI's in the h-th stratum.

$$S_{hxy} = \frac{1}{m_h - 1} \sum_{i=1}^{m_h} (\hat{x}_{c,hi} - \hat{x}_{c,h})(\hat{y}_{hi} - \hat{y}_h)$$

$$\hat{S}_h^2 = \frac{1}{m_h} \sum_{i=1}^{m_h} \frac{N_{hi}(N_{hi} - n_{hi})}{n_{hi}} S_{c,hi}^2$$

$$S_{hix}^2 = \frac{1}{n_{hi} - 1} \sum_{j=1}^{n_{hi}} (x_{c,hij} - \bar{x}_{c,hi})^2$$

$$S_{c,hi}^2 = S_{hix}^2 + r_c^2 S_{hiy}^2 - 2r_c S_{hixy}$$

$$S_{hixy} = \frac{1}{n_{hi} - 1} \sum_{j=1}^{n_{hi}} (x_{c,hij} - \bar{x}_{c,hi})(y_{hij} - \bar{y}_{hi})$$

$$S_{hiy}^2 = \frac{1}{n_{hi} - 1} \sum_{j=1}^{n_{hi}} (y_{hij} - \bar{y}_{hi})^2$$