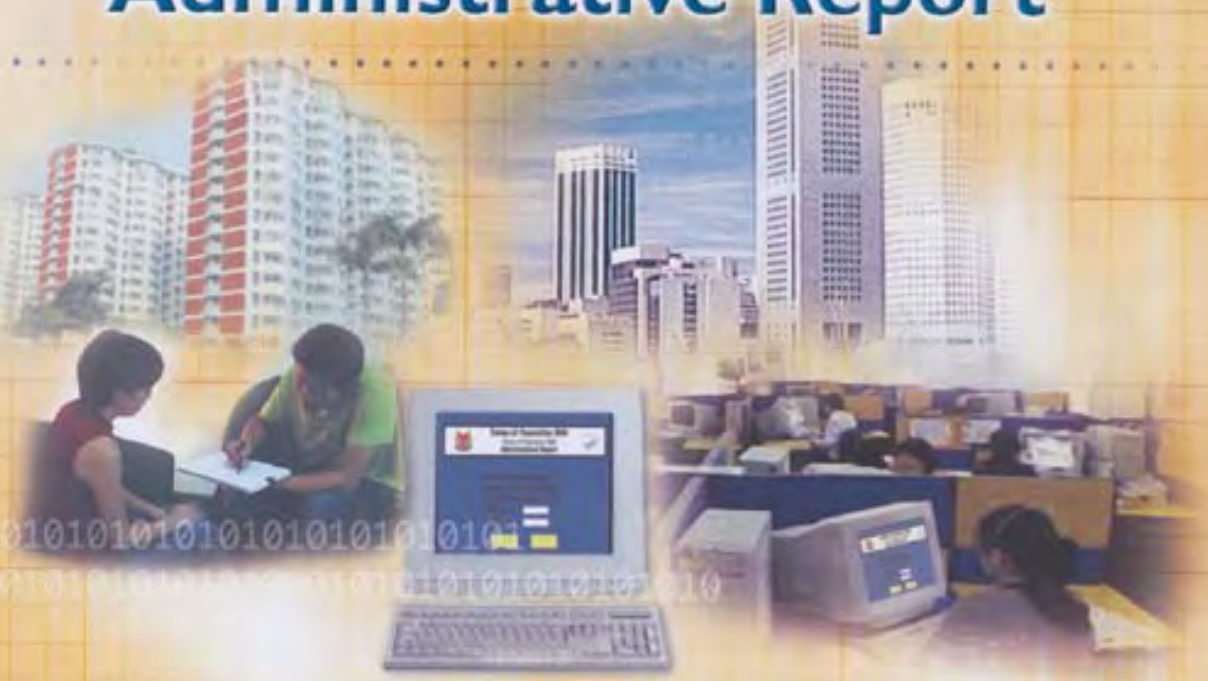
Census 2000

Census of Population 2000

Administrative Report



by

Leow Bee Geok
SUPERINTENDENT OF CENSUS

SINGAPORE DEPARTMENT OF STATISTICS

CENSUS OF POPULATION 2000, ADMINISTRATIVE REPORT
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Chief Statistician
Department of Statistics
Ministry of Trade & Industry
100 High Street #05-01
The Treasury
Singapore 179434
Republic of Singapore

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FOREWORD

The Population Census 2000 has achieved several milestones in Singapore's history of census-taking. It was the first Census in Singapore to adopt a register-based approach in the compilation of basic demographic information. It utilised advanced information technology in collecting information among the 20 per cent sample of households selected for a detailed enumeration. The new technology included the deployment of Internet for submission of returns and the use of call centre.

We live in a global information age where emphasis is placed on the importance of obtaining, disseminating and analysing accurate information in a timely manner. With the new approach and technological advancements, Census 2000 has achieved significant improvements in data timeliness to meet the increasing demands of sophisticated data users. The top-line data of the population were released within two months of Census Day (30 June 2000) and nine Advance Data Releases made available within a period of six months between November 2000 and February 2001. This was followed by five Census Statistical Releases providing detailed tables on demographic characteristics, education, language and religion, economic characteristics, geographic distribution and travel as well as households and housing over the period April-December 2001.

This Census 2000 Administrative Report is the final publication for the Census, outlining the major milestones of the Census operations from planning to data dissemination. For the benefit of our data users, an assessment of Census data quality obtained from the register is discussed. This report should be of interest to national statistical offices or research institutes tasked with similar challenges of delivering timely and accurate census information on population and households.

I would like to express my sincere thanks to all who have contributed in one way or another to the Population Census 2000. I am grateful to the Chairman and members of the Census Planning Committee for their guidance during the planning of the Census. My deep appreciation also goes to the Superintendent of Census, all the census officers and the staff of the Department of Statistics for their support and good work in making the Census 2000 a success.

Paul Cheung
Chief Statistician
Singapore

April 2002

PREFACE

The population census is the most comprehensive source of information on population and households. It provides benchmark data for all demographic, social and labour force statistics. Population Census 2000 was the fourth census carried out in Singapore since Independence and the thirteenth in the series of census-taking in Singapore.

Population Census 2000 adopted a register-based approach, which was a first in Singapore's census taking history. The total population was not required to file any census returns as basic information was available from the Department of Statistics' Household Registration Database. A 20 per cent sample of households was surveyed to obtain detailed information on demographic, education, economic, transport, household and housing characteristics.

A tri-modal collection strategy comprising Internet, Computer-Assisted Telephone Interviewing (CATI) and fieldwork was adopted for this census. Singapore was among the first few countries in the world to collect census information from households via the Internet. This innovation in data collection methodology brought about savings in labour effort as well as improvements in quality and timeliness of data.

The Census 2000 Administrative Report provides a comprehensive record of the census operations. These include evaluating the new approach to census-taking, set-up and use of the databases, planning and preparations for sample enumeration as well as implementing the IT application systems for data collection, processing and tabulation. To facilitate the work of future Census planners, this report also outlines the administrative activities necessary to carry out the large-scale Census project.

I would like to thank all who have, in one way or another, contributed to the success of this project. My deep appreciation is extended to all participating households who had given their full support to Population Census 2000. The contributions of government ministries and statutory boards, which provided pertinent information for the Population Census 2000, are gratefully acknowledged.

Mrs Leow Bee Geok
Superintendent of Census
Singapore

April 2002

Our

Mission

To develop and manage a national statistical information system of quality and integrity to support Singapore's social and economic development.

Performance Pledge

We pledge to maintain high service standards in meeting the data needs of local and overseas users :

Accessibility	*We provide a wide range of products and services which are readily accessible by the general public.*
Relevance	*We make special efforts to improve the relevance of statistical data to meet user needs.*
Reliability	*We benchmark ourselves against international best practices in statistical activities and adopt rigorous quality assurance standards.*
Timeliness	*We strive for the earliest possible release of data, while balancing the need to maintain data quality.*

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CHAPTER 1

SINGAPORE'S APPROACH TO POPULATION CENSUS 2000

1.1 THE IMPORTANCE OF THE POPULATION CENSUS

In its most basic form, a population census is a count of the number of inhabitants in a country or territory. Census taking has its beginnings in ancient times and was undertaken primarily for taxation purposes. From these early population counts, the modern census evolved around the seventeenth century, with the characteristics of universal coverage, wide scope of inquiry and provision of information for statistical and planning purposes.

Today, despite the availability of numerous sources of administrative records on the population, most countries still conduct the traditional census to obtain data on the size of the population, its characteristics and its distribution across the various areas within the country. In addition, most countries combine a population census with a census on housing to obtain data on housing conditions.

Census is probably the most comprehensive source of information on population and households. It meets a variety of needs and serves as benchmark data for all population and related social statistics. Therefore, the census must be considered an exercise of national importance and not just a routine government activity.

The United Nations (UN) recommends that a national census be taken at least once every 10 years. As the value of census data is increased if it can be compared internationally, the UN further recommends that countries may wish to undertake a census in years ending in '0' or as near to those years as possible.

1.2 HISTORY OF CENSUS TAKING IN SINGAPORE

Singapore's first census was taken in April 1871 as part of the Straits Settlement Census. Since then, regular censuses were undertaken at ten-year intervals up to 1931. The Second World War delayed the next censuses till 1947 and 1957. Singapore's first population census after independence was

conducted in 1970 in line with United Nations' recommendations. The next two censuses were conducted in 1980 and 1990.

1.3 THE 1970, 1980 AND 1990 CENSUSES

In the 1980 and earlier Censuses, a traditional fieldwork approach was adopted. In the first stage, houses and other physical dwelling tenements were physically numbered to ensure complete coverage. The second stage involved a large number of field interviewers visiting the households to collect the information and to record them on paper forms. The third stage was conducted during or slightly after census reference day to confirm the validity of entries earlier recorded in the census forms. The large volume of information collected was then processed through a cycle of coding, data entry, verification and table generation.

In all, some 2,015 enumerators were employed in 1970. In 1980, about 2,200 enumerators were mobilised, including 500 full-time National Servicemen who were seconded from Ministry of Defence (MINDEF) to assist in census taking and data processing.

The 1990 Census capitalized on the potential of using Unique Identification Numbers (UIN) of every citizen and permanent resident and Foreign Identification Number (FIN) for every foreigner for record linking among government databases. Information on level of education attending and highest qualification attained was merged with basic demographic and personal particulars of each individual to form the pre-census database. As far as possible, the census forms were pre-printed with data from the pre-census database for verification with respondents.

Field interview remained the main method of data collection. In all, about 3,500 census workers were involved. As in the 1980 Census, the data collected were processed through a cycle of coding, data entry, verification and table generation.

1.4 PLANNING FOR CENSUS 2000

After the 1990 Census, the Singapore Department of Statistics (DOS) reviewed the entire framework in which demographic statistics was collected and used with a view to improving the methods and procedures for Census 2000.

Three important exogenous trends were identified as having a profound influence on the collection of demographic statistics. First, the demand for comprehensive data on the population has been increasing. Secondly, the revolution in Information Technology (IT) including the widespread use of internet, database and integrated call-centre technologies has opened up new possibilities in data collection and capture. Thirdly, the stability and reliability of public databases developed since the 1980s meant that a large amount of administrative data could be matched, updated and used for statistical purposes.

1.5 CONDUCTING A REGISTER-BASED CENSUS 2000

Recognising the three major trends, the Department of Statistics initiated the development of a Household Registration Database (HRD) in March 1996 to provide up-to-date basic demographic information on the population between the censuses. The ultimate aim was to conduct an administrative register-based census in the year 2000.

HRD captures the basic personal and demographic data of all residents in Singapore and updates them by linking with existing public databases through the UIN. With the improvement in IT technology and the experience gained in the 1990 Census, the development of the HRD proceeded as planned. It became fully functional by late 1999.

In many countries, a population census is conducted together with a housing census to find out the characteristics of dwelling units. Since 1980, as a "by-product" of the 1980 Census, DOS maintains an up-to-date database on dwellings. In 1996, this database was upgraded and renamed National Database on Dwellings (NDD). The NDD and HRD together give a physical location for every household in Singapore.

The value of Census data lies in the comprehensiveness in coverage and the simultaneity of time reference. Since basic data items (e.g. sex, age, ethnic group, nationality and type of house) on the entire population are already available from the HRD and NDD, it would then suffice to conduct a register-based census. Additional data required for in-depth studies could be collected from a large sample of the population with the same reference period. Experience from the past censuses and sample surveys indicated that a 20% sample enumeration of households would provide sufficient details for in-depth studies and meet the needs of the majority of users.

In the process of merging public databases for the Population Census, the Department is aware that it is collating information of individuals and households into a single repository. The individual data collated are therefore confidential and are protected under the provisions of the Census Act Chapter 35 (1991 Edition). This Act strictly prohibits the release of any individual or household information by the Department to any other agency. Only aggregated statistics for statistical and analytical purposes could be released from the database.

1.6 THE TRI-MODAL DATA COLLECTION STRATEGY

For the 20% sample enumeration, Census 2000 exploited the possibilities offered by the IT revolution by adopting a tri-modal data collection strategy comprising Internet enumeration, Computer-Assisted Telephone Interviewing (CATI) and fieldwork.

Going Internet

Singapore was among the first few countries in the world to attempt collecting Census information from households via the Internet. Several issues and concerns were addressed before making this bold step. It was recognised that the onus was on the respondents to self-enumerate via the Census 2000 Internet website. To achieve a significant response rate, the design of the online Census form, incentives and publicity would be critical success factors. Furthermore, since a sample of the household database would be opened for online public access, security and confidentiality issues would have to be addressed in order to prevent unauthorized access, hacking or denial of service attacks.

It was assessed that the advantages of Internet enumeration outweighed the potential risk factors that could be minimised. Respondents would enjoy greater privacy, as their information would not be revealed to an interviewer, but transmitted directly to the Department's database. Furthermore, the form-filling experience over the Internet would be a positive and interactive one. When the respondent logs in to the Census website, some basic data already available in the pre-census database would be displayed. The respondent could then proceed to fill up the rest of the census questionnaire on-line. User-friendly help features and explanatory notes would be provided instantaneously when required. The system would also perform simple on-line checks, and prompt the respondent to re-enter data that are

clearly wrong or inconsistent. For further convenience, partially completed questionnaires could be saved and retrieved at a later time for completion.

From an operational perspective, Internet enumeration had many advantages. Most of the data collected from the Internet would already be electronically coded, thus reducing data entry and coding at the back end. Furthermore, there were substantial manpower savings since interviewers were not required to “canvass” information from the population.

CATI

CATI operations commenced with a suitable time lapse after the launch of Internet enumeration. Unlike Internet, CATI was a tried and tested data collection strategy, having been deployed for the mid-decade General Household Survey (GHS) in 1995 where some 40,000 households were successfully enumerated by CATI.

Households selected were distributed evenly by postal districts (PDs). For each PD, households that had not submitted their returns by Internet were automatically scheduled and dialed up for CATI interview.

Fieldwork

Households were scheduled for fieldwork if they could not be contacted by CATI after a fixed number of telephone attempts. These were grouped by PDs and passed to regional census offices.

Fieldworkers visited these remaining households to conduct face-to-face interviews. When they failed to get in touch with these households, they left a contact number for these households to call to arrange for a convenient time to complete the interview.

Confidentiality and Security of Information

The tri-modal data collection strategy involved the collection of personal and household information via the Internet and CATI where face-to-face contact with respondents was avoided. As such, data confidentiality and security issues were of paramount importance to the DOS.

To ensure confidentiality, all selected households received a notification letter with a house Identification Number (ID) and unique, randomly generated password. Using the house ID, password and the UINs of two members, respondents were able to log-on and retrieve their household record in the database via the Census website. The checking of the password was performed in a secure manner with Privylink. This used the password as a key to generate a random sequence at the respondent's computer. This random sequence was transmitted over the Internet. As the respondent's password was not sent across the Internet, the password could not be intercepted and read. At the server end, the random sequence received was decrypted with a key server. When the decrypted sequence matched, the respondent was authenticated and granted access.

All personal information provided by respondents was 128-bit encrypted before transmission over the Internet. This protected the information from unauthorised interception. To protect the information from hacking, a Demilitarised Zone (DMZ) utilising two layers of computer firewalls was set up to protect the on-line database in which the information was stored. These security measures were subjected to the most stringent tests and conformed to Infocomm Development Authority of Singapore (IDA)'s computer security requirements.

For CATI, census interviewers quoted the respondent's unique house ID over the telephone to identify themselves as genuine census officers before proceeding with the interview. When in doubt over the identity of the CATI interviewers, the public called the census hotline to verify their identity.

1.7 APPROACHES OF OTHER COUNTRIES

The register-based approach to Census 2000, supplemented by a large-scale 20% survey, marked a watershed in the history of census taking in Singapore. For the first time since 1871, information was no longer "canvassed" from the entire population. This approach is not entirely new and has been the practice of statistically advanced countries which maintain population registers, such as Denmark, Finland, Norway, Sweden and the Netherlands.

Outside of Europe, Singapore is the first country to embark on the register-based approach. In deciding to move in this direction, the DOS had studied three key issues. First, the quality of administrative data in Singapore is sufficiently high to produce an accurate count of the population and its basic

characteristics. Secondly, the legal environment and data confidentiality practices in Singapore permit the sharing of non-sensitive administrative information. Finally, the cost savings in adopting this approach are substantial. It is estimated that the cost of conducting a register-based census, coupled with a large-scale survey, is about one-third the cost of a full-scale census.

It is worthwhile to note that of the 163 censuses taken in the 1990 round, only 23 countries used more than one method of data collection, namely fieldwork and postal survey. Of these, only 2 countries adopted a combination of three data collection methods viz face-to-face interviews, delivery-collect as well as mail-out collect back. The tri-modal data collection strategy adopted for the 20 per cent sample enumeration in Singapore's Census 2000 is a bold experiment in multi-mode data capture and the application of cutting-edge technology. DOS views the integration of the various modes as a critical success factor for Census 2000. To ensure smooth workflow and seamless transfer of data from one mode to another, a robust and comprehensive census management system was built to track the progress and ensure completion of each phase.

1.8 THE CENSUS PLANNING COMMITTEE

As Census is the largest national statistical project involving many Ministries and Statutory Boards, a Census Planning Committee (CPC) was set up in February 1998. The Chairman of the Census 2000 CPC was the then Permanent Secretary of Ministry of Trade and Industry Mr Khaw Boon Wan. Before the decision was made on the new register-based and tri-modal data collection approaches for Census 2000, much deliberation and discussion took place internally within DOS and MTI. The CPC played an important role in the careful cross-examination of the success factors of the new approaches, and provided overall guidance and policy directions. Critical planning decisions were also made at the CPC, most important of which was the final list of data items to collect for Census 2000.

Reflecting the importance of the Census, representations to the CPC came from other main Ministries which use Census data for policy evaluation and planning. These included the Ministry of Community Development and Sports (MCDS), Ministry of Manpower (MOM), Ministry of Communications and Information Technology (MCIT), Ministry of Home Affairs (MHA), Ministry of Information and the Arts (MITA), Ministry of Education (MOE), Ministry of National Development (MND) and Ministry of Trade and Industry (MTI). The Chief Statistician and the Superintendent of Census were members of the

CPC. DOS served as the secretariat of the CPC. The list of members in the CPC can be found in the Appendix B.

1.9 CENSUS SUB-COMMITTEES

Besides the CPC, there were also several working committees to aid in the planning and conduct of the Census 2000. The Census Technical Advisory Committee was chaired by the Chief Statistician and representations came from the academia (the National University of Singapore and the Institute of Policy Studies). Three other Planning Groups were also formed mainly with DOS staff, namely, the Census Planning and the Census IT Resources and Support Groups (both chaired by the Chief Statistician) and the Census Planning Group in Sample Design and Selection (co-chaired by the Census Superintendent and the Director, Economic Accounts Division). Details of the members to these planning groups can be found in the Appendix B.

CHAPTER 2

DEVELOPMENT OF POPULATION AND DWELLING DATABASES FOR CENSUS 2000

Singapore conducted a register-based Census for the 2000 Population Census, the first in the Asia-Pacific Rim. Using this approach, the full population count on Census Day, 30 June 2000, was obtained from the Department's Household Registration Database (HRD). The decision to move to a register-based Census represented a mindset shift from the traditional population fieldwork (100%) enumeration adopted by most countries in census-taking.

This new approach to Census taking was endorsed by the Cabinet in the first quarter of 1998. The two basic databases used for the new approach were HRD and National Database on Dwellings (NDD). The HRD and NDD provide basic particulars on the population and housing related information respectively. This chapter traces the development of the HRD and NDD and discusses issues on database merging and data quality.

2.1 THE HOUSEHOLD REGISTRATION DATABASE (HRD) AND THE NATIONAL DATABASE ON DWELLINGS (NDD)

The HRD is a central population register, providing basic personal information on Singapore citizens and permanent residents (PRs). The database is maintained and updated quarterly using administrative data. The NDD is a register of all residential addresses in Singapore. It is updated monthly from administrative sources and through field surveys. It is also used as the sampling frame for most household surveys conducted by the Government, including the quarterly Labour Force Surveys.

2.2 SETTING UP OF THE HOUSEHOLD REGISTRATION DATABASE (HRD) AND THE NATIONAL DATABASE ON DWELLINGS (NDD)

In the early 1990s, the Department realised that it was possible for Singapore to move towards a register-based Census in the long run. The HRD was therefore set up at an opportune time when the deployment of administrative databases was becoming widespread in public agencies.

2.2.1 Experiment with the Use of Registers

It was during the 1990 Population Census that the Department first experimented with the use of registers on a large scale. Information on each individual was obtained from relevant public agencies, merged and printed onto census forms. Enumerators visiting each household therefore had pre-filled basic information on every household member from the database. Respondents were asked to verify and/or edit the pre-printed information. The exercise showed that the general characteristics of the population did not differ significantly between the database and field-collected census data. It confirmed that a register-based Census could be conducted in Singapore.

2.2.2 Development of the Household Registration Database

With the learning experience gained from the 1990 Census, DOS took active steps to develop the HRD. A study visit to Denmark and Sweden was undertaken in 1992 by a team of senior officers from DOS and MTI's Department of Computer Information Services. These Scandinavian countries have long histories of keeping population registers. Denmark has dispensed with the traditional Population and Housing Census since 1970, and Sweden uses information available in the computerised population register for pre-printing of census forms to facilitate field operations.

The HRD was created via a one-time extraction of data from the MHA People Hub as at end June 1995 and the 1990 Census database. Through the UIN of each citizen and PR captured in these databases, it was possible to merge basic particulars for residents. The HRD was first established in March 1996. After the core HRD which contains basic person data was created, linkage to administrative databases maintained by other public agencies through the UIN was made every quarter. This enables the HRD to be an integrated and updated statistical system.

2.2.3 Development of the National Database on Dwellings

The NDD, on the other hand, was developed as a by-product of the 1980 Population Census. Using records of all dwelling units enumerated during that census, a Master House Frame was set up. This was kept up-to-date monthly with information from the Housing and Development Board as well as other relevant agencies. In 1996, this database was renamed the NDD and later enhanced with more housing information.

With the core items on individuals and houses being available from the two databases, it became possible to conduct a register-based Census. Basic data of the population were extracted from these databases to form the Pre-Census 2000 database.

2.3 DATA UPDATING FREQUENCY

How often are the data updated? This section provides the frequency of update for the HRD and the NDD.

2.3.1 Household Registration Database

The HRD is being updated regularly and has developed into a comprehensive store of demographic information on every individual. For each period, data on live births, deaths, citizens granted, citizens annulled, PRs granted, PRs revoked, marriages and divorces, change of address registration, education attending and highest qualification attained are obtained. The following updates have been carried out regularly:

Data Type	*Frequency*
Live Births	Quarterly
Deaths	Quarterly
Immigration	Quarterly
Emigration	Quarterly
Marriages	Quarterly
Change of Address	Quarterly
Divorces	Annual
Education Attending / Qualification Attained	Annual

The HRD system has error correction checks during the updating process to ensure data quality and integrity. Records which failed the validation or edit checks are scrutinised and corrected. Source agencies are also consulted where necessary.

2.3.2 National Database on Dwellings

The updates of records in NDD are carried out via the address record linkage for both private and public housing. The residential addresses are stored uniquely in the National Coded Address (NCA) format. The NCA format

is a unique 25-byte field that identifies a dwelling's address type, house or block number, street code, storey level and unit number. The NCA is a standard format adopted by various government departments. The following updates have been carried out regularly:

Data Type	*Frequency*
Public Housing	Monthly
Newly Notified Private Housing	Monthly
Private Housing ready for occupation	Monthly
Annual Valuation of Property and Property Tax Rate	Quarterly
Motor vehicle ownership	Quarterly
Geographic Boundaries	Quarterly

2.4 DATA ITEMS

2.4.1 Household Registration Database Data Items

The core HRD contains both the principal and subsidiary data items for each Singapore citizen and permanent resident. Principal data items include:

- UIN
- Name
- Sex
- Date of Birth
- Age
- Ethnic Group
- Marital Status
- Citizenship

The subsidiary items include type of dwelling, highest qualification attained and date attained, and education attending and date attending.

2.4.2 National Database on Dwellings Data Items

For each dwelling, the information includes dwelling type, postal district and address in NCA format. Enhancements to the NDD were made in 1998 to include additional housing attributes such as property tax rate, annual valuation of property and motor vehicle ownership data for each dwelling.

2.5 CONDITIONS NECESSARY FOR DATABASE MERGING

Singapore is probably one of the few developing countries that utilized an integrated system of databases to form population and housing databases. These statistical databases are updated regularly through linkages with other government agencies. For this to happen, there are three major factors that are required:

a) have standard keys for record linkage. In Singapore, the national standard key is the UIN, a unique nine-byte field with a check digit that is assigned to every Singapore citizen or permanent resident. For housing records, the address standard key is its NCA format which is increasingly adopted by all government departments;

b) the availability of better and efficient data management systems and the capacity to store huge amounts of data. This rapid evolution in information technology makes database merging and storage technically feasible to implement; and

c) have the co-operation of public sector agencies. This is vital not only in the planning stages when the agencies share their data items and codes for classifying them, but also during the implementation and on-going stages.

2.6 KEY ISSUES IN DATABASE MERGING

Having met the precepts of setting up and maintaining large databases, an organisation would move on to consider two key issues that would affect the database: data security and data quality. Security includes issues on confidentiality and the legal, administrative and technical measures that could be put in place to protect the database. Data quality issues include coverage, concepts, coding and classification, reference period differences, errors from source and data outliers.

2.6.1 Data Security and Protection

There should be measures to protect the information contained in the integrated databases from unwarranted access which could cause intentional alteration or destruction of partial or full data, apart from a host of other damages.

Confidentiality and Legal Measures

Whilst the move towards an integrated database through merging of particulars bring significant benefits, it also means that the breach in data security will have more serious consequences. It is therefore essential that the confidentiality of the data be preserved. One of the ways is through legislation. In Singapore's context, DOS is empowered with the Statistics Act and the Census Act. These Acts are the principle pieces of legislation governing the collection, compilation and publication of statistics. The Acts govern the protection and disclosure of confidential information, including those contained in the statistical databases. Data for the HRD and the NDD are obtained and protected under the Statistical Act, which prohibits disclosure of individuals' particulars.

Administrative Measures

Coupled with the legal measures, administrative measures have been set in place to reduce the risk of disclosure of information. These include:

a) induction of new employees to the organisational culture which emphasises the importance and need for data protection;

b) keeping critical files kept under lock and key;

c) classifying information or material according to their sensitivity and security implications, and accord the appropriate level of protection; and

d) enforcing "need-to-know" principle whereby the knowledge, possession or access to information or data is strictly confined to authorised persons.

Technical Measures

The changing trends in IT and the increasing reliance on databases mean that there must be stringent measures from a technical viewpoint to safeguard the data contained in the databases. The following measures have been implemented to safeguard the security and information of the databases:

a) databases that store individual information are kept at a secure physical site and is not connected to any external network. This physical site has restricted access and is out of bounds to all unauthorised visitors;

b) computer systems require users to identify themselves using unique user IDs and passwords. Passwords are changed at least

once every 30 days. Staff are not to disclose or share their user IDs and passwords;

c) firewalls are installed to insulate the connections between internal systems and external systems against unauthorised entry;

d) data transfer is done via secured email network or through diskette or cartridge collected by an authorised staff;

e) access rights to the databases are limited to a handful of authorised officers;

f) changes in IT programmes for updating are authorised before they are carried out; and

g) transactions to the databases are logged for security audit purposes.

2.6.2 Data Quality

One of the key issues in database merging is whether quality and integrity of data is compromised when more data sources are added. In merging information from several sources, the following areas need attention and efforts in ratification:

a) Coverage

Each database targets a different segment and merging data from the different sources may result in inconsistency or record duplication. Resources and time are required to analyse and rectify coverage issues.

b) Concepts and Definitions

Different agencies may adopt different concepts and definitions for similar data items. Efforts must be made by the agency merging the datasets to standardise or harmonise the concepts and maintain data consistency.

c) Coding and Classification

Different databases may adopt different codes and classifications. It is necessary for the merging agency to establish code conversion tables for the data items obtained so that the codes can be mapped out and converted correctly.

d) Different Reference Periods

Since different databases may have different reference periods for the data kept, special attention must be paid by the merging agency to

ensure that the reference periods of all the data items are synchronised.

e) Administrative Errors

Databases may contain outdated or missing information because information was provided sometime ago or informants are unable to provide the required information at the point of registration, among the many reasons. The merging agency would have to sieve out such inconsistencies and errors. The HRD and NDD, for example, have in-built validation checks e.g. algorithm checks and standard digit-checks for specific data items obtained from the various agencies.

f) Rare Occurrences

In certain instances, databases may contain some rare occurrence. Efforts must be undertaken by the merging agency to detect and verify these records, whenever possible, in consultation with the source agencies.

2.7 DATA QUALITY MEASURES

In order to preserve the integrity of the HRD and NDD, and ensure that the data are of good quality, DOS has put in place a series of regular and ad-hoc checks and improvements. Three such efforts of checking and cleaning up the databases are documented below.

2.7.1 Comparison with Official Population Estimates

The population figures obtained from HRD were compared with the annual official population estimates, year by year. The latter were obtained by adding the natural increase and net migration to the 1990 Census base population count. For the initial years, there were higher discrepancies between the HRD and the official population estimates. Steps were taken to reduce the discrepancies by identifying inaccuracies and correcting such records in the HRD with the assistance of the source agencies.

2.7.2 Conducting Small-scale Surveys to Update Information

Prior to the Census 2000 launch, a “location” check of all persons aged 75 years and over was conducted via mail questionnaires to confirm their presence and determine their whereabouts. The returns, together with information on the elderly from the aged institutions were used to update the

HRD. The exercise confirmed that some of the elderly had either migrated, passed away overseas, changed address or residing in elderly institutions.

For the NDD, regular surveys are conducted to update the physical status of the dwelling units in the database. Fieldworkers check and verify if certain dwelling units have been demolished. Contacts are also made with the clerks-of-work of major property developers to confirm if a particular housing project has been granted "Temporary Occupation Permit" or if a site has been demolished.

2.7.3 Matching and Verifying with other Registers

Annual Housekeeping Job

Another data quality check which DOS does on an annual basis is to cross-check the basic data items of every individual in the HRD with those available from MHA's People Hub. This housekeeping job has been in place effective June 1998.

Address Updating for Children

The address information for residents aged below 15 years may not be up-to-date if they do not report the change in address to the relevant authority. To improve their address quality in HRD, DOS makes use of relevant database to carry out annual update in the HRD for children of school-going age.

Address Updating with other Sources

HRD also obtains address information from other registers to improve address quality. For instance, data from Singapore Post Pte Ltd's (SingPost) latest directory of postal codes and DOS's own NDD file on demolished addresses are being used regularly to update and remove obsolete codes.

2.8 DATA COMPLETENESS

With the key measures in place, the quality of the principal data items in the HRD for residents in terms of data completeness is high by any statistical standards (see Table 2.1). The coverage for most of the data items is universal, i.e., 100 per cent. There is no missing value in the records for such data items in the database.

Table 2.1 Data Completeness for Principal Data Items in HRD

Data Item	Dec 1995	Jun 2000
Unique Identification Number (UIN)	100.0%	100.0%
Residential Status	100.0%	100.0%
Name	100.0%	100.0%
Sex	100.0%	100.0%
Date of Birth	100.0%	100.0%
Marital Status	92.7%	99.5%
Ethnic Group	99.9%	100.0%
Dialect Group	99.9%	100.0%
Country of Birth	100.0%	100.0%
Citizenship	100.0%	100.0%
Address	92.9%	99.5%

The data items on marital status and address do not have full coverage for residents. However, the data completeness for these items has improved considerably since the HRD was set up in 1995 from 93% to 99.5% coverage for all residents in 2000. The less-than-complete coverage for address can be attributed mainly to new permanent residents who could not offer a residential address at the time of registration. For marital status, the reason could be attributed to the fact that some marriages are not registered with relevant authorities e.g. persons who marry overseas.

DOS moved towards the register-based census approach because the quality of administrative data in Singapore is sufficiently high to produce an accurate count of the population and its basic characteristics. The legal framework and data confidentiality practices in Singapore also permit the sharing of relevant administrative information. Moreover, the cost savings in adopting this approach are substantial.

Beyond 2000, the DOS will look into a system of continuous measurement of the population by further integrating the records of the HRD and the NDD. A system of regular small-scale surveys could be put in place to collect information not obtainable from administrative sources and to monitor population and social trends of current interest.

CHAPTER 3

PLANNING AND PREPARATION FOR SAMPLE ENUMERATION

INTRODUCTION

For the Census 2000, additional information not available in any public databases was sought from 20% of households for in-depth studies. Careful planning and preparations were required if the operations were to succeed. These included finalizing the list of Census data items, improving the coverage on foreigners living here and of Singaporeans overseas, designing a sampling methodology to select 20% of households, establishing a standard coding classification and conducting a Trial Run prior to the commencement of the main Census operations.

3.1 DATA ITEMS COLLECTED IN THE CENSUS OF POPULATION 2000

The planning for the Population Census 2000 data items commenced in May 1998. As various government ministries and statutory boards are the main users of Census statistical data, DOS, which is responsible for the conduct of the Census, wrote to these agencies to seek their views and suggestions on the current topics of interest for planning needs. They provided feedback to DOS on the suggested data items to be collected together with their justifications. Arising from these dialogue sessions, a complete list of proposed data items to be collected from a 20% sample population in the register-based Census was compiled. It was carefully considered by DOS and a finalised list was drawn up and submitted to the CPC for approval.

3.1.1 Selection Criteria

As the Population Census is conducted once in ten years, it would be useful to collect items of wide ranging issues and topics with continuity to past census items. A balance should be reached between operational concerns and maximising returns, while guided by certain considerations. It should be noted that the final content intended for enumeration will significantly affect the format

questionnaire, the accuracy and quality of respondents' reply, the data processing phase and time schedule for Census releases. The topics coverage should be necessary and sufficient to provide useful information for government planning, but also with certain degree of confidence that data collection could be achieved within a certain time frame and cost.

In evaluating the inclusion of data items in Census 2000, DOS took into consideration the guidelines as recommended in the UN Handbook of Population and Housing Censuses. These include the following:

a) topics should be of relative importance for major national policy-making;

b) the information to be collected must meet the current needs of the government for policy planning and decision making;

c) the data items should not be too in-depth and specialized;

d) the data items should not require extensive probing or the need for highly qualified enumerators;

e) the data items should not be of a sensitive or controversial nature, which could jeopardize the collection of other essential demographic and socio-economical data;

f) the data items should not cover too many different topics; and

g) usage of resources should be within acceptable limits.

In addition to these UN recommendations, a few other key criteria were used to assess the feasibility of collecting the proposed data items requested by government agencies. They include the following which are discussed in some detail below:

a) respondent burden and suitability for collection in a national census;

b) the quality of enumerators; and

c) resources required.

a) Respondent Burden and Suitability

The demand for Census data has been rising steadily over the years, as reflected in the increasing number of data items collected in previous censuses listed below:

Census Year	Data Items Collected		
	Total	Main	Sample
1957	18	18	-
1970	36	17	19 (10%)
1980	27	18	9 (20%)
1990	45	39	6 (10%)
2000	54	8*	46 (20%)

* obtained from Household Registration Database (HRD)

While it is reasonable to expect the coverage of the census to rise in tandem with increasing complexities of our society, the number of data items to be collected must take into account respondents' tolerance and time.

It is not operationally feasible to speak with every household member during enumeration. The head or any other responsible member of a household should be able to furnish information with relative ease on behalf of the other members in the respective household. For items which require further clarifications, it should not require respondents to spend much time and effort to find the answer.

For Census 2000, in addition to telephone interviewing and field interviews, self-enumeration was made possible through Internet filing and form filling. The level of interest, understanding and interpretation for the questionnaire items and accompanying instructions varied considerably for different respondents. The methods employed in Census 2000 also meant that contact time with respondents was relatively short. As such, respondents should not be overburdened with items requiring detailed probing or are sensitive in nature (e.g. whether any household member had physical disabilities) where data could not be accurately or adequately collected. It is also realistic to expect possible resentment from respondents over such questions. These considerations were taken into account in the final selection of data items.

b) Quality of Enumerators

It was expected that about 80% of the household responses would be received through phone or field interviews. A pool of about 120 call interviewers and 300 field enumerators were recruited before the commencement of Census data collection. Training on the Census household concepts, canvassing of household information, appropriate responses and communication techniques were conducted by the Department of Statistics Census staff to the call center trainers in advance. They in turn provided relevant training to the call agents before those agents were deployed to handle interviews. Close supervision was provided during the period where the call center was in operation.

For fieldwork, detailed training lasting a week was conducted by the Fieldwork Assistant Census Superintendents (ASCs) for the field supervisors. Topics covered included the planning and preparation, using of the Fieldwork System for work allocation, allocation of fieldwork cases to enumerators, as well as methods of instruction to enumerators under their charge. Fieldwork training of about three days duration was conducted for the enumerators as well. Once field operation had started, regular meetings and discussions were carried out regularly by individual Field ASCs to the supervisors and enumerators within their respective Regional Offices (RO). Concepts were reinforced and operational procedures were emphasized.

For operational efficiency, the coverage of topics for the Census data items was kept at a desirable level in terms of number, content and one that ensured reasonable understanding. The workload was set such that call agents or field enumerators were able to complete a reasonable number of cases a day effectively.

c) Resources Required

The increasing number of census data items, coupled with a growing population, meant that more resources had to be used to conduct a census. The 1980 and 1990 Population Censuses deployed some 2,200 field enumerators and 3,500 field enumerators respectively.

The new approach to Census 2000, together with significant technological developments in data collection and data processing, resulted in substantial cost and manpower savings. However, there was still a significant amount of manual efforts expended in data collection and clarifications that needed to be sought from household members. A larger volume of collected

data could result in a much longer period for data collection and processing, as well as releases of census information to users. There would also not be optimization of census resources.

3.1.2 Census 2000 Data Items

After much deliberation, a finalised list of 54 data items comprising basic demographic and socio-economic characteristics, educational upgrading, job mobility, fertility, housing, transport and household information was compiled subsequently. It was duly endorsed by the CPC in July 1999 for collection in the Population Census 2000.

Of the 54 items, 8 items were obtained directly from the HRD maintained by the Department of Statistics. The remaining items not available from the HRD were collected from a 20% sample survey of the population.

3.1.3 Comparison with Census of Population 1990

Census 2000 collected 54 data items compared with 45 in the previous census held 10 years ago. In comparison with the 1990 Census, fifteen items were added to the current census to obtain vital information on educational upgrading, job mobility and home upgrading, as well as overseas travel and financial support for the elderly. Two items from the previous census, namely "Age of Mother When First Child was Born" and "Income From All Sources", were dropped. The former was not included as such information could be obtained from the birth register for babies born after 1967. "Income From All Sources" was dropped as the experience from the 1990 Census showed that it was difficult to obtain good and complete information from the household members.

The finalised list of data items is given below:

Personal Particulars and Demographic Characteristics

Name	
Singapore NRIC or FIN	)
Sex	)
Ethnic Group	) from administrative
Date of Birth	) source
Country of Birth	)
Citizenship	)
Residential Status	)
Year of First Arrival in Singapore	

Marital Status
Religion
Year of First Marriage
Number of Children Born Alive
Whether Staying In/Outside Singapore
– Country of Residence
– Reason for Living Abroad
– Expected Duration of Employment/ Course of Study Abroad

Household Characteristics

Relationship to Head of Household
Spouse Linkage
Parent-Child Linkage

Housing and Home Upgrading

Type of Present Dwelling (from administrative source)
Tenancy of Present Dwelling
Year Shifted In)
Type of Previous Dwelling) new item
Tenancy of Previous Dwelling)

Education

Level of Education Attending
Name of School
Highest Qualification Attained
Major Field of Study
(for polytechnic/university graduates)
Country where Highest Qualification was Obtained
Year when Highest Qualification was Obtained
Languages Literate In
Languages/Dialects Most Frequently Spoken At Home

Educational Upgrading

Whether Acquired Vocational Qualification)
(for non-polytechnic/university graduates))
Type of Vocational Qualification Acquired)
Field of Study) new item
Educational Institution)
Field of Study of Basic Degree)
(for those with post-graduate qualifications)

Employment

Economic Status
Occupational Status
Occupation
Industry
Income from Work
Bonuses Received
Actual Number of Hours Worked Per Week (new item)

Job Mobility

Duration of Present Job)
Previous Occupation) new item
Previous Industry)

Non-Working Persons

Whether Worked Before
Action Taken to Look for Work
Reason for Not Working

Transport

Usual Mode of Transport to School
Usual Mode of Transport to Workplace

Overseas Travel

Number of Overseas Travel for
Business/Leisure in Last 12 Months (new item)
– Malaysia
– Other Countries

Elderly Persons Aged 65 Years and Over

Main Source of Financial Support (new item)
Ambulant Status (new item)

3.2 ENUMERATION OF SINGAPOREANS OVERSEAS

Singapore's regionalisation drive as well as globalisation efforts have led to an increasing number of Singaporeans living abroad. Arising from this trend, there has been growing interest in the number and profile of Singaporeans overseas.

However, such information is not comprehensively available from any administrative source. While the HRD provides some information on Singaporeans who had reported overseas addresses, it is by no means complete. The regionalisation and globalisation drives make the task of enumerating them more difficult. Singaporeans are now a very mobile lot and the frequency of them travelling abroad for work or other purposes has increased significantly.

3.2.1 The 1990 Census Experience

The 1990 Census enumerated some 36,179 Singaporeans living abroad. They comprised the following two groups:

a) Absentee Household Members (AHM): Singaporeans whose households are still residing locally while they are abroad; and

b) Persons living Overseas with their Household (POH): Singaporeans who live abroad with their entire household.

Of the 36,179 enumerated, 30,753 were AHMs while only 5,426 were POHs. While information on AHMs could be collected from a household member during census enumeration, information on POHs could not be easily obtained as the entire household was not present.

During the 1990 Census, large firms and multi-national corporations that were likely to have Singaporean staff abroad were contacted. Census Office also approached Singapore high commissions, embassies and trade offices for assistance to enumerate especially students and those living abroad. Despite all these effort, only 5,426 POHs were enumerated. The estimated 36,179 Singaporeans living abroad then was considered as an undercount. The Singapore International Foundation (SIF) estimated some 100,000 Singaporeans living abroad then.

It is widely believed that there are significant numbers of POHs who did not register with Singapore missions overseas. This is especially so for those who live in cities far away from the capital cities of large countries where the Singapore missions are situated. Such persons were therefore unknown to the missions and could not be reached.

3.2.2 Period of Absence for Overseas Singaporeans

Besides difficulties in contacting Singaporeans overseas, there were also conceptual issues involved. In the 1990 Census, the definition of an

Overseas Singaporean was someone who was away or intended to be away from Singapore for at least one year.

It is clear that this definition was increasingly losing relevance. Many Singaporeans who work or study overseas returned home regularly within a shorter period of time. As a result, their household members may report them as "present in Singapore" even though they spend the bulk of their time abroad. The high mobility of such Singaporeans meant that the concept of an "Overseas Singaporean" may need to be modified.

In the mid-decade General Household Survey of 1995, the minimum period of absence was therefore reduced from one year to six months, that is, those who were away for 6 months or more were regarded as "Overseas Singaporeans". The same definition of being away for at least six months was used in Census 2000.

3.2.3 Approach for Census 2000

The experience of the 1990 Census showed that the Population Census may not be the best vehicle to obtain information of Singaporeans living abroad. This is also the assessment made by the United Nations, which observes in its Handbook of Population and Housing Censuses (Part I, para 13) that:

> "*By definition, a census of population is required to include in its enumeration all persons in a country. However, some countries include in the census count the numbers of their nationals living abroad… In this context, it must be noted that the exact determination of nationals living abroad is* ***very difficult*** *and their inclusion in the census of a country might result in distortions in the data."*

Despite the measurement and conceptual difficulties, Singapore's unique social and economic circumstances meant that some information on the Singaporean community overseas should be obtained. The objectives are two-fold:

a) to obtain an estimate of Singaporeans who are usually overseas in order to measure the impact of globalisation and monitor this growing trend;

b) to obtain at least the basic characteristics of such Singaporeans. It is preferable if other characteristics including their purpose and duration of stay overseas as well as their skills and employment could be obtained as well.

In Census 2000, the estimated number and profile of AHMs were obtained from the Census enumeration. As the Census enumeration was a 20% sample of the total population, the number of AHMs obtained from the survey was statistically grossed-up.

Unfortunately, similar information could not be reliably obtained for POHs. This figure was under-counted because Census enumerators were not able to contact and ascertain complete households that were overseas, even with the help of neighbours. Getting a complete and true picture of POHs will remain a challenge to Census planners and enumerators for some time yet.

3.3 ENUMERATION OF FOREIGNERS IN SINGAPORE

There has been an increasing trend towards recruiting foreign labour to ease the labour shortage in some industries. Such foreigners entering Singapore apply for permits with MOM and are categorised as Employment Pass Holders (EPH) or Work Permit Holders (WPH). Enumerating the higher-skilled EPHs including their spouses/ dependents, and the lower-skilled WPHs who are domestic workers (maids) does not pose a problem as they are usually provided with accommodation or live in rented housing. Enumerating the non-maid WPHs (construction workers) is a challenge as most live in non-residential dwellings e.g. labour lines/quarters. In past Censuses, this group had traditionally been underrepresented.

The increasing presence of WPHs in Singapore makes it necessary for this group to be adequately covered in the Census 2000. The Department recommended that 20% of them be enumerated alongside the 20% of residents living in private households. The recommendation was endorsed by the CPC in early 1999. As section 14 of the Census Act (Chapter 35, Revised Edition 1991) allows for employers to act as census enumerators, the approach to enumerating these foreign workers was to contact their employers to provide the required information.

To select the 20% sample, DOS created a sampling frame of enterprises employing foreign workers with the help of Ministry of Manpower (MOM). The sample comprised some 6,400 firms engaging 88,000 WPHs.

The sample was representative in terms of the industries that covered employed non-maid WPHs. After the sample was selected and contact details of the employers (address and telephone numbers) updated from the Department's Commercial Establishment Information System (CEIS), the survey was carried out via mail questionnaire from end March 2000 till August 2000. Employers were asked to verify and/or update the pre-printed basic items e.g. name, FIN, ethnic group, sex, skill type, as well as furnish detailed characteristics on housing, occupation, income, education/skill and mode of transport to work. The results of the survey were merged with the main sample of the residents to provide the overall profile of the total population and working persons.

3.4 CENSUS REGIONAL DIVISIONS FOR ENUMERATION

The 20% sample for the main Census or 218,000 households were selected systematically throughout the whole island of Singapore. They were grouped into 5 physical regions namely: North, North-East, East, Central and West to facilitate fieldwork operations. Within each region, a regional office (RO) was set up. Each RO was headed by an Assistant Census Superintendent and was fully equipped with laser printers, high speed Personal Computers (PCs) and email facilities through secured leased-line connection to Census Office.

The ROs for the fieldwork operations were:

North	–	Cheng San Community Club
North-East	–	Punggol Community Club
East	–	Pasir Ris South Community Club
Central	–	Environment Building, Census Headquarter
West	–	Hong Kah North Community Club

The 218,000 households were divided into 6 batches each across the 5 regions. This is to achieve 6 independent sub-samples of about equal size (see table on postal district distribution) with the aim to obtain representative results for each sub-sample during the 5 months data collection period. From the practical perspective, with staggered start dates for the 6 batches, the workload was evened out to achieve a good and manageable spread of Internet traffic to the Census Internet enumeration website. The fixed number of CATI and fieldwork enumerators employed by Census Office would also be able to cope with the even workload effectively.

Households in each batch were initially given 2 weeks to submit their Census returns through the Internet. If their cases were not completed during the specified 2-week period, CATI operators would start contacting them from the third week. Households would still be able to submit their returns either through Internet or CATI between the 3rd to 5th week. Thereafter, incomplete cases would flow to fieldwork system and the enumerators would conduct face-to-face interviews with the households. This would take place between the 6th to 10th week. Details on fieldwork operations can be found in Chapter 4.4.

3.5 SAMPLE DESIGN AND SELECTION

This section outlines the Census 2000 sample design and selection. In particular, the practical considerations of sampling, principles and sample methodology, actual selection procedure and the reliability of data obtained from the 20% sample are highlighted. A separate write-up on the sampling errors is included in the Appendix E.

3.5.1 Practical Considerations in Sample Selection

The HRD provides the total count and basic characteristics of the population. For the additional detailed information required, it would suffice if a reasonably large sample survey is conducted. Given the details of data required by users and the range of topics included in the Census 2000, a 20% sample would be able to satisfy most data requirements.

More Timely Release of Census Results

For purposes of planning, programme evaluation and research, there has been increasing demands for greater timeliness in the release of statistical results. In the Census 2000, as the information was sought from 20% of the population, it was expected that data collection and processing would be completed within four months and results released within six months from the Census Day.

Cost considerations

As a sample is a small proportion of the population, it would be less expensive to obtain information from a sample than to enumerate the entire population. For the Census 2000, the cost of conducting a register-based Census together with a sample enumeration of 20% of the population is

estimated to be $22 million. This would be about one-third the total cost if a full-scale traditional 100% enumeration were to be undertaken.

3.5.2 Principles of Sampling Methodology

During the sample design stage, detailed study was carried out before deciding on the sampling methodology for the Population Census 2000. The final sample design took into consideration the following factors:

a) good broad-level estimation of variables can be obtained at Development Guide Plan (DGP) level;

b) ease of expansion of sample size from 20 per cent to 25 per cent of the population when it is needed; and

c) ease of implementation.

To ensure a good spread and representation of the sample at DGP level, the list of dwelling units in the National Database on Dwellings was stratified by DGP zones. There were 44 DGP zones. These zones were designated as the strata from which independent samples were selected.

The proposed sampling methodology also had to take into consideration the ease of expansion of sample size from 20 per cent to 25 per cent of the population when required without compromising on data quality. For this purpose, a 2-phase sample selection was proposed. For the first phase sample, 25% of the dwellings were selected systematically with a random start within each DGP zone. This was to prepare for expansion in the event of a need to increase the coverage. In the second phase sample, 80% of the selected dwellings were systematically picked from the first phase sample. This formed the main sample of 20% of households which would be enumerated through Internet, CATI or fieldwork. The remaining sample with a size of 5% (20% of 25%) of households was kept as reserve.

The basic design is the proportionate stratified sampling and the technique used in the actual selection of sampling units is the systematic selection procedure with a random start. This is an effective and efficient method.

First Phase Selection and Order of Sampling Units

For the first phase of sample selection, the sampling units which consist of dwellings in each DGP zone were sorted in order of:

a) house-type, in the sequence of public, private and others; and

b) address by street code, block number, storey level and unit number.

This enabled proportionate selection across the house-type and DGP zones (i.e. area) since units in each zone were similarly stratified. The selected dwellings in the first phase sample also reflected the stratification characteristics of the sampling units.

Second Phase Selection : Independent Samples

In the second phase sample selection, 80% of dwellings were to be selected from the first phase sample.

To facilitate variance computations and comparison, four 1-in-5 systematic samples using 4 random starts were selected from the first phase sample for each DGP zone. Each of these four samples constituted 20% of the first phase sample within the DGP zone. The advantages of taking four independent samples are:

a) exactly 80% of the dwellings in the first phase are selected; and

b) variance of estimators was obtained from the four systematic samples in the second phase. These four independent samples enabled the comparison of variances of estimators, if required.

3.5.3 Actual Sample Selection Procedure

Based on the methodology proposed, the Department embarked on sample selection using the National Database on Dwellings (NDD). This section outlines the actual steps involved in the sample selection.

Creation of Sampling Frame

The National Database on Dwellings (NDD) contains a comprehensive listing of dwelling units in Singapore. It forms the “population”, N, from which a representative sample of 20% of dwelling units (n = 20% of N) would be selected.

To create the sampling frame, the list of dwellings that were under construction were excluded from the frame. Only dwellings that were completed for at least six months were included. In addition, as the target sample was persons living in private households, institutions such as military camps,

hospitals and hostels were excluded from the frame. This was to ensure that there would be household members residing in the selected dwelling unit during enumeration.

Ordering of Sampling Units

Before selection, the eligible dwelling units were listed in order of their house-type and DGP zones. Although there were 55 DGP zones, as demarcated by the Urban Redevelopment Authority (URA), 44 DGPs were found with residential dwellings. As such, each dwelling unit was uniquely classified into one of the 44 DGP zones with a residential address.

Two-Phase Sampling

As advised, DOS adopted a 2-phase sample selection for Census 2000. During the first phase, 25% of total sampling units (dwelling units) were selected. From the first phase sample, 80% of the dwellings were systematically selected to form the baseline for the second phase sample. The second phase thus had a size of 20% of total dwellings. The first stage selection yielded some 275,000 households across the 44 DGP zones.

The purpose of second phase sampling was to select 80% of the dwelling units selected in the first phase. For this, the 275,000 dwellings in the first stage were arranged in order of DGP zone and detailed house-type. The sampling list is thus implicitly stratified by geographic zone. Four random numbers were generated to pick four 1-in-5 systematic samples. This formed the final sample of 218,000 addresses. This final sample of dwellings were used in the detailed enumeration in the Census 2000.

3.5.4 Reliability of Sample Estimates

The main objective of sampling is to obtain estimates and inferences of a given population on the basis of observations made of a representative sample from that population. There are several ways to assess the reliability of data from a sample. One of the best ways is to compare them with data from another source that use similar time reference and concepts and definitions. In the Census 20% sample, the ideal alternative source would be to compare with data from the HRD. The HRD would be a good source for comparison as it has a full 100% coverage of the population in Singapore.

3.5.5 Comparison of Sample Data with HRD Data

Data on a number of key demographic and socio-economic characteristics from the HRD and 20% sample on the resident population are presented in the Tables 3.1 and 3.2. The 20% sample data have been blown-up to represent 100% of the population based on a set of derived expansion factors. For data comparability, the 20% sample data includes Singapore residents who were present in Singapore, absentee members who are overseas for more than 6 months as well as absentee members in overseas households.

Resident Population by Age Group

Data on the Singapore resident population by age group from the HRD and the 20% sample enumeration are presented in Table 3.1. The comparison of the age data shows that the two distributions are similar structurally that they could be considered to be identical. There is only a 0.1 to 0.4 percentage point difference in the absolute values for the sub-categories. Some age-groups showed a zero percentage point difference, which meant that the two sets of figures were practically the same.

Table 3.1 Resident Population by Age Group, 2000

Age Group (Years)	HRD Data		20% Sample Enumeration		Absolute Difference in % Dist.
	Resident Population	% Distribution	Resident Population	% Distribution	
All Groups	**3,263,209**	**100.0**	**3,263,209**	**100.0**	**-**
0-4	213,278	6.5	224,799	6.9	0.4
5-9	252,082	7.7	257,762	7.9	0.2
10-14	235,438	7.2	237,468	7.3	0.1
15-19	211,320	6.5	214,396	6.6	0.1
20-24	212,609	6.5	212,061	6.5	-
25-29	267,582	8.2	265,885	8.1	0.1
30-34	290,880	8.9	286,987	8.7	0.2
35-39	323,064	9.9	316,415	9.7	0.2
40-44	313,048	9.6	309,170	9.5	0.1
45-49	262,626	8.0	260,129	8.0	-
50-54	207,082	6.3	207,161	6.3	-
55-59	125,471	3.8	126,220	3.9	0.1
60-64	111,103	3.4	111,397	3.4	-
65-69	89,182	2.7	88,326	2.7	-
70-74	68,001	2.1	64,973	2.0	0.1
75-79	40,053	1.2	39,663	1.2	-
80 & over	40,390	1.2	40,398	1.2	-

Resident Population by Ethnic Group and Sex

Table 3.2 shows the data on the Singapore resident population by ethnic group and sex from the HRD and the 20% sample enumeration. The two distributions for ethnic group were also very close, with a 0.1 to 0.5 percentage point difference in the absolute values for Chinese, Malay, Indian and the Other categories. By ethnic group and sex, the differences narrowed further to 0.1 to 0.2 percentage point difference.

Table 3.2 Resident Population by Ethnic Group and Sex, 2000

Ethnic Group	HRD Data		20% Sample Enumeration		Absolute Difference in % Dist.
	Resident Population	% Distribution	Resident Population	% Distribution	
All Groups	**3,263,209**	**100.0**	**3,263,209**	**100.0**	**-**
Chinese	**2,505,379**	**76.7**	**2,517,955**	**77.2**	**0.5**
Males	1,245,782	38.2	1,254,388	38.4	0.2
Females	1,259,597	38.6	1,263,568	38.7	0.1
Malay	**453,633**	**13.9**	**456,850**	**14.0**	**0.1**
Males	228,174	7.0	229,041	7.0	-
Females	225,459	6.9	227,809	7.0	0.1
Indian	**257,791**	**7.9**	**246,325**	**7.5**	**0.4**
Males	134,544	4.1	126,890	3.9	0.2
Females	123,247	3.8	119,435	3.7	0.1
Others	**46,406**	**1.4**	**42,078**	**1.3**	**0.1**
Males	21,793	0.7	19,974	0.6	0.1
Females	24,613	0.8	22,105	0.7	0.1

3.6 SINGAPORE STANDARD CLASSIFICATION FOR OCCUPATION, INDUSTRY AND EDUCATION

As part of the run-up to Census 2000, three national standards of statistical classifications were prepared. Out of these, two were current national standards that were updated from the previous editions. They are the Singapore Standard Occupational Classification (SSOC) and the Singapore Standard Industrial Classification (SSIC). The Singapore Standard Educational Classification (SSEC) was a new national standard designed for the first time for Census 2000 use. The adoption of a common framework for statistical

information classification facilitates data sharing and analysis among producers and users.

3.6.1 Occupational Classification

The SSOC was designed for use in Population Censuses and surveys where occupation data are collected. It is the national standard for classifying statistical information on occupation. SSOC 2000 was updated from the SSOC 1990, which was essentially based on the International Standard Classification of Occupations 1988 (ISCO-88), published by the International Labour Organisation (ILO). It took into account changes in the employment scene in Singapore during this period that resulted in the emergence of new occupations, as well as the redundancy of some jobs arising from economic, technological and organisational changes.

a) *Scope and Nature of Classification*

The SSOC 2000 classified occupations of the workforce in detail based on the main type of work performed. However, those working as armed forces personnel or foreign diplomatic personnel were grouped collectively in their respective categories. The economically inactive population such as housewives, full-time students and retirees were not classified.

b) *Structure of Classification*

A numerical five-digit coding system is used to distinguish the five levels of aggregation, namely Major Group, Sub-major Group, Minor Group, Unit Group and Occupation. The Major Groups (one-digit codes) are the highest level of aggregation and represent broad type of work. There are 10 major groups such as Managers, Professionals, Sales and Service Workers, Plant and Machine Operators, etc. Each group is identified by their corresponding one-digit code. Sub-major Groups (two-digit codes) are the sub-divisions of the major groups. There are 32 sub-major groups each corresponding to their respective two-digit code. Minor Groups (three-digit codes) are the segregation within the sub-major groups. There are 119 groups corresponding to their respective three-digit code. Unit Groups (four-digit codes) are the finer divisions within the minor groups, each identified by their corresponding four-digit code. There are 274 unit groups. Occupations (five-digit codes) are the sub-divisions within the unit groups. In all, there are 993 occupations where each represents an important type of work performed. For Census 2000, published tabulations on occupations involved only the major groups (one-digit codes).

c) *Working Committee*

The SSOC 2000 was prepared by an occupational classification planning group, comprising representatives from the Ministry of Manpower, Economic Development Board, Monetary Authority of Singapore, Institute of Technical Education, Infocomm Development Authority of Singapore and the Singapore Department of Statistics. Inputs were obtained from relevant government ministries and statutory boards.

3.6.2 Industrial Classification

The SSIC was designed for use in population censuses, statistical surveys and administrative databases where data related to economic activities are collected. SSIC 2000 replaced the SSOC 1996, which was adapted from the International Standard Industrial Classification (ISIC) Revision 3 (1990). This current classification took into account changes in the economic activities of Singapore's economy. The adaptation of this basic framework and the necessary modifications provide for international comparability of data.

a) *Nature and Principle of Classification*

The SSIC is a classification of economic activities undertaken by economic units. Industrial classifications are not determined by the kind of ownership, type of legal organisation or mode of operation, as such criteria do not relate to the characteristics of the economic activity. The SSIC 2000 classified economic units under the same category if these units engaged in the same or similar kind of economic activity. When an economic unit engages in more than one activity, it is classified according to its principal activity. The principal activity of an economic unit is defined as the activity contributing the most to the value added of the unit or the activity with a higher value added than that of any other activity of the unit. Secondary and ancillary activities are not considered when making classifications.

b) *Structure of Classification*

Like the SSOC 2000, a numerical five-digit coding system is used to distinguish the various categories of principal activities undertaken by an economic unit. At the highest aggregation level, there are 54 two-digit divisions in 18 tabulation categories known as "Sections", each denoted by a single alphabetical letter. Each section comprises one or more divisions. Overall, these 54 divisions are further broken down into 152 three-digit groups, 323 four-digit classes, and 1072 five-digit items at the most detailed level.

Some economic activities that bear little importance are re-classified into residual industries. In general, SSOC 2000 contains fewer categories at the 4- and 5-digit levels as compared with SSOC 1990.

c) *Working Committee*

This eighth edition of the SSIC 2000 was prepared by an industrial classification planning group. It comprised representatives from the Ministry of Manpower, Building and Construction Authority, Economic Development Board, Infocomm Development Authority of Singapore, Monetary Authority of Singapore, Trade Development Board and the Singapore Department of Statistics. Inputs and feedbacks for improvements were obtained from other government agencies and statutory boards.

3.6.3 Educational Classification

The SSEC 2000 was prepared for use in the Census 2000, as well as for future statistical surveys and other administrative systems requiring the classification of data on education. This classification system allows producers of education statistics the option of data sharing while users benefit from having consistent and comparable data for analysis.

a) *Scope and Structure of the Classification*

The SSEC 2000 comprises three integral components, namely Level of Education Attending, Educational Qualification Attained and Field of Study.

The current education system and formal educational qualifications awarded in Singapore are used to define the broad types of learning and hierarchical structure of the SSEC. Qualifications that were awarded overseas or in Singapore in the past could be appropriately classified according to their perceived equivalence to the current standards in Singapore.

b) *Level of Education Attending*

This refers to the grade or standard of formal education that a full-time student is attending. The classification system is a two-digit hierarchical structure. Six broad levels of education are defined according to the typical age and years of schooling of the student. They are segregated further by the grade of education at primary and secondary levels, and by the curriculum type at upper secondary levels and above, where appropriate.

c) *Educational Qualification Attained*

This refers to the grade or standard of formal education passed or the highest level of education where a certificate, diploma or degree is awarded by a formal educational institution. The educational qualification may be attained through full-time or part-time study in a structured learning programme. The levels of educational qualifications are categorised into nine broad groups in accordance to the type of certification used in Singapore's formal educational system. These nine broad categories of qualifications exclude those skill certification, certificates of course attendance, as well as awards and honorary qualifications which are not obtained through formal learning and examination by formal educational institutions and professional bodies. This system is similarly distinguished by a two-digit coding system containing more detailed distinctions by type of qualification (general/vocational) where appropriate.

d) *Field of Study*

Field of Study refers to the principal discipline, branch or subject matter of study that leads to the award of the qualification attained at polytechnic or university level. Vocational qualifications at upper secondary level may also be classified by field of study.

A four-digit coding system is defined with three levels of aggregation, namely Broad Field, Narrow Field and Detailed Field. The broad field of study represent the highest level of aggregation in the classification, with 14 broad fields in all which can be identified by their corresponding two-digit codes. Narrow fields are the sub-divisions of the broad fields. There are 57 narrow fields of study each denoted by a three-digit code and 230 four-digit detailed fields of study.

e) *Working Committee*

The SSEC 2000 working committee consisted of representatives from the Ministry of Education, Ministry of Manpower, Institute of Technical Education, Singapore Productivity and Standards Board as well as the Singapore Department of Statistics. Inputs were obtained from other relevant government agencies, educational institutions and professional bodies.

3.7 TENDER PREPARATION FOR CENSUS SYSTEMS

For Census 1990 and GHS 1995, the IT systems were developed by an in-house application development team. This in-house model could not however be used for Census 2000 because of the complexity of the integrated Tri-Modal Data Collection System. Also for certain systems like CATI, it was economically not feasible to build the system and then discard it after the close of Census. An international Open Tender (*NCB (T) – 387*) was therefore called in August 1998 to select a vendor to build the IT system for Census 2000.

To call the Tender, an internal Detailed Requirements Study was conducted. This study was carried out by a combined team of statistical and IT staff. The requirements identified by this study were split into two major categories. These were:

a) Functional Requirements – These were the business needs identified during the study. Examples of this were the detailed functions that the systems must perform, workflow of the systems and validation rules to ensure that the data submitted were clean; and

b) Infrastructure Requirements – This is what was needed technically to support the business needs that had been identified. Examples of this were performance levels of the systems, compatibility across different platforms and design requirements to ensure secure access.

There was also the legal structure of the Tender, which was split into two components. These were:

a) Terms and Conditions – These refer to the Terms and Conditions of the Contract. These were prepared with the assistance of the Singapore Attorney General's Chambers. As these formed the legal basis of the Contract, no variation was allowed; and

b) Requirements – These refer to the Functional and Infrastructure Requirements. Here, vendors were allowed to propose options and variations for consideration. This was to allow for flexibility to award the Contract to a vendor with innovative ideas and solutions that were superior to what had been identified during the internal Detailed Requirements Study.

3.7.1 Tender Evaluation and Award

At the close of the Tender in September 1998, a total of 9 Tender Proposals were received. These proposals were evaluated using a two stage Tender Evaluation process. These two stages were:

a) Preliminary Evaluation – The evaluation team checked to see that the proposals were complete, within budget and met the basic requirements of the Tender. Proposals that did not meet these criteria were eliminated; and

b) Detailed Evaluation – At this point, remaining proposals were examined in detail. To clarify the details, the vendors that submitted the respective proposals were invited to conduct a Vendor Presentation and Demonstration.

For the 9 proposals received, 6 were found not to have met the criteria of the Preliminary Evaluation. These were therefore eliminated after the Preliminary Evaluation. The remaining 3 proposals which met the criteria were:

a) International Business Machines Pte Ltd (IBM);

b) National Computer Systems Pte Ltd (NCS) ; and

c) Singapore Computer Systems Pte Ltd (SCS).

In the Detailed Evaluation that followed, the details of the proposals from these 3 vendors were studied carefully. All 3 vendors were invited to conduct a Vendor Presentation and Demonstration to clarify points which were unclear. From this, a recommendation was then made to the Tender Board. In making this recommendation, a number of factors were considered. Some of these were:

a) quality of solution;

b) manpower assigned;

c) experience;

d) cost; and

e) compliance with Terms and Conditions of the Contract.

At the close of the Detailed Evaluation, it was found that the proposal from NCS best suited the needs of Census 2000. This proposal was therefore recommended to the Tender Board. After due consideration, the recommendation was accepted by the Tender Board.

3.8 TRIAL RUN

Trial Runs are traditionally conducted prior to a main Census. These smaller scale operations are also known as “Pilot Censuses” or “Pre-Tests”. They serve as full-dress rehearsals for the main Census, so that difficulties or problems may be detected and rectified in time for the Census. Such testings are so important that for some countries, more than one round of test is conducted before the actual Census.

As endorsed by the Census Planning Committee, a Trial Run was conducted from 8 Dec 1999 to 19 Jan 2000. Some 10,000 households in the eastern region of Singapore were selected to participate in the Trial Run. The aims of the Trial Run were:

a) to test robustness of the different modules within the IT system;

b) to test the integration of the three data collection modes;

c) to test questionnaire flow, especially for the Internet self-enumeration mode; and

d) to fine-tune operational procedures, logistics support, classification schemes and other plans.

3.8.1 Publicity

A low key publicity campaign was launched to inform and encourage participation from respondents selected for Trial Run. In early Dec 1999, Census posters were distributed to government departments, libraries, schools, Community Clubs and selected organisations. Following a press release on Monday, 6 Dec 1999, the Census hotline was activated on 7 Dec 1999, and notification letters were sent to respondents to commence Internet submission on 8 Dec 1999.

During the Trial Run, twenty-eight feedbacks were received through email, fax or media. Some twenty-five of these pertained to technical difficulties while the respondents were submitting Census returns through Internet. As a result of the learning experience from the Trial Run, a more intensive and wider publicity campaign was staged for the main Census 2000 to encourage respondents’ participation.

3.8.2 Internet Submission

Internet Submission for the Trial Run started on 8 Dec 1999 and remained open until 28 Dec 1999. To cater to high traffic volume and improve overall speed, a new high-performance server (Compaq 5500 series) was added to the existing three Internet servers midway during the enumeration period. At the close of Internet enumeration, less than 10% of households successfully completed their Census returns using the Internet mode.

Security escalation procedures were streamlined during the period to ensure quick and effective reaction to IT security intrusions. This escalation plan was tested during the Trial Run when there was nearly a breach of security. A systematic pattern of attack by an Internet subscriber was detected on the Census Internet Submission System. The attack was unsuccessful and there was neither loss nor disruption to either the Internet Submission System or the database. The matter was subsequently referred to GITSIR (Government IT Security Incident Response team) who advised that the severity and evidence of the incident did not warrant further action.

Three main areas of deficiencies were highlighted by respondents:

a) slow Internet response time;

b) technical problems in Internet submission; and

c) the questionnaire was too long.

In response to the feedback received, improvements were made to the Internet Submission system. These included:

a) removing sidebar encryption to speed up response time;

b) splitting of Basic Particulars page into 2 to speed up downloading time; and

c) setting up a message server to display messages whenever there was down time due to maintenance or technical problems.

3.8.3 Computer-Assisted Telephone Interviewing (CATI)

CATI outbound call operations formally started on 15 Dec 1999, concurrently with Internet submission, and lasted until 28 Dec 1999.

CATI team completed the bulk of the sample selected for the Trial Run. Owing to the fact that the CATI interviewers were new to the Census

Form, completion rate was slow in the beginning. CATI also experienced minor technical problems at the start of the Trial Run. Completion rate increased towards the end when the system performance was optimised. By then, CATI interviewers had become familiar with the line of questioning. The number of CATI stations were correspondingly increased. There were about 40 stations at the peak of operations.

3.8.4 Fieldwork

Fieldwork was the last mode of data collection after Internet and CATI enumeration closed. It started on 30 Dec 1999, following the assignment and printing of cases for fieldworkers on 29 Dec 1999. Detailed and extensive briefings were given to the fieldworkers as this last mode of survey was expected to be the most difficult part of the operation.

At the close of fieldwork on 14 Jan 2000, slightly over 10% of households had been completed. The average number of households completed per day per fieldworker was 3, as compared with about 9 for CATI at its peak.

The fieldwork system worked fairly well for the Trial Run and the operational flow was reasonably smooth. The main problems encountered were high turnover of fieldworkers and uncooperative respondents. To improve on office operations, the following changes were made:

a) an additional high-speed laser printer was added to the one at the regional offices to cater to bulk volume of printing of household and individual forms; and

c) more fieldworkers were employed to work in the evenings, as this is the most productive time when household members were around.

3.8.5 Electronic Document Management System (EDMS)

EDMS was used to scan and capture the markings and readings on the Census fieldwork forms. Operations started on 6 Jan 2000, and ended on 19 Jan 2000.

All the fieldwork forms were successfully scanned. Some 70% of the forms with at least one response not filled in were detected by the system. For the EDMS scanning and detection, two major problems were:

a) errors resolved led to more errors later as there were minor system bugs; and

b) completeness checks were too stringent, such that fieldwork forms could not flow through to the coding system.

The system bugs were subsequently resolved. The completeness rules were also reviewed and the less important ones were excluded. Complete verification for the main Census was conducted at the Data Verification stage.

3.8.6 Data Coding System (DCS)

The Advanced Coding Environment (ACE) R&D software was used for the Census coding operations. ACE was designed to improve coding accuracy and reduce labour-intensive operations. Using a combination of information collected from the Census, ACE auto-codes direct matches from code dictionaries. For unmatched fields, artificial intelligence technique was used to suggest codes to the human coder for selection. All completed forms from Internet, CATI and Fieldwork/EDMS flowed to the DCS for coding by ACE. DCS was in operation from 20 Dec 1999 to 19 Jan 2000.

The Trial Run coding exercise was highly successful and no major problems were encountered. There was a 60% increase in the coding turnaround time for the Trial Run compared with previous surveys. Each coder was able to code about 80-100 records, or 50 households per day. This was a marked improvement from the 50 records per day during the 1995 General Household Survey.

3.8.7 Data Verification System (DVS)

DVS started on 23 Dec 1999, after sufficient records have accumulated from coding. The verification of inconsistencies in the completed returns proceeded faster than expected and very few errors were encountered. On average, a Data Verification editor was able to verify about 50 cases per day. Apart from the fact that returns submitted by respondents through Internet or CATI were relatively error-free, the reasons for this high rate were:

a) relatively clean data (EDMS has taken the load and performed some of DVS functions);

b) effectiveness of ACE (Advanced Coding Environment);

c) references made to CEIS (Commercial Establishment Information System) for industrial codes; and

d) addition of non-standard information recorded in the remarks column in CATI and fieldwork questionnaires to help verification.

3.8.8 Census Management System (CMS)

The Census Management System is an internal system responsible for the orderly flow of data from one system to another. It keeps track of the status of the cases and provides daily management reports on the progress of the Census.

For the Trial Run, CMS did not face any major problems. Data from one system flowed to the other very smoothly. Minor refinements were made to the daily management reports to allow the progress of the Trial Run to be tracked more closely. These included changing the presentation of the daily reports to a time series format.

3.8.9 Changes Following the Trial Run

On the whole, the Trial Run achieved its aims. Following the experiences of the Trial Run, the systems and operational flows were fine-tuned. These included enhancing the Internet screen, improving fieldwork questionnaire flow, and testing the integration of the different modules. Errors and enhancements were rectified and incorporated before the main Census. The main changes that were made were as follows:

a) removing non-critical encryption in Internet to reduce response time;

b) setting up permanent message server for Internet downtimes;

c) removing completed records from the Internet/CATI enumeration database on a daily basis to minimise server redundancy;

d) increasing the number of CATI stations;

e) sending separate letters requesting respondents with confidential or no telephone numbers to respond to Census;

f) increasing the number of fieldworkers to work during the evenings; and

g) making slight modifications to questionnaire design to improve the flow.

CHAPTER 4

ENUMERATION, DATA PROCESSING AND DISSEMINATION

4.1 OVERVIEW

For the detailed enumeration, a 20% stratified sample of households in Singapore was selected, to obtain detailed information of the Singapore population not available from any administrative databases. The tri-modal data collection system was adopted. The data collected were sent for processing where the records were edited to eliminate errors and omissions and coded for further processing. This was then followed by the production of statistical tables for analyses and data presentations.

For enumeration under the tri-modal data collection system, the 20% sample comprising some 218,000 dwelling units was split into six batches. The enumeration of these six batches was done using the staggered workflow of two weeks between each batch as shown below. This staggered workflow was designed to optimise the use of time and scarce resources.

Batch	Weeks									
	1	2	3	4	5	6	7	8	9	----→
1	Internet	Internet	Internet CATI	Internet CATI	Internet CATI	Field-work	Field-work	Field-work	Field-work	
2			Internet	Internet	Internet CATI	Internet CATI	Internet CATI	Field-work	Field-work	Field-work
3					Internet	Internet	Internet CATI	Internet CATI	Internet CATI	Field-work
↓ 6										

Respondents in a batch were first sent a notification letter informing them that they had been selected to participate in the sample Census enumeration. Following this, the respondents were then given 2 weeks to submit their returns via the Internet.

After the two-week period, the CATI system then began calling respondents in the batch that had not completed their returns. At this juncture,

respondents had the option of completing their returns via the telephone or through the Internet. For respondents who had not completed their returns by the end of the fourth week, a reminder letter was sent. This reminder letter also alerted respondents that if their returns were not submitted by the end of the fifth week, a fieldworker would visit them at their home to assist them in completing their returns. From experience, many respondents did not prefer the last option of having the interviewers visit them. They would prefer to complete their returns using the Internet or CATI.

At the end of the fifth week, Internet and CATI submissions for the respondents would close. Fieldwork for the respondents in the batch would then begin. This fieldwork would continue for four weeks until all respondents had completed their returns.

There was a one-week overlap for each CATI batch and a two-week overlap for each fieldwork batch. The actual schedule for the despatch of the notification letters to the households, Electronic Submission System (ESS), CATI and fieldwork operations is given below:

Critical Dates for ESS, CATI and FW

Batch	Despatch of Notification Letters	ESS starts	CATI starts[1]	Despatch of Reminder Letters[2]	ESS/CATI close[3]	FW starts[4]	FW ends[5]
1	21 Mar	23 Mar	05 Apr	18 Apr	25 Apr	27 Apr	25 May
2	4 Apr	5 Apr	19 Apr	02 May	9 May	11 May	08 Jun
3	18 Apr	19 Apr	3 May	15/17 May	24 May	26 May	22 Jun
4	2 May	3 May	17 May	29/31 May	7 Jun	9 Jun	13 Jul
5	16 May	17 May	31 May	12/14 Jun	28 Jun	30 Jun	03 Aug
6	30 May	31 May	14 Jun	26/28 Jun	07 Jul	11 Jul	31 Aug

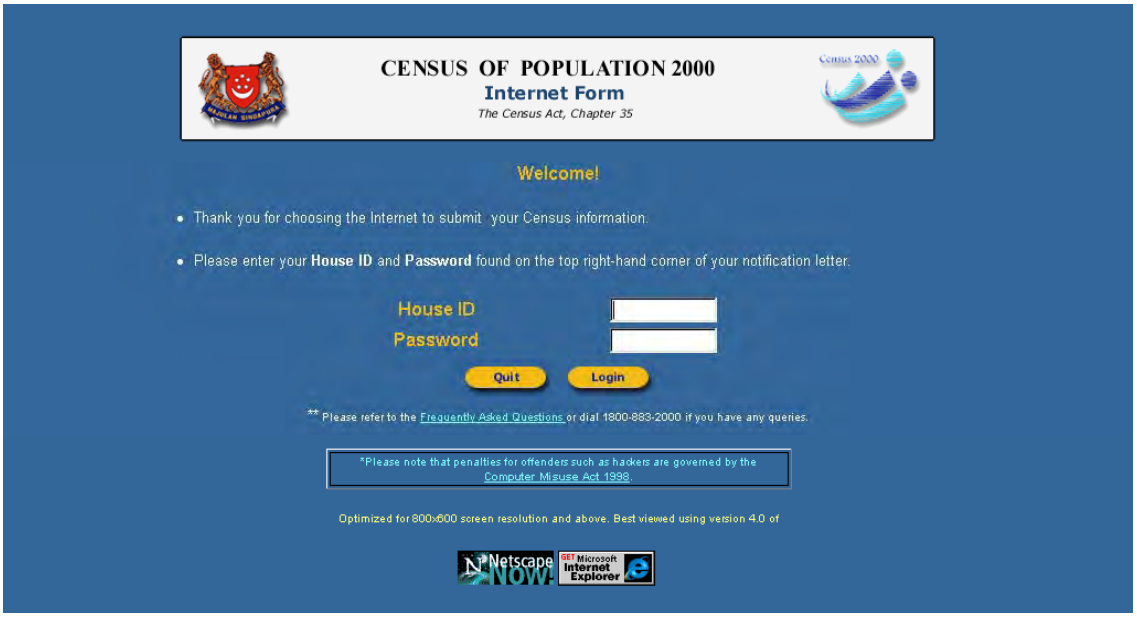
1. CATI commenced two weeks from the ESS start date.
2. Reminder letters were sent to households that did not submit their Census returns via ESS/CATI.
3. The closing date for ESS/CATI coincided with the closing date for reminder letters.
4. Fieldwork (FW) commenced after the closing date of ESS/CATI. A 2-day lag was necessary to allow for the extraction of household records outstanding and the printing of information onto Census questionnaires.
5. Each FW batch lasted four weeks. The actual end-date was dependent on the response from the field.

4.2 INTERNET DATA COLLECTION

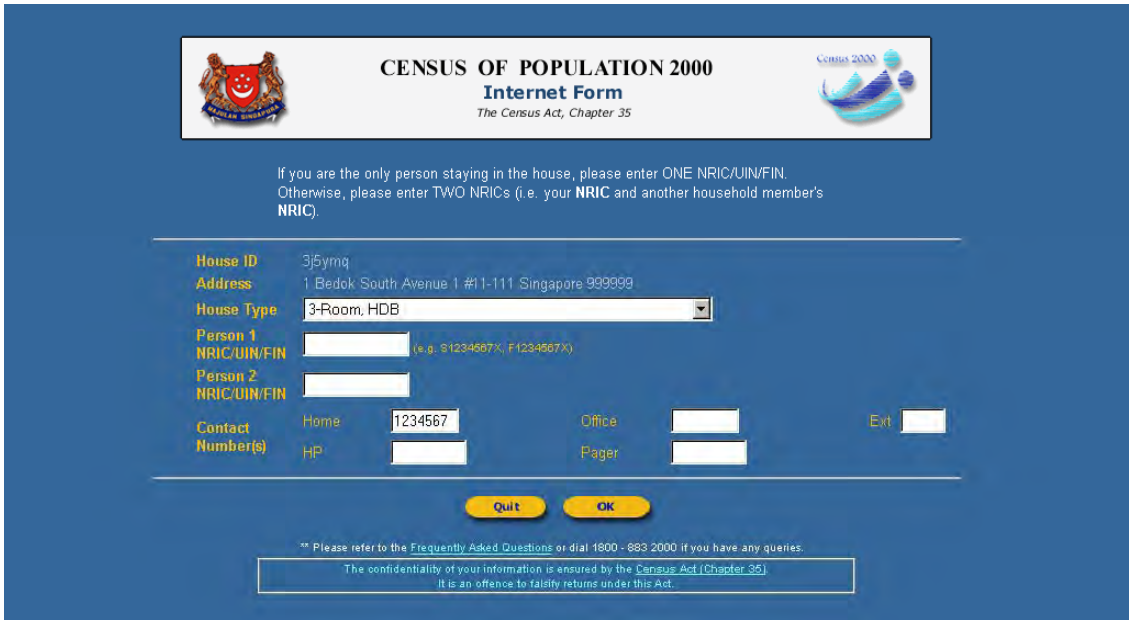
For Internet Data Collection, the system used was codenamed ESS. This system was a second generation Internet Data Collection System. Previously in 1998, the Singapore Department of Statistics had launched its first Internet data collection system codenamed Electronic Transmission of

Returns (ETR). The design of the ESS was therefore based on the lessons learnt from the ETR.

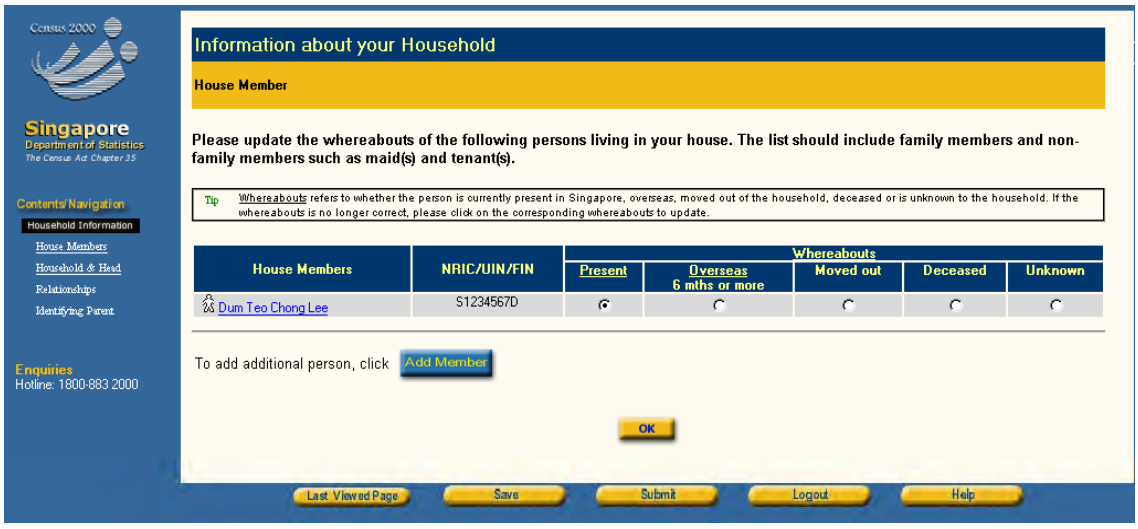
The ESS was developed mainly using Java. To use the system, users first logged in using a user ID and password. This user ID and password was sent to the users along with the notification letter.



After logging in, the identity of the respondent was confirmed using an advanced challenge and response model that utilized 128-bit encryption. If the log in was successful, the user would then move to the next screen where he would be asked to provide the Unique Identification Numbers (NRIC) of two members living in that house.



If the user was able to provide two valid NRIC numbers of the household members, a screen containing pre-filled information about the members would appear. Otherwise, the user would get a screen containing a blank form to fill in.



4.2.1 Lessons Learnt from Internet Deployment

From the Trial Run experience in December 1999, there were several critical lessons that could be gathered with regard to building and deploying an Internet application for a large number of respondents. These were:

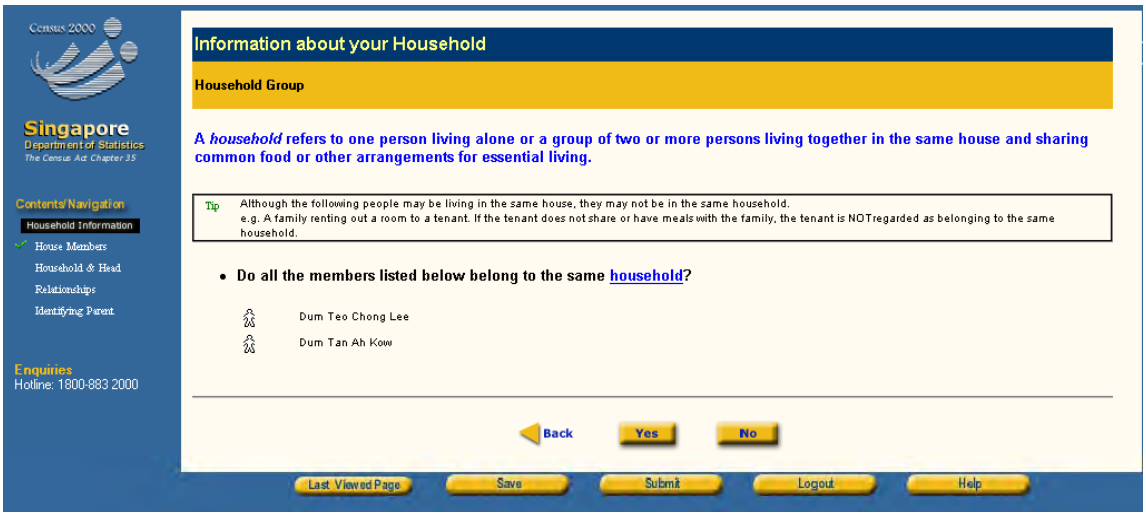
Speed

From feedback received, an overwhelming number of respondents wanted a system that was fast. In tests conducted during the Trial Run, most abandoned the use of the system if they had to wait some time before getting a response from the system. It was noted that respondents tended to judge the speed of the system based on the speed of the slowest page. Hence if there was a single page which took relatively long time to load, respondents psychologically judged the entire system as being slow.

To address this, the ESS was modified for the main Census use wherever possible. The question flow of the system was refined so as to spread out the loading time of the various pages. At the same time, fast loading message boxes were introduced to provide feedback to respondents that the system was processing their return.

User-friendliness

A common feedback received was that the system should be more user friendly. This is because while instructions were given on screen, many respondents appeared to mentally filter out these instructions. A good example of this can be seen in the screen below:



Although the instructions to define a household were given on screen, many respondents nevertheless called the Census Hotline number for the definition of a household. To reduce the occurrence of such calls, it was important to have a user-friendly system for the main Census that proved easy for most respondents to use.

Compatibility

Another important lesson from the Trial Run experience was that the system should be compatible across a large number of platforms. There was no control over the type of system that respondents would be using to complete their census returns. As it was prohibitively expensive to build a system that would work with all configurations, a critical decision was therefore made for the main Census to limit the scope to only Intel-based PCs using the Windows operating system. For browsers, only Internet Explorer and Netscape versions were supported. To assist users who had problems, a technical hotline was made available from 9.00am to 9.00pm daily, including Sundays and Public Holidays.

Security

The fourth major lesson learnt was that of security. The danger here of course was the possibility of an on-line attack by hackers to compromise or disable the system.

In handling such an issue, it was noted that the more security layers there are built in to protect the system, the slower the system would be. Hence for a system which is very secure, it might become too slow to encourage anyone from using it. On the other hand for a system which is very fast, the security might become too lax and be disabled easily. A balance therefore needed to be struck between these two conflicting objectives.

In designing the system security for the main Census, it was also acknowledged that it would not be possible to design an impenetrable system that could never be compromised. The additional step taken for Census 2000 was therefore to prepare an exhaustive contingency plan in the event that the system might be hacked. To implement this plan, officers at all levels were put on 24-hour standby so that they could react immediately to contain the damage. During the course of the Census, there were over 100 attempts by hackers to penetrate the security of the system. None of these were successful.

4.3 COMPUTER-ASSISTED TELEPHONE INTERVIEWING (CATI)

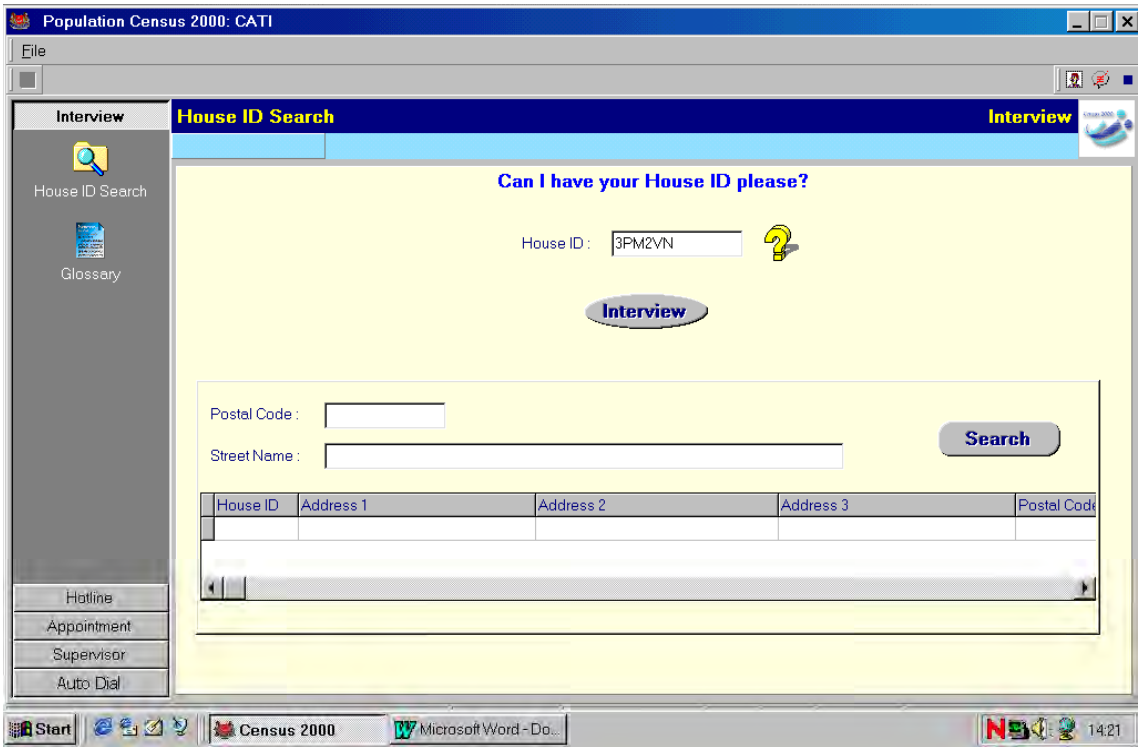
The CATI system used was also a second generation system type. The DOS first utilized CATI during the 1995 GHS. The design of the CATI system for Census 2000 was based on the lessons learnt in 1995.

Apart from the usual automatic branching of questions and on-line verification checks, there were two major improvements that were made for Census 2000 over 1995's GHS. The first was that a fully automated dialing system was introduced in Census 2000. This automated dialing system searched through and dialed numbers on a phone list based on a set of "priority" rules built into the system. When a respondent picked up the phone, the line was then automatically transferred to CATI interviewer who then interviewed the respondent. On the other hand if the number was busy or if there was no response, the system would search for the next available phone number. By using this system, the CATI for Census 2000 was able to screen through over 10,000 phone numbers each day in a "round-robin" manner using

an average of only 120 CATI interviewers. This was a significant improvement over the manual list-box dialing system of GHS 1995.

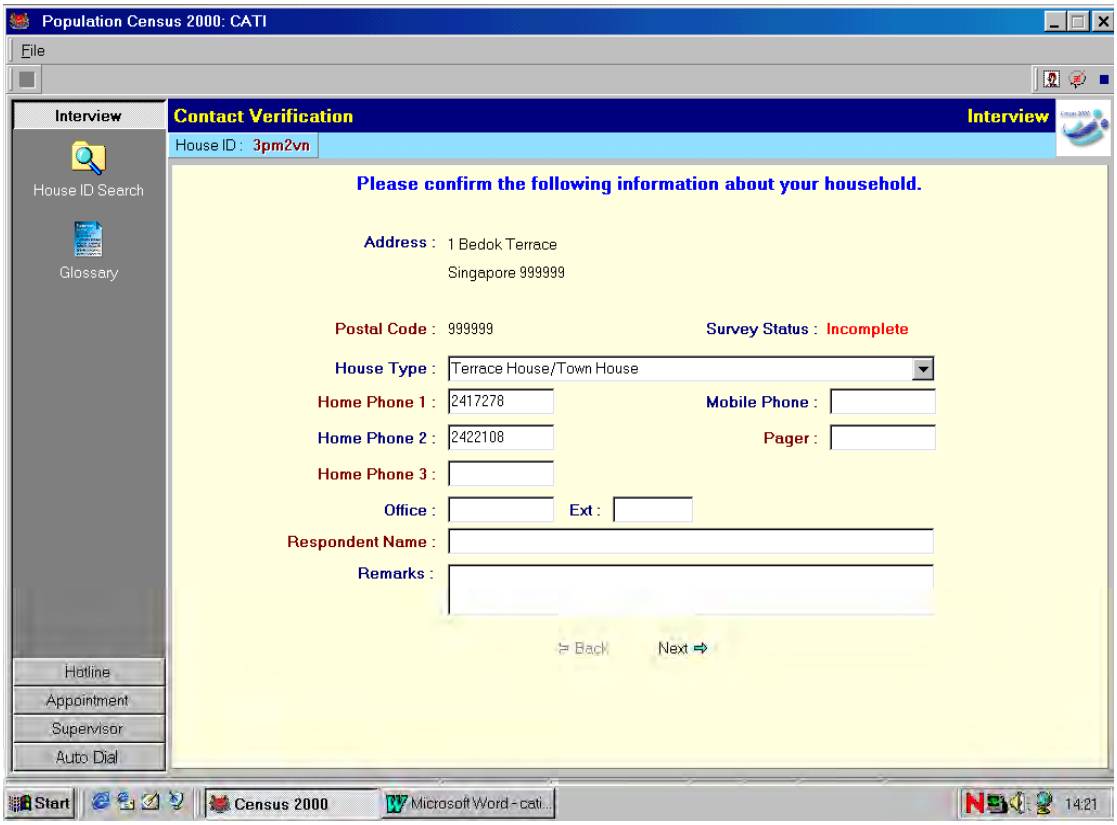
The second major improvement for Census 2000 was the call management system. This system allowed the CATI supervisors to do on-line monitoring of what the CATI interviewers were doing. When an interviewer encountered difficulties, the supervisor could then immediately assist. This call management system also allowed for the indexed recording of the various interviews.

The workflow system was designed such that it was similar to that of the ESS system. There were slight variations between an Inbound (respondents calling CATI) and an Outbound call. For an inbound call, it was necessary for the CATI interviewer to first determine the identity of the caller. The CATI interviewer therefore logged on to the following screen:



In the screen, the CATI interviewer would ask for the House ID number of the respondent. This House ID was sent to the household along with the Census notification letter. As it is common for respondents to misplace or lose this House ID, an alternative verification mechanism was therefore put in place to allow the CATI interviewer to verify the identity of the caller by the unique 6-digit postal code or even the address.

After the identity of the caller had been established, the system would then move on to the following screen.



The critical information on the house of the respondent was displayed on screen. The CATI interviewer read out the information listed on the screen to further confirm the identity of the respondent before starting actual enumeration.

In instances of an outbound call, the identity of the household would already be known since the call was made by the system. The system therefore skipped the first screen. The CATI interviewer would confirm the correctness of the listed information and proceed to conduct the interview.

4.3.1 Lessons Learnt

Like the ESS, there were several critical lessons that could be learnt from conducting Census using CATI:

Incorporating a "Remarks" field in CATI Screen

The remarks keyed in allowed officers doing coding and verification to understand the reason for certain seemingly anomalous responses. At the

same time, it also allowed for the capture of non-standard information that was useful for census officers following up on the cases. For example in instances where the household had special linguistic requirements, this was noted so that officers doing the follow up could make the necessary arrangements. It was found that the "Remarks" field was a very useful feature of the design.

Fast Downloading of Screens

Like ESS, the speed of screen downloading was also very important for CATI. This was because the CATI interviewer had to read off the screen to interview the respondent. Hence if the system response time was slow, respondents would get irritated and might refuse to co-operate further. To prevent this from happening, it was therefore important to stress test the system to ensure that the response time was adequate even during peak enumeration periods.

Knowledgeable and Confident Interviewers

The Trial Run in December 1999 brought out the fact that it was very important for the CATI interviewer to be knowledgeable and confident. If the interviewer was hesitant or unsure, respondents may then be not too keen to participate and would become difficult and refuse to co-operate. To prevent this from happening during the actual census, all CATI interviewers attended a rigorous training program which included workshops conducted by private sector consultants. Moreover, they were instructed to immediately pass very difficult cases to a supervisor or approach one of the senior DOS officers on site for assistance.

4.4 FIELDWORK OPERATIONS

As mentioned in Chapter 3.4, field operations were conducted from the 5 regional offices, each headed by an ASC with 5-6 field supervisors and about 50 enumerators. The ASCs and supervisors provided close supervision and guidance to the enumerators, as this phase of data collection was the most difficult. Besides spending much effort in persuading households to respond to census taking expeditiously, certain regions had their own characteristics which made fieldwork operations very challenging. For example, there was a large group of construction workers in the western region (Jurong) and a higher proportion of private condominiums and foreign households in the Central and East regions. They required special attention and different procedures from the mainstream households.

At Census Headquarters in Scotts Road, a Fieldwork Coordinating Team (FWCT) performed the crucial role in coordinating manpower and logistics requirements for the regional offices as well as detailed checking of census forms. A courier service operated 3 times a week to provide blank forms, supplies and stationery, and to collect completed forms from the regional offices. After the forms had been checked by the FWCT, they were forwarded to the EDMS team to scan and capture information entered in the completed forms.

4.4.1 Fieldwork Allocation and Big Households

Before the fieldwork operations began, the ASCs mapped out their respective regions for efficient workload allocation among the supervisors. At the same time, as part of their practical training, the supervisors themselves enumerated the extremely large households comprising 30 or more members prior to the start of the fieldwork operations. These households were taken out of the Census Enumeration Database for special handling because it would not be effective for them to go through Internet or CATI due to their large sizes. As it turned out, majority of these households were later found to use their addresses as registration print for a large number of foreign workers who resided elsewhere.

4.4.2 More Efficient Follow-up of Incomplete Cases

A computerised Fieldwork System (FWS) was developed to keep track of the movement of cases, enumerators' workload and status of the cases assigned to them. The workflow for typical fieldwork cases is as follows:

a) household records with partial information obtained via the Internet and CATI as well as those not enumerated yet were transferred to the FWS upon Internet/CATI cut-off date;

b) ASCs assigned enumerators to supervisors using the FWS. Supervisors would in turn allocate these household cases to enumerators;

c) for greater efficiency, available information was downloaded and printed onto the Household and Individual forms at the regional offices to facilitate interviews;

d) after obtaining the other missing information, interviewers/ supervisors would update the completion status onto the FWS when they returned to their regional offices. The forms were transported to Census Headquarters to be electronically scanned; and

e) at Census Headquarters, the FWCT liaised with the regional offices and the EDMS team to ensure high standard of fieldwork in terms of completeness and consistency of data.

Overall, field enumeration accounted for about 27% of the 218,000 households selected for Census 2000. Majority of these were households who had either no access to Internet or no telephones. Of those who finally completed their Census returns through fieldwork, about 44% had tried either Internet or CATI.

The register-based approach and the innovative tri-modal data collection system significantly reduced the total number of enumerators from about 2,200 and 3,500 enumerators in 1980 and 1990 respectively to about 400 enumerators in 2000. Fieldwork phase lasted about 4 months, and completed successfully on 31 August 2000.

DATA PROCESSING

Like the tri-modal data collection strategy which exploited the latest technology, the cutting-edge technology was also harnessed in data processing to reap productivity gains. Data processing could be divided into the following three main stages, namely, form scanning, data coding and data verification.

4.5 ELECTRONIC DOCUMENT MANAGEMENT SYSTEM (EDMS)

Data collected via Internet and CATI were captured in the Census database directly without the need for data entry. However, additional processing had to be undertaken for data obtained from fieldwork. The EDMS handled the completed census questionnaires obtained from fieldwork, including the scanning of survey forms, image sorting and verification.

Before the forms were processed by EDMS, the EDMS operators would perform pre-scanning check for completeness to ensure the forms would not be rejected subsequently by the system. Incomplete forms would be passed back to fieldworkers through the FWCT to complete. The completed forms were sent for scanning. The forms were scanned in batches, each comprising a number of household records. The forms, which were in A3 size, were scanned and captured as A4 size images.

The scanned images were then sorted by the system which assigned a template ID to each page based on the bar code or number string located at the bottom of the census forms. After the scanned images were sorted, the system would capture data items which could be read by Optical Mark Recognition (OMR), Optical Character Recognition (OCR) and Intelligent Character Recognition (ICR). These data items included sex, marital status, ethnic group and dwelling type. Verification of these data items was then carried out by EDMS operators. The system was able to perform basic data check and would, for instance, prompt the operators if an alphabet was keyed in a numeric field.

For data items where OMR/OCR/ICR cannot be applied, the EDMS operator performed data entry. Examples of such data items were highest qualification attained, major field of study and country of usual residence. However, for most of the questions, “drop-down” lists were provided for the operators to select. Upon selection, coding was done simultaneously as a code was attached to each descriptive field.

After data entry, the system would perform auto consolidation and indexing where the images of individual forms of each household were grouped and stored in the object server for archival purposes. The data items, on the other hand, were uploaded into the CMS where they were checked for completeness. Forms with too many missing data items would be returned to fieldworkers to complete while those with only a few missing items would be allowed to go through the system to the data verification stage where the editors would call up the respondents to provide the missing information. The workflow of EDMS is shown in Diagram 4.1.

Diagram 4.1 Electronic Document Management System Workflow

Stage 1
Operator checks completeness of the forms.

Stage 2
Operator creates a batch name and scan the forms.

Stage 3
System assigns template ID to each page (by referencing barcode or number string i.e. 2001/3001 etc).

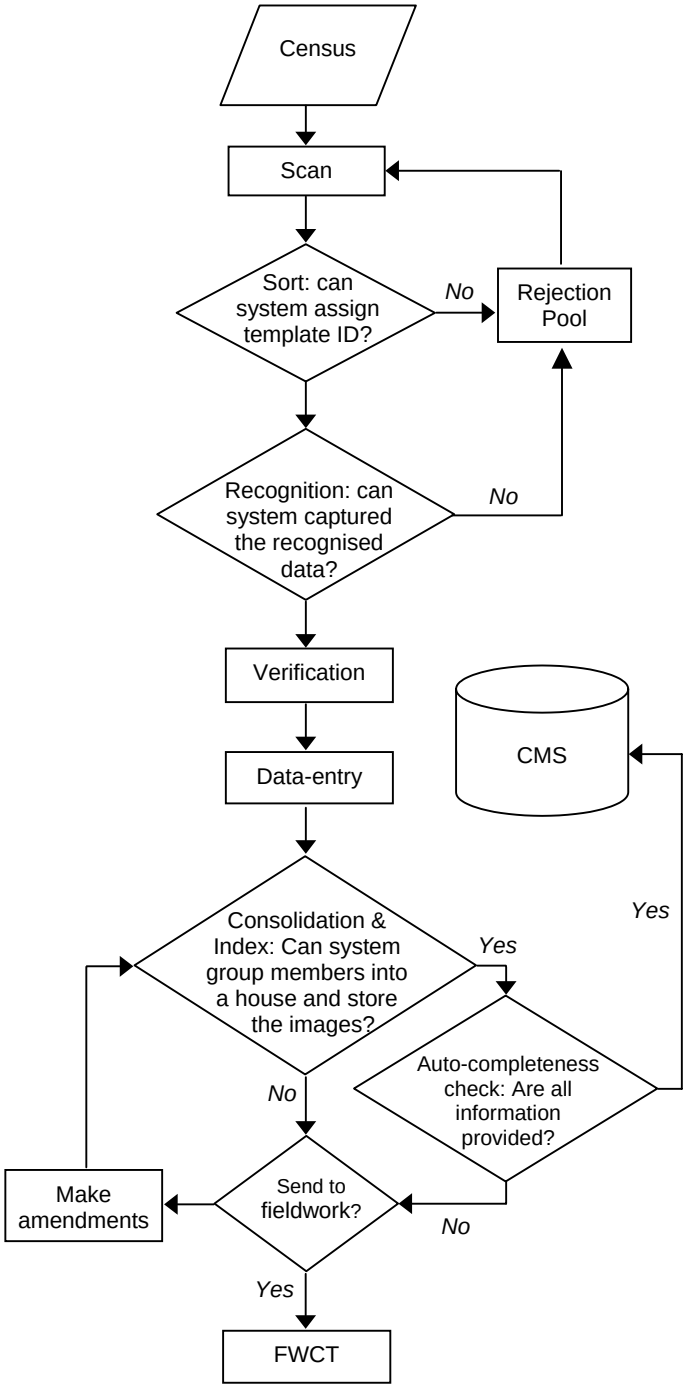
Stage 4
System matches template to each page and performs OMR, ICR and OCR recognition

Stage 5
Operator verifies if recognition performed at Stage 4 is correct.

Stage 6
Operator does data-entry for data not recognized by OMR, ICR and OCR.

Stage 7
System groups members for each house ID.

Stage 8
System checks for the completeness of data. Successful cases are routed to the Census Management System.



The combination of high-end scanning technology and superb recognition software in EDMS resulted in time and cost savings as fewer data fields needed to be manually entered by data entry personnel.

4.6 ADVANCED CODING ENVIRONMENT (ACE)

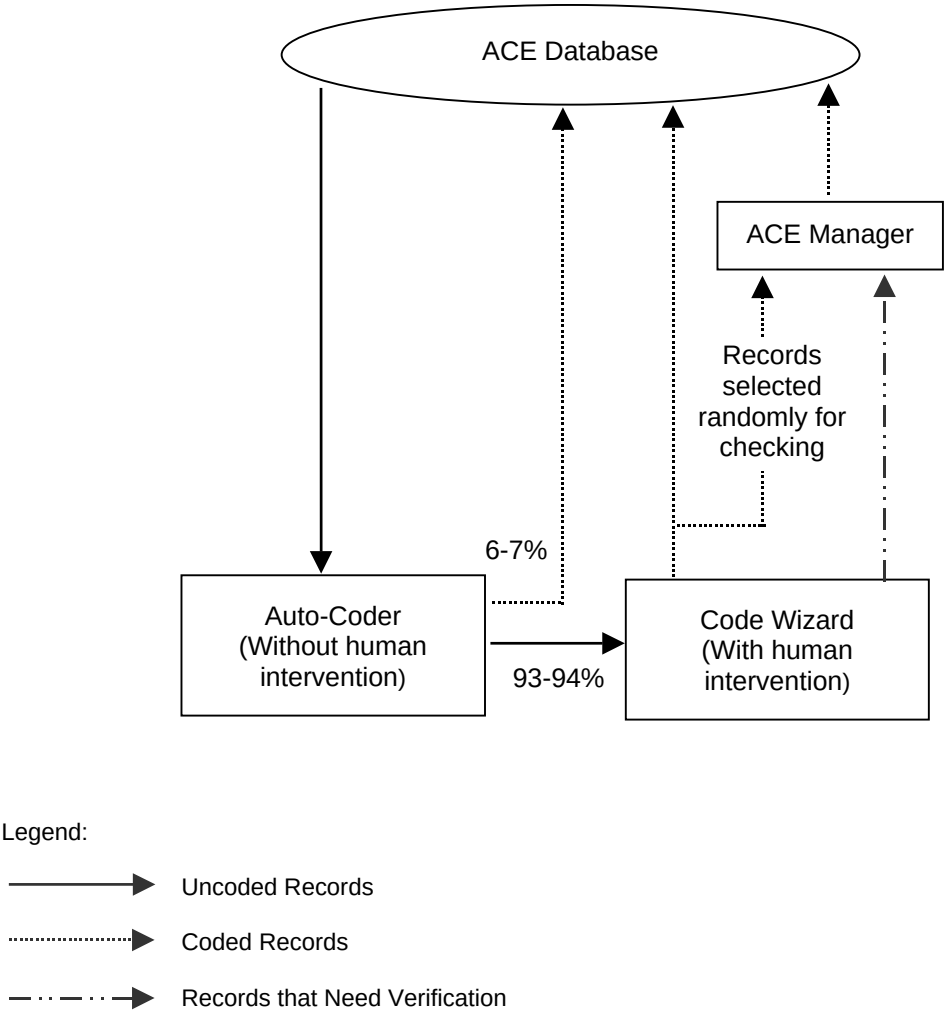
Once data were collected and captured in the Census database, records with working persons were routed to the Data Coding System (DCS) where the occupation and industry of working persons were coded. The coding of industry and occupation was based on SSIC and SSOC 2000 respectively. The application software called ACE was specially designed and developed to perform computer-assisted coding. ACE comprises two distinct modules, namely the auto-coder and the code wizard. The auto-coder performs a direct string match with a dictionary of codes. All records with distinct and non-ambiguous industrial description and occupational job titles were automatically coded in this way. During the census, about 6 – 7% of the industries and occupations were coded automatically.

For records which did not have a perfect match in the auto-coding phase, the DCS staff would perform computer-assisted coding. The module code wizard provided intelligent assistance to the coding staff in searching for the correct codes. Besides performing sophisticated string match, the coding wizard engine takes into account related fields such as business activities, products or services, highest educational qualification and job duties in determining the most likely codes for industry and occupation. The wizard then lists these codes out, in descending order of likelihood. The coders only needed to study the record and select the correct code. However, if a coder did not agree with the codes suggested by the wizard or if ACE did not make any code suggestion, the coder could go through the code dictionary in ACE to assign the most appropriate code.

In the coding of industries, the coders would usually refer to the company name, activity and products/services to help them ascertain the code. In instances when only the company name was furnished by the respondents but not the company's activity and products/services, the coders referred to the CEIS for assistance. The CEIS is a comprehensive database on establishments maintained by the DOS and contains key establishment information such as main activities and five-digit SSIC codes. For the coding of occupations, the job title and main tasks performed were useful guides although the coders could also refer to additional information such as the industry the person was working in, his highest qualification attained, field of study and income.

When a coder faced difficulty in coding a record, he could transfer such records through ACE to his supervisor who would then help him to code. Coding supervisors also checked the coded records regularly to ensure the quality of coding. The workflow of DCS is shown in Diagram 4.2.

Diagram 4.2 Data Coding System Workflow



The use of ACE to perform industry and occupation coding represents a significant change from the past when coders had to flip through hundreds of pages of the SSIC and SSOC dictionaries to search for the appropriate codes.

4.7 DATA VERIFICATION SYSTEM (DVS)

DVS was responsible for the final processing of respondents' information that had been coded. It acted as the final "goalkeeper" in which erroneous and inconsistent data could be detected, cleaned and edited prior to generating tabulations. After the data had been coded, the records would go through auto-correction, auto-detection, on-line verification and editing and duplicate checking.

A set of edit and compatibility check rules was built into the auto-correction and auto-detection functions to flag out erroneous and inconsistent records. The check rules, consolidated from past experiences of censuses and household surveys, comprised two types, namely, error checks and verification checks. Error checks usually pertain to missing key information which could not be left blank. Examples are missing name, sex, date of birth and missing field of study for tertiary graduates. Verification checks usually pertain to inconsistent scenarios which nevertheless could still exist. Examples are incompatibility of occupation with highest qualification attained, field of study and age; and incompatible spouse linkages. Records which failed the edit and compatibility check rules could be retrieved for the editing staff at DVS to edit and verify.

During the on-line verification and editing process, the editors would verify the inconsistencies and amend any errors found in the household or individual data that were highlighted on the computer screen. When the editors performed on-line editing and verification, they could access the SSIC and SSOC dictionaries as well as CEIS to help them amend the industrial and occupational codes, if necessary. They could also access images captured by the EDMS to resolve inconsistencies arising from poor handwriting of certain data items. To minimise inconveniencing the respondents, editors would enter remarks (e.g. appropriate time to call) in the relevant column so that respondents were not disturbed unnecessary.

At the end of data collection phase when all the records had been edited once, a duplicate check was conducted to retrieve individuals who had been enumerated twice. This could happen for instance when a person was enumerated in both the establishment Survey of Foreigners in Singapore (SFS) and the household. For such cases, the additional records were deleted to prevent double counting.

After all the data were edited and verified, a file was produced for the generation of the report tabulations. The workflow of DVS is shown in Diagram 4.3.

Diagram 4.3 Data Verification System Workflow

Data Archival Process (scheduled by the system on a daily basis) archives records for data verification purpose into the Data Verification Database (DVD).

All records are matched against a set of Auto Correction rules.

Data are subjected to a comprehensive in-built set of DVS rules.

Erroneous records undergo online verification where respondents are called up to verify the furnished data.

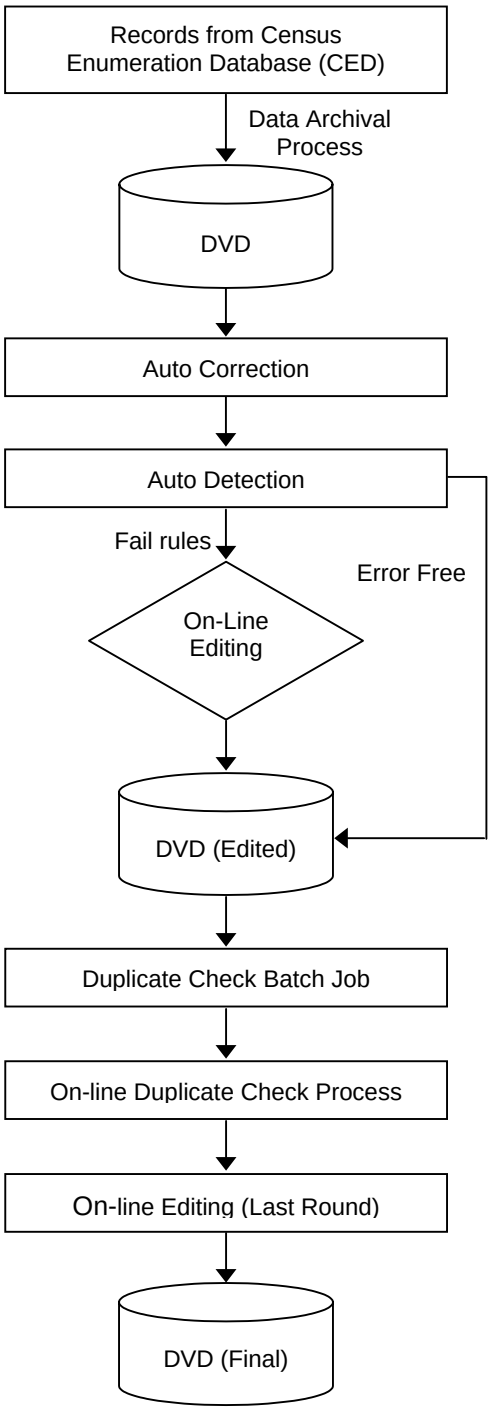
Error-free records flow straight to edited database.

Duplicates are sieved out during Duplicate Check.

Two types of duplicates:

- House Duplicates
- Member Duplicates

Any inconsistencies/discrepancies are verified during the last round of On-line Editing before the record is considered clean for tabulation purposes.



4.8 CENSUS MANAGEMENT SYSTEM (CMS)

For Census 2000, the key innovation and improvement over previous data collection exercises was the integration of different modes of data collection. Because of such integration, respondents were able to enjoy the convenience of seamless switching between different modes of data collection to complete their return. Based on the submitted returns, 15% of respondents completed their Census returns using multiple modes.

For integrated multi-modal data collection to work, it is essential to have a highly reliable system that is able to track the status of the different cases. Given the size and complexity of Census 2000, this was an extremely formidable task. The system that was developed to integrate the various modules was the CMS.

In developing the CMS, a key requirement was that the system had to be extremely robust. This is because the CMS formed the backbone of the entire Census 2000 IT system. If the CMS broke down, the entire Census operations would be paralyzed.

To achieve the necessary robustness, the CMS utilized massive redundancy techniques such as server clustering at the Enterprise level. Recognizing that it was possible for the systems to go down in spite of such redundancy protection measures, the CMS system also incorporated the latest rapid switch and repair technologies that were then available such as RAID and COLD SWAP. It should be noted what while such technologies are now commonplace, they were considered revolutionary when the specifications for them were first drawn up in 1998. Owing to such protection, the CMS achieved 100% uptime and the CMS did not have any downtime besides maintenance done during the authorized batch window.

Given the need for robustness, the CMS utilized a very simple and basic flag system to update and track the status of the various cases. Whenever the status of a case was changed, the corresponding system would automatically log on to the Enterprise Server to update the status of the case. This primitive flag design was chosen over more advanced technologies like Daemons or Intelligent Agents because of two reasons:

a) it was necessary to have a robust system so that the chance of a failure was very low. While the eventual system was not as sophisticated as that of the newer technologies and consumed

more resources, it was, nevertheless, more robust. In the trade-off between robustness and efficiency, robustness was deemed more important in this case given the critical function of the CMS; and

b) it was necessary for the Systems Integrator (SI) to integrate the various components that were built by different teams and in some cases, by different IT vendors. By adopting a simple flag design, it was easy to spell out the rules for the different development teams to follow. Subsequently, it was easy to integrate the different systems that had been developed.

Aside from integrating the different systems, one extremely useful by-product of the CMS was that it was able to provide timely, up-to-date management reports. By looking at the status of the various cases, it was possible to closely track the progress that was being made at the different stages. This allowed for early identification of problems such as bottlenecks that may form if data collection from a certain stage was proceeding too slowly. By identifying such problems early, the necessary adjustments in manpower and resources could then be made to resolve the problem promptly. As such, the instances of delays and resources being left idle were greatly reduced.

4.9 ENUMERATING FOREIGNERS THROUGH EMPLOYERS

The data collection phase of the SFS lasted for about 5 months from 29 March till 31 August 2000. This section elucidates the data processing procedures for the SFS which covered 6,400 enterprises with 88,000 non-maid WPHs.

Employers were given 3 weeks to furnish the required information and the survey progressed at a smooth pace. Majority of the firms responded by the due-date. Although most firms sent in their returns via mail, some smaller firms, especially those employing less than five WPHs, provided information via telephone interviews. Two reminders were sent to enterprises that did not meet the stipulated deadline. Extension was granted to a few of these enterprises as they needed more time to fill up the returns for a large number of workers.

4.9.1 Data Entry Screen

The data entry screen was designed using user-friendly Graphical User Interfaces (GUIs). Since the records of individual WPHs on the survey questionnaire were listed in the same order as they appeared on the PC screen, it was possible for the data entry staff to enter the information in a seamless manner. The individual company details could be retrieved in a matter of seconds by simply keying in the name of the enterprise or the Company Registration number (CR-number) that was pre-printed on the survey questionnaire. The features of the on-line data entry screen included the following:

a) retrieval of any company's record based on its Company Registration (CR) number or the name;

b) addition of new WPH records (for those newly employed by the company);

c) deletion of existing WPH records (for those who left the company);

d) quitting the session which would automatically save and update the changes; and

e) adding more records after all the returns for a particular enterprise had been completed.

The on-line data entry screen was also used when the staff conducted telephone interviews. As basic information relating to the foreign workers engaged in the enterprise would be listed on-line, the data entry clerks simply needed to confirm the company name, verify the basic details of the foreign workers and key in the additional information provided by the employer directly into the system.

4.9.2 Survey Response and Progress

A response rate of 98 per cent was achieved by August 2000, with responses from 6,230 enterprises employing some 89,000 non-maid WPHs. The remaining enterprises could not be covered because they have either ceased business operations or became/remained dormant.

Almost one-half of the completed returns (47%) were received by Census Office in April 2000. By May, nearly four-fifths of the companies (78%) had responded to the SFS. For the following three months, Census Office put

in much effort to conduct telephone interviews and sending reminders to obtain the survey returns for the remaining number of enterprises.

4.9.3 Data Processing

Data processing for SFS began about 2 weeks after the questionnaires were sent out so that sufficient number of records could be accumulated for data entry. The processing of the SFS data was carried out using the integrated IT system, comprising on-line validation of data, intelligent coding of occupation, on-line editing of records and high-end scanning of the survey returns for archival purposes.

Online Validation of Data

At the data entry stage, validation checks were built in to ensure high quality and consistency of data. However, these checks were kept relatively simple so that the speed and performance (i.e. response time) of the system would not be compromised. The on-line validation checks included the following:

a) record length of data items;

b) number of hours worked to be within an acceptable range;

c) monthly income which must not have a null value; and

d) individuals must be of working age.

The system prompted the editors with user-friendly features, including alerts, to rectify the records. Once done, these records were exported to the file server ready for the next stage of processing, i.e., coding of occupation.

Coding of Occupation

Occupation was coded according to the SSOC 2000. The ACE software was used. ACE was designed to improve coding accuracy and reduce labour-intensive operations.

The first stage involved automatic coding of records, i.e., matching of codes with description using the existing SSOC 2000 dictionary. Some 10 per cent of records were coded during the automatic coding phase. The second stage involved intelligent coding. ACE made use of artificial intelligence to read descriptive occupational titles and suggest the appropriate codes for selection

by the coders. This greatly enhanced the speed of coding and did away with the tedious manual method of looking up the 1,000-code reference text. Once coded, the records were exported back to the main server for consistency and verification checks.

Verification of Data Items Collected

To ensure high data quality, the verification rules for SFS were based on stringent validity and consistency checks using both logical and rational criteria between related pieces of information. Checks were performed on marital status, highest qualification attained, income and occupation with age. Compatibility checks between industry and occupation, occupation and sex, age and qualification as well as income and occupation were also carried out.

Records that did not pass the verification checks were subjected to another round of online editing by the staff who would call up the firm's contact person through telephone. The amended data were subjected to further rounds of edit and validity checks.

As mentioned in section 4.7, a few of the foreign workers could also have been covered during the main Census 2000 enumeration if they resided in dwelling units selected for the 20% sample. For such cases, duplicate checks were carried out. The database containing the edited records from the SFS was merged with the main Census database. From the merged database, the editing staff would study the sets of duplicated records and retain the desired set of information pertaining to these workers.

Scanning the Survey Returns

After the records had passed through the data verification stage, the survey questionnaires were sent for high-end scanning using the EDMS. An exact image of the survey returns was made so that a softcopy version of the information supplied by the enterprises could be retrieved when required.

4.10 FASTAB: TABULATION PACKAGE FOR SINGAPORE'S POPULATION CENSUS

DOS commissioned the use of a new software, FASTAB, as the tabulation package for the Population Census 2000 database. FASTAB, which stands for "**F**lexible **A**nd **S**wift **T**abulation", is a sophisticated tabulation software tool operating on a client-server, windows-based environment. FASTAB was

developed to address the needs for a fast, flexible, easy-to-use and windows-based cross tabulation software system.

4.10.1 Need for FASTAB

DOS as the national statistical agency, requires large amounts of statistical tables to be produced in a quick and timely manner to inform policy makers of the social, economic and demographic trends. As such, the FASTAB project was commissioned by DOS to address the needs of data users for a fast, flexible, windows-based cross tabulation package. Experiences of the 1990 Census showed that tabulations done with the mainframe-based Table Programming Language (TPL) required more time and much effort. TPL tables needed extensive programming and users were dependent on the expertise of IT specialists. The need for an end-user product became apparent.

4.10.2 Collaboration with Research Institute

DOS collaborated with Kent Ridge Digital Labs (KRDL), a publicly-funded R&D company to develop the FASTAB software. In 1998, a Memorandum of Understanding between DOS and KRDL was signed. FASTAB was jointly shared and invested by KRDL and MTI/DOS.

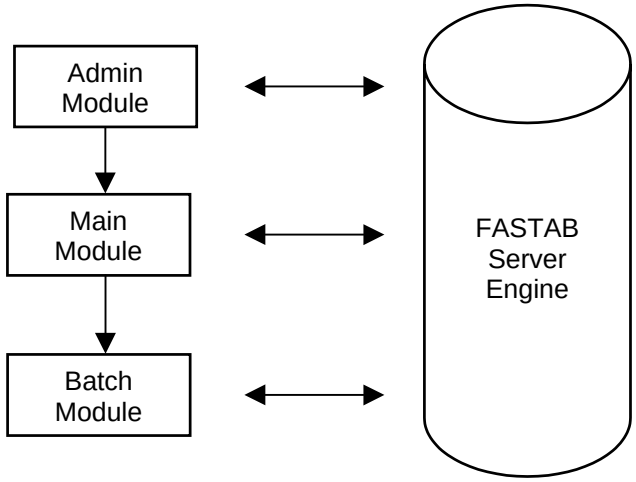
At the user end, DOS users provided the domain knowledge of statistical concepts, tabulation capabilities, user-interface and derivation rules for tabulation. KRDL provided the IT expertise and conducted extensive research into designing the software to suit the needs of users and improving software flexibility and performance.

The FASTAB software was developed and completed by mid-1999. Users tested the software with data from the Census 1990 and 1995 General Household Survey for speed, performance and functions of the software. The development of the FASTAB software was deemed completed and ready for use since 1999.

4.10.3 The FASTAB System

The FASTAB system comprises the Administrative Module, Main Module, Batch Module and the FASTAB Server Engine. Each module is designed to serve a primary function of the FASTAB system. Diagram 4.4 shows the configuration of the FASTAB system.

Diagram 4.4 Configuration of FASTAB System



Administrative Module

The Administrative module enables databases and datasets to be created and/or stored in the FASTAB system. It caters to the following functions:

a) Getting into the FASTAB system by registering with the database;
b) Registering past datasets or files into the database for tabulation;
c) Creating new datasets or files; and
d) Maintaining the datasets prevalent in the FASTAB system.

Household and individual records from the Census 1990, 1995 GHS and Census 2000 were registered and stored in the database. Past records from the Census 1990 and the 1995 GHS facilitated cross-sectional as well as time series analysis on social, economic and demographic trends.

Main Module

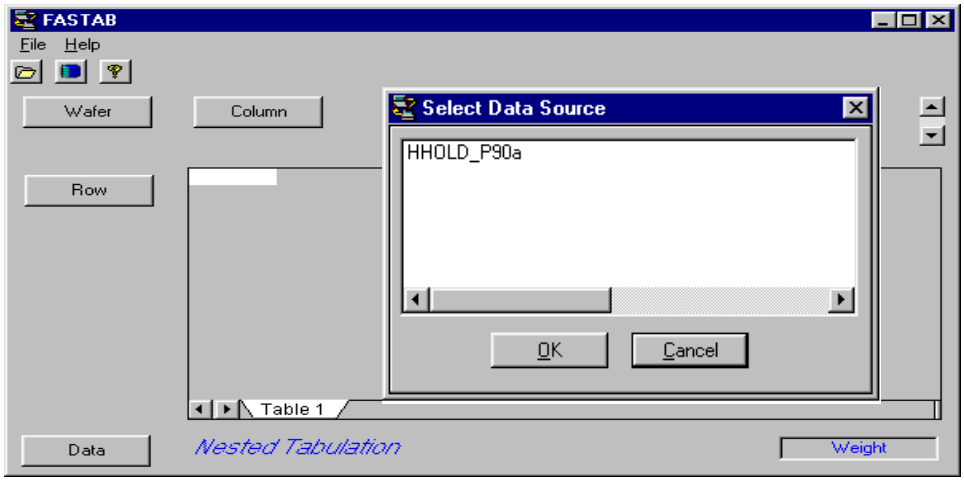
The Main Module is where the records are *tabulated* after the Census and GHS data have been stored in the system via the Admin module. In this module, users specify the parameters with the selected criteria and the data source. FASTAB then performs the required tabulation. An illustration of how a table can be generated in the FASTAB Main Module is given below:

3-STEP GUIDE TO CROSS TABULATIONS IN FASTAB : An Illustration of Marital Status and Sex by House Type on FASTAB's Main Module

This section illustrates how a cross tabulation of marital status by sex and house type can be performed. The objective is to cross tabulate the different categories of marital status (married, single, divorced, separated) and sex (total, male and female) by house type using Census 1990 data stored in the FASTAB Server Engine.

Step 1 Selecting the Database

Upon logging into FASTAB, the following FASTAB screen will appear.

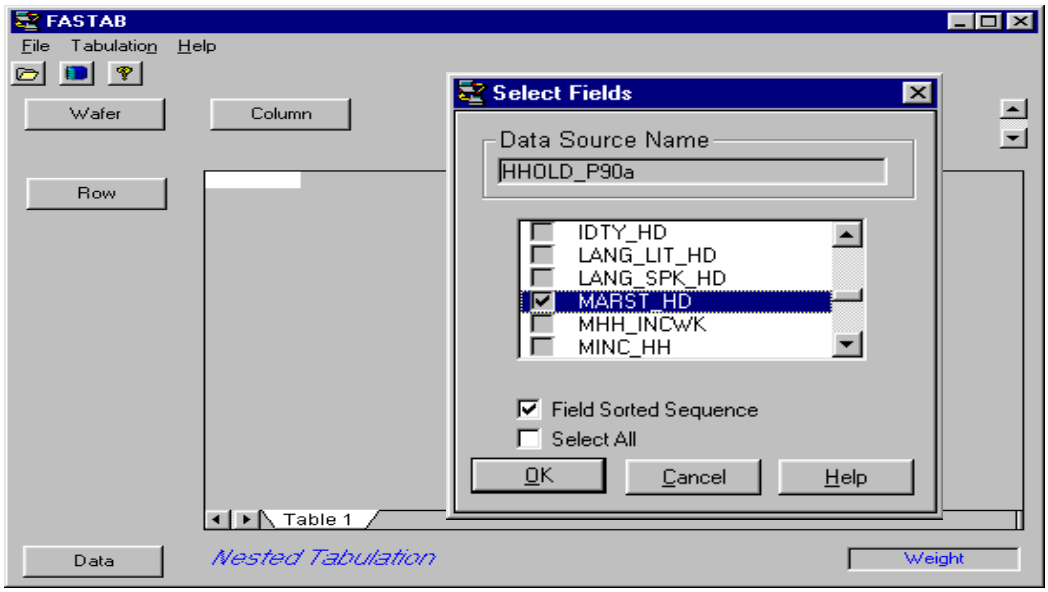


i. To open the data source, click on the second icon at the top left hand corner.
ii. To select the data source, click on the third icon and the "Select Data Source" screen showing the different databases will appear.
iii. Select the Population Census 1990 database as denoted by "HHOLD_P90a".
iv. Click "OK".

The Population Census 1990 database has been selected.

Step 2 Selecting Required Fields

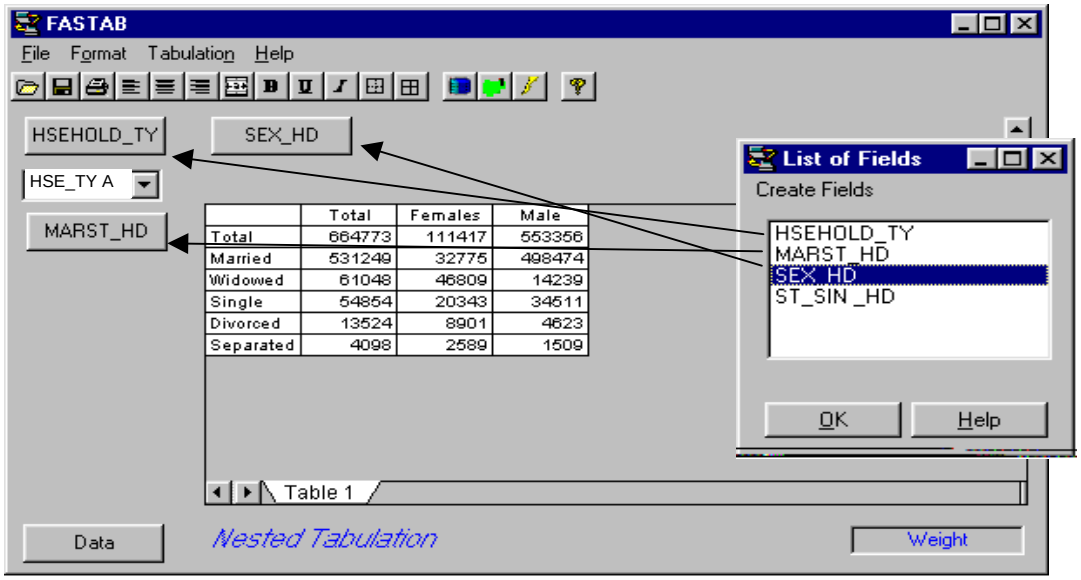
i. Go to the “Tabulation” pull-down menu and select “Fields Selection”.
ii. The “Select Fields” screen will appear as shown on screen.
iii. Click on the required fields:
   - Marital Status (denoted by MARST_HD as shown)
   - Sex
   - House Type
iv. Click “OK”.



The required fields have been selected.

Step 3 FASTAB Tabulations

In Step 2, once the required fields have been selected, the “List of Fields” screen will appear.



From the “List of Fields” screen, click and drag each field onto the “FASTAB” screen:

i. Drag the House Type field (denoted by “HSEHOLD_TY”) to the Wafer button.
ii. Drag the Marital Status field (denoted by “MARST_HD”) to the Row button.
iii. Drag the Sex field (denoted by “SEX_HD”) to the Column button.

The final tabulation shows the cross tabulations of marital status and sex by house type. This whole process takes less than 1 minute to complete.

The table can be exported to other Microsoft Applications for computation and analysis.

Batch Module

The Batch Module makes use of previously saved FASTAB interactive sessions with existing datasets stored as batch jobs for cross tabulations at a later date. The status of all the jobs submitted is constantly updated for the purpose of job monitoring. Users can also print the results directly upon completion of the job.

FASTAB Server Engine

The FASTAB server engine is the *main work engine*. It is an interactive work engine where everything stored, programmed and tabulated in the other modules is accessed by this server engine for data generation. This engine then feeds the required output back to the various modules to obtain the desired tabulations.

4.10.4 Features and Benefits

Technical Features

The FASTAB system operates on a Windows NT Server, with users interacting through GUI on a Windows 95 platform. Compared to TPL used for the 1990 Census, some of the features and benefits which make FASTAB a more desirable software include:

a) Performing Cross and Multiple Tabulations with relative ease

The distinct feature of FASTAB lies in its swift ability to perform cross and multiple tabulations. Cross tabulations include relating

2-variables, for example, displaying marital status by sex. Multiple tabulations cater to multiple levels of data being tabulated by the system, for example, showing the number of non-students by highest qualification attained, age and sex.

b) Generating High-Speed, High-Volume Tabulations

FASTAB can process millions of records in the minimum time possible. FASTAB is targeted to process 5 levels of tabulations for 3 million records at the maximum speed of 60 seconds. This is a marked improvement compared with TPL tables which took as much as 40 minutes to generate the 5-level tabulations.

(c) User-friendly Software

As FASTAB is a client-server application where the server handles the intensive computation, user interactions are done via the client. Users simply specify the parameters using the drag-and-drop capabilities with online tips. Users can also share datasets and create new data sets from existing data fields. Comparatively, TPL is not as user friendly as it requires extensive programming in a mainframe environment.

(d) Flexible Software

FASTAB is flexible as programs written in earlier sessions can be saved, modified and re-applied to new tabulations at the click of a mouse. It is possible to format spreadsheets before and after tabulation by moving and deleting columns and rows as well as grouping and renaming fields. In contrast, any table generated in TPL requires additional programming and users depend on the IT personnel to program and re-define the variables.

(e) Independent Usage of Data

FASTAB allows for independent generation of data to meet specific needs as tabulations are done at the user's end. There is no need to write specialised programs or code books and be dependent on the IT personnel, as in the case of TPL. This saves time and costs significantly.

(f) Able to Export to Microsoft Applications

Tables in FASTAB can be exported as MS Excel spreadsheet for further computing, or embedded as tables in MS Word and used in Powerpoint presentations.

Enhancements to FASTAB

In addition to the above capabilities, DOS and KRDL worked together to enhance the FASTAB prototype so that it could be better used for Census 2000. Some of the enhancements included the following:

a) printing tables to a "publishable" standard;

b) modifying existing tables without any re-specification of parameters;

c) giving users the option to display a code and/or code description;

d) performing additional statistical computations e.g. mean, median, percentage;

e) providing for a "drill-down" facility for users to zoom into unit-record (raw) data; and

f) creating an Open Database Connectivity (ODBC) module to the system so that FASTAB can read from any ODBC compliant data source.

4.11 Data Dissemination

The register-based Census coupled with the tri-modal data collection strategy using state-of-the-art technology for processing and tabulation, contributed to the timely release of the Census 2000 results.

4.11.1 Advance Data Releases (ADRs)

From the register-based Census, the Department published top-line data in end-August 2000 on the size, growth and demographic patterns of the Singapore population and household for Census Day, 30 June 2000. Following the completion of the data processing for the 20% sample in October 2000, the Department released a topical series of Advance Data Releases (ADRs) in stages. This series informed the public of the characteristics and changes in

the Singapore population and households. The ADRs by topic were released from Nov 2000 – Feb 2001, as follows:

Publication.	Topic	Release Date
Special Issue	A Quick Count	30 Aug 2000
ADR No. 1	Changing Education Profile	10 Nov 2000
ADR No. 2	Religion	17 Nov 2000
ADR No. 3	Literacy and Language	1 Dec 2000
ADR No. 4	Economic Characteristics of Singapore Resident Population	19 Dec 2000
ADR No. 5	Mode of Transport	19 Jan 2001
ADR No. 6	Households and Housing	31 Jan 2001
ADR No. 7	Household Income Growth and Distribution	9 Feb 2001
ADR No. 8	Marriage and Fertility	15 Feb 2001
ADR No. 9	A Decade of Progress	20 Feb 2001

The ADRs were disseminated over the Internet from the Department's web site at www.singstat.gov.sg, as well as in the form of hardcopy Information Papers distributed on a complimentary basis. Data users could have immediate on-line access to the Census data. By releasing these ADRs in stages, data users could receive information as soon as the data became available.

4.11.2 Statistical Releases

Whilst ADRs served to meet the immediate needs of data users, the Department also published a series of the Census 2000 Statistical Releases. These Releases aimed to meet the needs of users requiring more detailed data. These Releases provide key indicators, detailed tables, charts and descriptions of the Census 2000 concepts and definitions. Following the release of the ADRs, the Statistical Releases (SRs) were published over the period April-December 2001, as follows:

Publication	Topic	Release Date
	Advance Data Release (detailed version)	24 May 2001
SR No. 1	Demographic Characteristics	19 July 2001
SR No. 2	Education, Language and Religion	1 Oct 2001
SR No. 3	Economic Characteristics	29 Nov 2001
SR No. 4	Geographic Distribution and Travel	6 Dec 2001
SR No. 5	Households and Housing	13 Dec 2001

The Advance Data Release (detailed version) and the 5 Census Statistical Releases are available for sale to the public at all major bookstores in Singapore. These publications can also be purchased online at the Singstat DataShop.

With the new approach to Census taking and the use of cutting-edge technology to improve operational and processing efficiency, the Department achieved the target of timely release of Census data. The release of the top-line data within a short span of 2 months from the Census Day, 30 June 2000 marked a significant milestone in the Census data dissemination process. The timely and progressive release of Census data benefitted planners and policy makers in evaluating and planning programmes and services. They also enable the public to have a better understanding of the changes in the population demographics during the past decade. The Statistical Releases serve as a comprehensive source of reference materials for planners, researchers and data users requiring detailed data for in-depth topical studies.

CHAPTER 5

ORGANIZATION AND ADMINISTRATION

5.1 ACCOMMODATION FOR CENSUS OFFICE AND REGIONAL OFFICES

Looking for a suitable accommodation for the Census Headquarters was an important and necessary task once the planning of the Census of Population begins. The Census Headquarters would have to accommodate a large number of data processing staff and have adequate training facilities. The location of the Census Headquarters was also important as there would be a large number of temporary officers who needed to work on shift duties as well as on Sunday and public holidays. Sourcing for a suitable premise for Census Headquarters started in mid-1997. The following premises were being considered:

- Basement 3, The Treasury
- Nanyang Polytechnic old campus at Lower Delta Road
- Ayer Rajah Industrial Area
- 9th Storey, Environment Building

After careful evaluation and consideration, the 9th Storey of Environment Building was selected based on the following factors:

a) timing and period when the premises were available for occupation by Census Headquarters are adequate;

b) floor area was big enough to accommodate some 200 staff and to store the census forms;

c) the extent of renovation needed to cater to the electrical, air-conditioning and floor loading requirements of Census Headquarters for IT equipment and systems was moderate;

d) it was located near Mass Rapid Transit (MRT) station and bus stop. Easy access of public transport was important as Census staff worked in shifts;

e) security of the building was good;

f) distance from the Main Office, DOS, at The Treasury was acceptable for some staff who had to commute between the Census Headquarters and the main office to take care of their departmental responsibilities; and

g) cost of rental and renovation were reasonable and within budget provision.

Approval was given by the Commissioner of Lands on 3 Jun 1998 for DOS to use the 9th Storey of Environment Building as Census Headquarters. The Ministry of the Environment handed over the 9th Storey to DOS on 18 March 1999.

Renovation plans for the Census Headquarters spanning an area of some 1,400 m^2 were drawn up in consultation with Public Works Department EMS (PWD EMS) and Census IT contractor. The IT contractor was responsible for the laying of Local Area Network (LAN) cables and installation of servers, computer equipment and PCs. The rest of the general renovation and supply of some furniture items were undertaken by PWD EMS at an estimated cost of $230,000. To reduce cost, redundant furniture were used where available and suitable.

The first phase of renovation was ready at end May 1999. Under Phase I, the construction of the LAN room was completed early so that the IT contractor could proceed with the installation of servers, computer cables and some PCs necessary for the testing of Census system. Computer cables and equipment were installed in stages from June 1999. Renovation for the whole Census Headquarters was completed in early September 1999. The Census Headquarters had about 430 electrical points and more than 120 telephone points to cater for 150 coders and editors per shift.

For field operation, Census Office made arrangements with the People's Association to use Community Clubs as the ROs. The following Community Clubs were used during the census enumeration period, from February 2000 to mid-September 2000:

- Punggol Community Club as Northeast Regional Office
- Chengsan Community Club as North Regional Office
- Pasir Ris South Community Club as East Regional Office
- Hong Kah North Community Club as West Regional Office

The Census Headquarters also accommodated the Central RO during the Census proper. RO at Pasir Ris South Community Club was set up earlier in September 1999 for the conduct of the User Acceptance Testing and Trial Run. These strategically located ROs facilitated efficient field operations. The ROs were equipped with PCs, laser printers, photocopiers and telephones.

5.2 CENSUS BUDGET

The approved budget for the Census IT systems and operations were $13,574,000 and $10,300,000 respectively.

The actual expenditure on IT project was nearly $11.65 million, of which $8.81 million and $2.84 million were expenditure on computer systems and services respectively.

The functional areas and computer applications covered by the IT budget were Pre-Census Preparation, FWS, DVS, CMS, DCS, Network Infrastructure, Enterprise Server, EDMS, Resource Management System, Project Management and Support Services.

For the operating expenditure, most of the costs incurred were in the areas of Manpower, Transport, Utilities Charges, Renovation, Publicity and Printing.

5.3 EQUIPMENT AND SUPPLIES

Acquisition of office equipment and supplies began in early 1999. In addition to the standard office supplies, the following items were acquired for the Census operations:

a) 13 units of high speed laser printers – for voluminous printing especially the census enumeration forms for use by the field interviewers; and

b) 39 sets of handphones and 47 pagers – for senior census officials and fieldwork supervisory staff to facilitate ease of communication and supervision.

Dedicated delivery service was also engaged to transport enumeration forms, stationery and supplies to/from the Census Headquarters and the ROs.

While planning for the acquisition of computer equipment, e.g. PCs, consideration was given to its life span and deployment after the relative short span of Census operations. After weighing the pros and cons of the “purchasing” and “leasing” options, most of the IT items were acquired under "leasing" arrangement.

5.4 CENSUS STAFF

For the purpose of conducting the Census, the Census Superintendent and 4 Deputy Superintendents were appointed in mid-October 1999 to facilitate the planning and organisation of activities. In addition to these appointments, 4 Senior Assistant Superintendents and 8 Assistant Superintendents were appointed in March 2000 to take charge of the eight main areas, namely, pre-census preparation, data capture systems, data collection, data processing and verification, data analysis, publication and dissemination, publicity, finance and administration. Other categories of Census staff such as Supervisors, Coders/Editors and Field Interviewers were deployed/recruited to carry out the Census operations in phases from March 2000 to October 2000.

To ensure that the Census was conducted expeditiously, there was a need to mobilise qualified and dedicated staff in the government ministries and statutory boards for Census field operations and data processing. In February 2000, the Permanent Secretary (Trade and Industry) wrote to the heads of ministries, departments and statutory boards to encourage their officers to apply for the various Census appointments either on full-time or part-time basis and release them if they were selected. A recruitment circular was also issued by the Census Superintendent.

MOM and Housing & Development Board released 10 and 2 officers respectively to help in the Census operations. Another 140 public officers from various ministries, departments and statutory boards were released to work part-time.

Census Office wrote to various junior colleges, polytechnics and universities to encourage students to take up temporary employment during the Census operations period. A total of 6 recruitment advertisements were also published in the newspaper from December 1999 to June 2000.

Some staff were recruited early to provide support during the planning stage of Census 2000. For the actual census, an average of 200 and 300 staff were recruited for data processing and fieldwork respectively.

A summary of the Census Team is as follows :

Permanent Staff	Number
Superintendent	1
Deputy Superintendents	4
Senior Assistant Superintendents	4
Assistant Superintendents	8
Senior Supervisors	14
Supervisors	19

From Open Recruitment (refer to maximum number during Census period)	Total	Full-time	Part-time
Data Processing Staff	209	133	76
Fieldwork Staff	290	164	126

Furthermore, close to 20 staff were deployed to support the functions of Census Administration, Data Dissemination and Publication.

An average of 300 temporary staff was employed during the Census period. This was significantly less than 3,500 enumerators and 500 coders/editors hired for Census 1990. The register-based approach to Census 2000 and the tri-modal data collection of the 20 per cent sample households, had resulted in a much smaller number of staff for the entire operation.

Census Office operated in two shifts, i.e., from 8.30am to 5.00pm and from 1.15pm to 9.45pm. The shift hours ended at 5.00pm on Saturdays, Sundays and public holidays. Fieldwork staff were not constrained by the timing, as they were required to conduct the visits to households during the agreed time slots with households, mostly in the evenings or weekends.

During the peak period, i.e. May to June 2000, there were about 500 temporary staff working on various functions. Of these, about 300 worked full-time and 200 worked part-time. About 78 per cent of the temporary staff had secondary and upper secondary qualifications. The remaining 22 per cent had diploma, professional or university degree.

A Resource Management System was acquired to handle the recruitment, deployment and payroll for these staff under temporary employment. This computerised system lessened much administrative related tasks handled by the data collection and processing supervisors.

5.5 TRAINING

5.5.1 Training of CATI Staff

Training of CATI staff was conducted mainly on two topics. These were:

a) how to conduct a telephone interview; and

b) technical operations within the Call Centre

For the first component of the training, a “training the trainers” approach was adopted. Under this approach, senior staff from the Census Office conducted an intensive training session for the supervisory staff of the Call Centre. Manuals of instructions for the supervisory staff on the completion of household and individual schedules were prepared. The session covered the importance of the Census, key business aspects of running Census 2000 and the salient points behind each line of questioning. From this session, the supervisory staff of the Call Centre was able to train the CATI interviewers on how to handle the calls. A workshop on outbound surveys was conducted by a professional firm of consultants and attended by the Call Centre trainers as well as senior Census Office staff in mid-November 1999.

Training on technical operations within the Call Centre was done by the supervisory staff of the Centre. This training was conducted in a simulated environment that allowed the CATI interviewers to practise with the Call Centre Equipment.

It was easier to conduct the training on technical operations as the course could be structured and defined easily. Training on how to conduct telephone interviews was however considerably more difficult. Apart from asking the necessary questions from the Census forms, the CATI interviewers should react to unexpected and unforeseen responses by the respondent and tackle questions and queries in an intelligent manner. As part of the training, the CATI interviewers role-played a number of difficult scenarios given by the trainers. They were also paired for a brief period with the more experienced staff who would then provide on-the-job guidance and training on how to handle some of the more difficult situations.

5.5.2 Training of Field Staff

Training of the field staff comprised 3 parts, namely, training of the ASCs, the field supervisors and field interviewers.

Training on the fieldwork system to the ASCs started as early as September 1999, when the system developers first introduced the FWS to the users. The ASCs participated in the users' acceptance test and Trial Run 1999, and these provided them with the confidence needed to handle their duties. Regular meetings were held to strengthen the camaraderie among the ASCs and to imbue in them the broad responsibilities.

The Fieldwork ASC training manual summarised the main roles and responsibilities of the ASC. The main areas covered were:

a) coverage by fieldwork;

b) map preparation for every batch of enumeration cases;

c) allocation of cases to field supervisors;

d) carrying out field reconnaissance;

e) training of field supervisors, interviewers and administrative staff engaged in fieldwork operations;

f) requisition of manpower, stationery and other supplies;

g) using the Fieldwork System;

h) monitoring the progress of fieldwork operation through generated statistics and daily reports; and

i) supervision of fieldwork staff to ensure smooth running of operations.

For the field supervisors, training lasted six days to ensure that they were familiar with the Census concepts and the requirements of the operations. The first three days were spent on the classroom training, while the following two days were devoted to the systems training. The final day was spent on field training.

For the first two days of classroom training, emphasis was placed on the roles and responsibilities of the field supervisor. The field supervisor's training manual was used as the basis for this. Methods in approaching households, Census concepts and completing the items in the survey forms, administrative procedures pertaining to attendance marking, stationery and

collection as well as return of enumeration cases were taught. ASCs took on different sections of the training manual and went through them with the supervisors. The topics covered were:

a) pre-survey planning which included allocation of enumeration cases to interviewers by location of addresses and house type;

b) preparation of maps and transportation routes;

c) functions of the Fieldwork System that are accessible to supervisors;

d) supervision of the interviewers and monitoring the progress of fieldwork;

e) issuing survey forms and stationery to interviewers;

f) checking of completed forms, highlighting common mistakes made from experience of Trial Run;

g) attendance marking for the interviewers; and

h) reporting to the ASC on specific areas of tasks and duties completed.

For the next two days of training, mock-ups of households in different scenarios were distributed to supervisors. Based on these scenarios, supervisors completed the survey forms, playing the role of interviewers. This helped strengthen the supervisors' understanding of Census concepts as well as enabled them in turn to better guide their interviewers.

The supervisors had hands-on experience with the Fieldwork System for the next two days. The on-line system was important for them as printing of forms was done at respective regional offices. Supervisors were taught on:

a) accessing the Fieldwork System using an unique identification name and corresponding password;

b) using the system to assign and reassign enumeration cases to interviewers;

c) printing the survey forms for interviewers to work on;

d) updating the case status upon completion and checking of survey forms; and

e) handling of cases rejected by the EDMS.

The last day of training for the supervisors was held at the respective ROs, where they discussed the operational procedures with their ASC. The ASC for that RO briefed them on the boundary demarcation for each fieldwork batch. They were also briefed on the tentative schedule for each batch completion and the area maps prepared.

Subsequent to the comprehensive training and briefing sessions, the supervisors were assigned to tackle all households in the survey frame which were pre-identified to have 30 or more members. The 3-day exercise reinforced the training and enhanced their confidence, such that they were better equipped to handle their interviewers when the actual operations started.

For field interviewers, training was split into 2 sessions, one for full-time and the other for the part-time. Based on a standard set of instructions, the trainings were centralised at Census Headquarters in Scotts Road, for consistency.

Full-time interviewers attended a 2-day training. For the first day, they were taught the proper way to approach the households and to ask appropriate questions in order to complete the Household and Individual forms. Specifically, the training topics covered were:

a) preparation for enumeration and ways to approach households;

b) completing the items in Household Form; and

c) completing the items in Individual Form.

Much time was spent on the training to fill up the Census returns. For the Household Form, interviewers were taught to differentiate the house status (vacant, invalid address, demolished or away overseas). There was also explanation on the definition of household to prevent ambiguity and members' relationships to the head of household. Importance of the identification of parent-child and spouse linkages were further explained and the interviewers were given a practical session so that they could fully understand the concept.

For the Individual Form, interviewers were taught to confirm the pre-printed information with the household member and to obtain information for new members, if any. Emphasis was placed on obtaining information for the education and economic characteristic fields. Interviewers were trained to differentiate academic and non-academic qualifications and to obtain and fill the information in the relevant columns of the OMR/OCR form. They were also instructed to obtain occupational and industrial information of working persons

as detailed as possible for coding purposes. Examples were shown to meet the adequacy standard of economic characteristic description. Specific pointers were also given for other data items.

The second day of training was more interactive as the interviewers had to take a mini test. A hypothetical household with members of different economic and educational background was given as test question. Interviewers completed the survey forms and later compared with answers given. Doubts on the answers were raised and discussed. There was a question-and-answer session in which interviewers raised concerns on ways to handle respondents' queries. They were briefed on the dos and don'ts of carrying out the survey. Before they break off and go to their respective ROs, the interviewers were also briefed on the administrative procedures and other duties such as attendance marking, regular meetings with their supervisors and the procedures for requesting stationery and supplies.

The part-time interviewers underwent the same training over a period of three evenings.

5.5.3 Training of Data-Processing Staff

Much effort went into the planning and organization of the training to ensure that the data processing staff were adequately trained so that they could handle the tasks capably. They were trained according to the type of data processing system they were assigned to. The training duration for the various systems were as follows:

Data-Processing Staff Training Duration

System	Full-Timers	Part-Timers
Electronic Document Management System (EDMS)	2 days	4 evenings
Data Coding System (DCS)	2 days	3 evenings
Data Verification System (DVS)	3 days	5 evenings

Training was conducted during the day for full-timers and in the evenings for part-timers, this latter group being mostly serving government officers. The training for all data processing staff could be broadly divided into two parts. The first part usually covered the concepts and definitions of the Census which were of relevance to the system they would be dealing with,

while the second part usually required the staff to undergo some hands-on training to familiarize them with that system.

EDMS staff were first briefed on the data items that were collected and the guidelines in coding highest qualification attained, including major field of study and vocational qualification. They were subsequently given time to practice coding of these fields. Most of the data were obtained from Trial Run questionnaire. In the second part of their training, the trainees were taught the operations of the various modules of EDMS and given opportunities to practise scanning, data verification and data-entry.

For the DCS staff, the training largely focused on the principles and structure of the SSIC and SSOC. The trainees were given extensive practice on both industrial and occupational coding before being taught how to perform such coding using the ACE.

DVS staff was generally handpicked from the more experienced data processing staff, as verification was the final process of accepting a clean record. They were taught the functions of the DVS as well as the various error and verification checks for invalid and inconsistent data. As the DVS staff were also required to contact respondents sometimes to verify the furnished data, they were also taught the appropriate telephone and probing techniques to elicit the best responses. DVS staff also underwent the SSIC and SSOC training like their DCS counterparts. This was to facilitate their editing of industrial and occupational classifications whenever necessary.

For all the training sessions, manuals were prepared and given to trainees. These manuals not only formed the basis for lectures during the training sessions but were also used as reference materials when the trainees started their work. Data from the Trial Run were frequently utilized to provide examples for practical exercises as well as hands-on training in the various systems.

5.6 CENSUS PUBLICITY

The success of the Census depends not only on the efficiency of the operations but also on public acceptance and co-operation. To promote national awareness and to gain public co-operation for Census 2000, a strategic publicity campaign was mounted to publicise this important national undertaking.

5.6.1 Thrusts of Census 2000 Publicity

The thrusts of the Census 2000 publicity campaign were as follows:

a) Publicising the New Census 2000 Approach

Singapore was the first in the region to adopt a register-based approach for Census 2000 and tri-modal data collection strategy of Internet, CATI and fieldwork. The publicity programme therefore needed to explain the change in the approach and inform selected households on how to submit returns using new methods.

b) Seeking Public Acceptance and Cooperation

The success of the Census depended on the co-operation of the public. One of the main motivating factors for respondents to willingly provide information in a census was their awareness of the purpose of the Census. It was therefore essential that the public understood the importance of being counted and the impact of the Census data had on policy planning and evaluation.

c) Assuring Public of Data Confidentiality

As the selected households were obliged to provide their personal information, it was necessary to assure the public that submission of returns over the Internet and telephone was safe and protected.

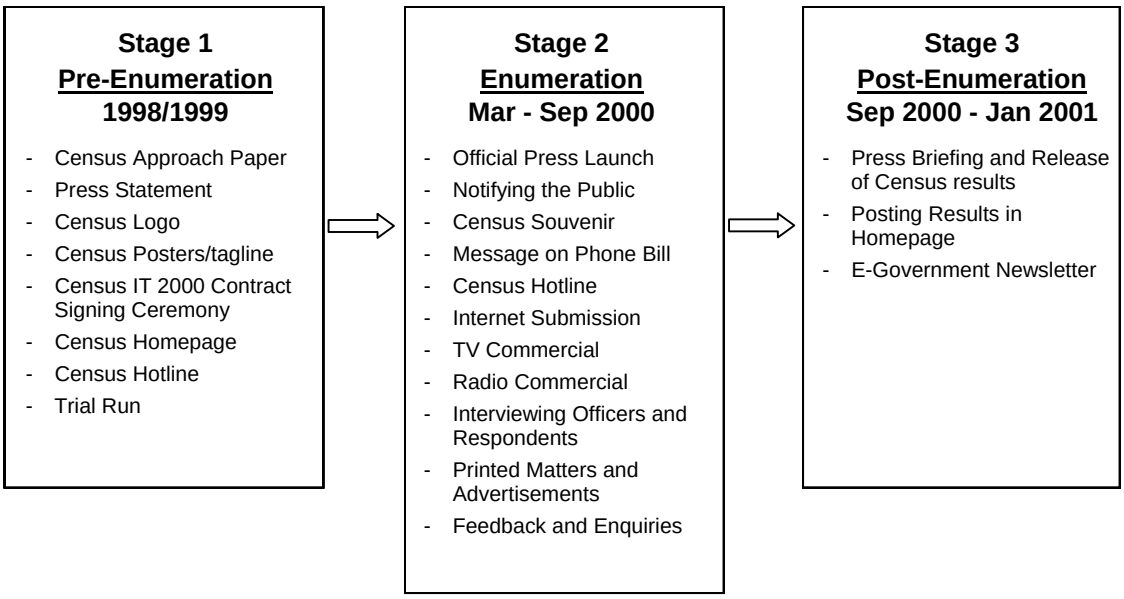
d) Informing Public of the Importance of Furnishing Accurate Information

The Census information would be used in the planning of policies and programme evaluation. As such, publicity awareness campaign had to emphasize this message to the public in order to solicit accurate information from them.

5.6.2 Strategy of Census 2000 Publicity

Census 2000 publicity was implemented over 3 strategic stages: Pre-enumeration, Enumeration and Post-enumeration. Varying tempo, intensity, content and activities (depicted below) were tailored for each stage of Census operations. Each stage of the publicity carried a different message and the publicity activities are indicated in Figure 5.1.

Figure 5.1 Stages of Census Publicity



5.6.3 Pre-Enumeration Stage

The pre-enumeration stage started with the planning in 1998 and ended with the completion of Trial Run in Feb 2000. During the pre-enumeration stage, publicity focused on acquainting the public with information pertaining to the purpose, scope and usefulness of the Census.

Census Logo Competition

The Census logo competition was launched in 1998 and was opened to design schools and the public. The competition was also mounted at the Department's homepage at www.singstat.gov.sg. Over 30 entries were received. Cash prizes of $1,000, $500 and $200 were given to the first, second and third winning entries respectively. The winning Census logo, symbolically expressed the following messages:

a) the three strokes revealed the historical linkage of Census 2000 with previous Censuses 1970, 1980 and 1990 after Singapore became independent in 1965;

b) surging upwards, the strokes captured Census 2000's innovative strategy of using technology and statistical methods intelligently;

c) the two circles reflected the Census as a national effort involving individual and household participation; and

d) the modern typeface and bright colours expressed the essence of Census as an important source of information about Singapore's most valued resource – its population.

The Census 2000 logo was used in the Census homepage, and all related Census materials, releases and publications. This competition gave the first indication to the public that a national Census would be conducted in year 2000.

Census Posters/Tagline

One poster each was designed for the Trial Run and Main Census. The designs of the 2 posters portrayed the following message:

a) For the Trial Run, the design portrayed IT as a collection mode for Census, which was in line with the objective of the Trial to test the integration mode of the various IT systems.

b) For the Main Census, the design conveyed to the public that sample enumeration was adopted for Census 2000.

Both posters carried with it the Census 2000 tagline:

"POPULATION CENSUS 2000: EVERY SINGAPOREAN COUNTS
Census 2000 collects key information on the population.
With good information, better decisions can be made."

emphasising the thrusts of the Census publicity campaign. To generate public awareness, these Census posters were displayed during the enumeration stage at strategic locations with high public traffic at MRT stations. They were also distributed to government departments, national libraries, schools and institutions for display. The Census poster designs are included in the Appendix H.

Census Approach Paper (Feb 1999)

To raise public awareness that a Population Census would be conducted in the year 2000, a press statement and paper on "Singapore's Approach to Population Census 2000" was released in Feb 1999 in the Statistics Singapore Newsletter (SSN). The paper introduced the new approach to Census taking and the integrated tri-modal data collection system.

Census IT 2000 Contract Signing Ceremony

In March 1999, the Population Census IT 2000 Contract Signing Ceremony was held with the Census IT vendor – NCS and with KRDL. The event signified the participation of private sector IT firms in developing IT system to support national projects.

Launch of Census Homepage

The Census homepage was launched on 31 March 1999 to take care of the following functions:

a) to provide information on Census 2000;

b) to serve as a feedback channel for the public;

c) to disseminate Census results; and

d) to promote wider use of Census data.

Census 2000: Trial Run (Dec 1999-Jan 2000)

The Census Office conducted a month-long Trial Run from 8 December 1999 till mid-January 2000. Notification letters were sent to the selected 10,000 households in early Dec 1999 to explain the purpose of conducting the Trial Run and how the public could submit their returns. The Census poster was also distributed to selected organisations. An article on "Census of Population 2000: Trial Run" was published in the January 2000 issue of SSN. The conduct of the Trial Run helped gauge public response to the new modes of enumeration. It also raised public awareness on the impending Main Census to be conducted in March-April 2000.

5.6.4 Enumeration Stage

Comprehensive publicity programmes were launched during the enumeration stage. It lasted for a period of six months from March to August 2000. Publicity during the enumeration stage focused on:

a) seeking public co-operation;

b) informing the public on the type of information sought and the method of completing the Census questionnaire;

c) assuring the public of data confidentiality; and

d) informing the public the importance of furnishing correct information and the benefits to the community.

Official Press Launch (March 2000)

To officially launch Singapore's Population Census 2000, a press briefing was held on 17 March 2000, chaired by the Chief Statistician, Dr. Paul Cheung. A press release was also issued to inform the public of the Census launch and its importance, the type of information sought, the three modes of data collection and how selected households could submit their returns. The news media gave extensive coverage to generate further public awareness on the start of the Census.

Notification to Households

Following the Press Briefing, the Census Office sent out notification letters to the first batch of households selected for Census 2000 enumeration on 23 March 2000. The selected households received the letter together with Census information pamphlet, Internet submission guide and a specially designed Census souvenir. The letter informed the households that they were selected and required to submit their returns via either Internet, telephone or face-to-face interviews. It provided the House ID, password and due date as well. The Census pamphlet outlined the purposes of the Population Census and the types of information sought. The Internet guidebook provided a step-by-step guide on how to submit returns via Internet. The Census souvenir had the Census Toll-free Hotline number (1800-883-2000) printed on it to enable telephone submissions as well as public enquiries. Such information materials were aimed at informing the public about the Census and helping them on the submission of Census returns.

Message on Telephone Bills

Arrangements were made with Singtel to imprint a census message on the telephone bills envelopes for three months from February to April. The message of the phone bill envelopes was:

SingTel is proud to be appointed the call centre for Population Census 2000 conducted by the Singapore Department of Statistics

e-Census Banner

Two Census banners were mounted on the Singapore Government Intranet website at www.intranet.gov.sg and the Singapore website at www.sg. These banners provided links to the Census Homepage and enabled the civil servants and public alike to be kept informed of the updates of Census 2000 activities.

Television/Radio Commercials and Phua Chu Kang sitcom

To disseminate the Census message to a larger audience, a 30-second television (TV) commercial in four languages was broadcasted over Television Corporation of Singapore (TCS) 5, TCS 8, Suria and Central. Different races and generations of people from all walks of life were depicted in the commercial bringing home the message that Census 2000 covers every one in Singapore. The tri-modal data collection strategy of Internet, telephone and face-to-face interviews was also illustrated in the commercial.

Census Office also produced two versions of radio commercial broadcast in four official languages over Class 95 FM, Capital Radio 95.8 FM, Warna 94.2 FM and Oli 96.8 FM. The message of the first version of the radio commercial, implemented at the early stages of data collection, highlighted the Internet enumeration mode to encourage households to submit their returns via the Internet. The second version of the radio commercial highlighted that only 20% of households would be selected and that the notification letter would be sent out in different batches during the period March-May 2000.

To seek full participation from the households, the TV and radio commercials were broadcasted throughout the entire phase of the Census data collection from March till August 2000. In addition, the Department made arrangements with the TCS to convey the Census message in the popular local sitcom, Phua Chu Kang which was aired in June 2000.

Interviewing Internet Respondents

The local media took the initiative to interview several Internet respondents. The experiences and feedback on submitting Census returns via the Internet were published in the newspapers. One of the respondents who filed online on behalf of her family of five, said, "The site is reasonably user-friendly. Its no-frills appearance makes the download time of each page much shorter."

Newspaper Advertisements and Printed Media

Printed media was also used to advertise the Census campaign with the aim to improve the response rate of Census submission. Newspaper advertisements were published in the Straits Times and Lianhe Zaobao in end-June 2000. The message was to seek households' co-operation in the Census, especially for those selected households with unlisted telephone numbers who had yet to submit returns. As mentioned earlier, Census posters were displayed in various public buildings and areas, such as government departments, statutory boards, MRT stations, schools, neighbourhood police posts, community clubs and lift lobbies in public housing areas under the management of Town Councils.

Feedback Mechanism

Throughout the entire Census operations, members of the public could provide their feedback via fax, mail, toll-free hotline or email (via Census Homepage). The toll-free Census hotline, available in 4 languages, was available 9.00am – 9.00pm daily for the public to call in and inquire about the Census. A technical helpdesk was also made available to assist households in troubleshooting their problems with Internet submission. Frequently-Asked Questions (FAQs) were mounted on the Census Internet Submission web site to provide information of common interests. In total, Census Office received nearly 1,000 responses and requests via fax, mail and email. These excluded those received via telephone. Majority of the requests were replied to within 3 days. A summary of the feedback is provided in section 5.6.6.

5.6.5 Post-Enumeration Stage

The aim of Census publicity during the post-enumeration stage was to keep the public informed of the Census results through release of preliminary data, articles and reports on the socio-economic profile of the population. Such post-enumeration publicity promoted wider use of census data.

Press Briefing on Release of Census Top-line Data

Top-line data on the population size, growth and demographic profile from Singapore's population register were released on 31 August 2000 at a press briefing. Prominent coverage was given in all the major newspapers. The TV and local radio stations also helped publicise Singapore's population of 4 million by various attributes. The top-line results were posted in Census homepage at www.census.gov.sg and Department of Statistics homepage at www.singstat.gov.sg.

e-Government Newsletter

Towards the tail-end of Census operations, an article on "Why haven't I been interviewed for Census 2000?" was published in the inaugural issue of the IDA e-Government's newsletter. Apart from mentioning that it was a sample enumeration of 20 per cent, the article highlighted the tangible and intangible benefits of the new register-based Census approach, feedback from respondents and IDA's involvement in the Population Census 2000.

Public Appreciation

The Population Census 2000 would not have been a success if it did not have the co-operation of the persons from and about whom the information was collected. At the press briefing and in the Forum page of the Straits Times, the Census Office thanked all households that had participated in the Census. The Census IT vendor, the National Computer Systems Pte Ltd, also sponsored lucky-draw gifts such as e-Pads with Duo-Pens, Personal Digital Assistants, handphones and measuring keychains to 2,400 households who submitted their returns via the Internet.

Release of Census Results

The final phase of publicity for the post-enumeration stage concentrated on publicising the release of the Population Census results collected from the 20% sample of households. The data were released by topics in stages, as and when the data were processed, tabulated and analysed.

5.6.6 Public Feedback

During the Census operations from late-March to Oct 2000, the Census Office received 938 responses and reactions on Population Census 2000 via email, fax, newspapers write-ups (i.e. forum page of newspapers) and walk-in requests. Majority of the feedback was received via email (56%), followed by fax (39%), walk-in requests and newspapers. The maximum number of feedback received within a week was 86. The feedback included the following:

Table 5.1 Public Feedback

Total	**938**
Internet Submission	**289**
Log In Problem	57
Slow Downloading	62
Pre-printed Information	26
Access Problems	16
Assistance on IT Matters	7
Other Problems	121
Request for CATI Interview	**125**
Operations	**245**
Vacant House/Change of Ownership	70
Request for Questionnaire	44
Submission from Singaporeans Overseas	32
Fieldwork Follow-up	17
Others	82
Submit Partial Information	**63**
Compliments	**17**
Complaints	**30**
Others	**169**
Data Requests	13
US Census Respondents	27
Comments	129

The feedback obtained proved to be useful. About one-third of the feedback was on Internet submission e.g. technical problems on logging-in and downloading of pages. Some of the useful suggestions received on the Internet were:

a) improving the response time of Internet submission;

b) simplifying the navigation through the system and improving the design e.g. to have four page buttons for easy navigation, i.e., first page, previous page, next page and last page; and

c) using bigger typeface/font that would be easier to read e.g. the password that was printed on the notification letter.

Other feedback received pertained to the purpose and participation in the Census, confidentiality of returns, job vacancy and complaints. In addition, there were over 200,000 calls received via Census Hotlines. Respondents called mainly to submit their returns via telephone, make general enquiries or request for assistance in submitting information over the Internet.

5.6.7 Budget for Publicity

The budget for Census publicity amounted to about $322,700. The breakdown of the expenditure items are as follows:

Census Posters and Display	$27,000
Notification Letters, Pamphlets and Internet Guide	$45,700
Census Souvenir to Households	$28,600
TV Commercial Production and Airtime	$154,600
Radio Commercial Production and Airtime	$29,300
Newspaper Advertisements	$20,400
Other Expenditure	$17,100
Total	**$322,700**

5.6.8 Concluding Remarks

Since the Population Census 2000 was conducted in a different approach from previous Censuses in that only 20% of the population was selected for enumeration, the publicity activities and target groups differed from previous Censuses. In terms of the extent of publicity, past Censuses had more programmes launched islandwide, aimed at securing the support of 100% of households covered. In Census 2000, publicity towards the entire population or households was to create public awareness (mainly during pre-enumeration stage) and in informing the public of the Census results (during post-enumeration stage). Publicity activities during the enumeration stage focused on the targeted group i.e. 20% households selected for enumeration.

This approach had proved to be effective in securing good response. In addition, unlike past Censuses, Census 2000 publicity made use of new communication channels to disseminate the Census message e.g. through the Census website, email and hotline feedback facilities.

The target-focus approach of the Census 2000 publicity and using a wider range of communication channels in transmitting the Census message and obtaining feedback greatly enhanced the response rate. With the active participation of the households, the Population Census 2000 was completed successfully on schedule.

CHAPTER 6

ASSESSMENT OF DATA QUALITY

6.1 OFFICIAL DATABASE AND SAMPLE POPULATION ESTIMATES : A COMPARISON

The HRD provided the total count and basic profile of the population for the register-based Census 2000. Out of a total of 54 data items collected for Census of Population 2000, 8 were obtained directly from the HRD. Extensive efforts were made well before the Census to ensure that the quality of records and data from the HRD were of a high standard.

With the adoption of a register-based Census, the basic population count was shifted to a de jure concept based on a person's usual place of residence. Only Singapore residents (citizens and permanent residents) with valid local addresses were included in the population count. This would include whole households or individual citizens or PRs who were temporarily out of the country. Foreigners with valid permits to stay or work here for at least one year were also included in the total population count.

The detailed socio-economic characteristics of the population were obtained from a large sample of 20 per cent of the population. The 46 data items that were not available from HRD were collected from the field. Updates were allowed to specific administrative data items during the enumeration phase of the Census upon verification checks.

To assess the quality of the sample data vis-à-vis database data, the basic characteristics from both sets of data (20 per cent sample was expanded to population size) and their discrepancies were compared in Table 6.1. The overall resident population by sex and citizenship status showed no differences as these variables were controlled to provide the expansion factors for the 20 per cent sample.

By ethnic group, the Chinese and Malay resident population estimates showed high agreement between HRD and sample estimates. The percentage difference in the estimates was less than 1 per cent. However, the Indians showed a difference of 11,500 or 5 per cent between HRD and sample estimates. This could be due to a lack of address updating by the Indian

Singapore PRs who shifted their residences. This led to a small percentage of under-coverage of Indians in the sample which could have contributed to the discrepancy.

For children aged 0-4 years old, the database figure was 11,500 lower than the sample estimate. As explained in Chapter 2, their addresses registered at the time of birth usually became outdated when their parents shifted residence. To enhance the accuracy of the population count and overcome this aberration in address reporting, updating exercises with the relevant databases have been carried out since 1998. It is expected that the data quality for this group of population will improve over time.

Table 6.1 HRD and Sample Estimates

	HRD (100%) (1)	Sample (Grossed-up) (2)	Difference (1) - (2)	
			Number	Per Cent
Resident Population	**3,263,209**	**3,263,209**	–	–
Females	1,632,916	1,632,916	–	–
Males	1,630,293	1,630,293	–	–
Citizens	2,973,091	2,973,091	–	–
Permanent Residents	290,118	290,118	–	–
Chinese	2,505,379	2,517,955	-12,576	-0.5
Malays	453,633	456,850	-3,217	-0.7
Indians	257,791	246,325	11,466	4.7
Others	46,406	42,078	4,328	10.3
0-4	213,278	224,799	-11,521	-5.1
5-9	252,082	257,762	-5,680	-2.2
10-14	235,438	237,468	-2,030	-0.9
15-19	211,320	214,396	-3,076	-1.4
20-24	212,609	212,061	548	0.3
25-29	267,582	265,885	1,697	0.6
30-34	290,880	286,987	3,893	1.4
35-39	323,064	316,415	6,649	2.1
40-44	313,048	309,170	3,878	1.3
45-49	262,626	260,129	2,497	1.0
50-54	207,082	207,161	-79	-0.0
55-59	125,471	126,220	-749	-0.6
60-64	111,103	111,397	-294	-0.3
65-69	89,182	88,326	856	1.0
70-74	68,001	64,973	3,028	4.7
75-79	40,053	39,663	390	1.0
80 & over	40,390	40,398	-8	-0.0

For the elderly aged 75 years and above, the data agreement between the HRD and sample enumeration was exceptionally high. This was the desired result of the pre-census Survey of the Elderly conducted from August 1998 to March 1999 to verify the addresses and whereabouts of the elderly. The survey was a successful and important one that was carried out as part of the series of data quality measures of the HRD. Details of the survey can be found in Chapter 2.

The overall high agreement between the HRD and the sample estimate augurs well for both systems. The large 20 per cent Census sample enumeration results confirmed that the HRD could stand up to scrutiny, and could deliver quality data. During the inter-censal years, small-scale surveys, regular quality checks and corrective measures for systematic errors would continue to be carried out to update and enhance the HRD.

6.2 Future Population Estimates : Database Approach

Prior to year 2000, Census population counts provided the basis for Singapore's inter-censal population estimates. For non-census years, annual Singapore resident estimates comprising citizens and those granted Singapore permanent residence were obtained by adding aggregate yearly figures of natural increase and net migration to the Census base population count. The total population count was obtained by adding the number of foreigners to that for Singapore residents.

From 2001, instead of deriving these population estimates by monitoring the individual components of population change, the HRD will provide these components and their changes after regular data merging with other official sources. This means the inter-censal estimates for Singapore residents (citizen and PRs) will be derived from the HRD. Data from administrative records on foreign population will be added to form the total population count.

This would be similar to the experiences of countries that have been using the register-based approach to the Population Census, such as the Netherlands, Denmark, Finland, Norway and Sweden. Their basic population counts during Census as well as inter-censal years are derived from national population registers. Comprehensive population and housing censuses are selectively undertaken to provide additional detailed information about the

population. These serve as valuable supplements to basic population statistics.

In Singapore, the use of the HRD also provides an avenue for a variety of administrative databases to be linked, thereby increasing the volume and diversity of data on the population. The inter-censal population statistics would be able to provide other basic profile of the population in addition to age, ethnic group and sex, which previously was not possible with the traditional approach. In time to come, with continued checks on the HRD and its improvement, more information on the population would be available.

Future population censuses in Singapore would be reduced in scale and size, thereby eliminating large shocks to the statistical system in terms of planning, logistics and manpower needs, and minimising respondent burden. The Singapore Department of Statistics envisages that the use of the HRD for future censuses coupled with smaller scale surveys for continuous population measurements would be the way ahead.

CONCEPTS AND DEFINITIONS

DEMOGRAPHIC AND SOCIAL CHARACTERISTICS

Country of Birth

Country of birth refers to the country in which the person was born as defined by current political boundaries.

Residential Status

Singapore citizens and permanent residents are classified as Singapore residents or the resident population. Singapore permanent residents refer to non-citizens who have been granted permanent residence in Singapore. The non-resident population refers to those who are non-citizens and non-permanent residents of Singapore, such as employment pass holders, work permit holders, student pass holders, dependent pass holders and long-term social visit pass holders.

Age

Age refers to the number of completed years between a person's date of birth and 30 June 2000.

Ethnic/Dialect Group

Ethnic group refers to a person's race. Those of mixed parentage are classified under the ethnic group of their fathers. The population is classified into the following four categories:

Chinese	This refers to persons of Chinese origin such as Hokkiens, Teochews, Cantonese, Hakkas, Hainanese, Hockchias, Foochows, Henghuas, Shanghainese, etc.
Malays	This refers to persons of Malay or Indonesian origin, such as Javanese, Boyanese, Bugis, etc.

Indians	This refers to persons of Indian, Pakistani, Bangladeshi or Sri Lankan origin such as Tamils, Malayalis, Punjabis, Bengalis, Singhalese, etc.
Other Ethnic Groups	This comprises all persons other than Chinese, Malays and Indians. They include Eurasians, Caucasians, Arabs, Japanese, etc.

Marital Status

Marital status refers to a person's conjugal status in relation to the marriage laws or customs in Singapore.

Single	This refers to persons who have never been married.
Married	This refers to persons who are legally married, married according to customary rites, or cohabiting with another person as man and wife.
Widowed	This refers to persons whose spouses are deceased and have not remarried.
Divorced/Separated	This refers to persons whose marriages have been legally dissolved, or persons who have been legally separated or estranged from their spouses and who have not remarried.

Ever-Married Females

Ever-married females refer to resident females who have been married before and are currently married, widowed, or divorced/separated.

Age at First Marriage

Age at first marriage refers to the age at which the resident ever-married female was first married.

Number of Children Born

Number of children born refers to all the live-born children each resident ever-married woman has given birth to. It includes those children who are currently staying with her, those who have set up their own homes and those who are no longer living.

Elderly Living Arrangement

Elderly persons aged 65 years and over are classified according to their co-residence with their spouse or children. Additional dimension on the economic status of the children is incorporated into the classification.

With Working Children	This refers to an elderly person living with his/her children in the same household, at least one of whom are working.
With Non-Working Children Only	This refers to an elderly person living with his/her children in the same household, all of whom are not working.

Elderly persons who are not living with their spouse or children are classified according to whether they are living alone or with other elderly persons. Elderly persons living alone refer to those in one-person households, with or without other occupants in the same dwelling unit.

Religion

Religion refers to the religious faith or spiritual belief of a person regardless of whether or not he regularly attends religious ceremonies in a temple, mosque, church or other religious building. He may or may not practise his faith or belief.

EDUCATION, LITERACY AND LANGUAGE

Level of Education Attending

Level of education attending refers to the grade or standard of formal education which a full-time student is attending. Students aged 5 years and over are classified into the following six main categories:

Pre-Primary	This refers to students attending kindergartens or pre-primary classes.
Primary	This refers to students attending Primary 1 to 6 and special classes for the educationally sub-normal.
Secondary	This refers to students attending Secondary 1 to 5 or courses of secondary level offered in the vocational,

	technical and commercial educational institutions, e.g. NTC Grade 3.
Upper Secondary	This refers to students attending Pre-university classes and junior colleges or other courses at upper secondary level, e.g. ITC, NTC Grades 1 and 2 and diploma courses in teacher training for those with GCE 'O' or 'A' level qualifications.
Polytechnic	This refers to students attending courses offered by the Polytechnics such as the Singapore, Ngee Ann, Temasek and Nanyang Polytechnics.
University	This refers to students attending degree or post-graduate courses in universities.

Highest Qualification Attained

Highest qualification attained refers to the highest grade or standard a person has passed or the highest level where a certificate, diploma or degree is awarded. Persons aged 15 years and over who are not attending educational institutions as full-time students are classified into the following main categories:

No Formal Qualification/Lower Primary	This refers to those who have never attended school, or have primary education but without Primary School Leaving Examination (PSLE) certificate or their equivalent, or have Certificate in Best 1-3.
Primary	This refers to those who have PSLE or other certificate of equivalent standard, or have Certificate in Best 4.
Lower Secondary	This refers to those who have secondary education without a GCE 'O'/'N' Level pass or equivalent, or have Certificate in Wise 1-3, or basic vocational certificates (incl. Basic vocational training).
Secondary	This refers to those who have at least 1 GCE 'N'/'O' Level pass, or Certificate of Competency, or Technical Certificate at NTC Grade 3 level or equivalent (e.g. Certificate of Vocational Training, BCA Builder Certificate), or other certificates/ qualifications of equivalent standard.

Upper Secondary	GENERAL – This refers to those who have at least 1 GCE 'A' Level pass, or have other certificates/ qualifications of equivalent standard. VOCATIONAL – This refers to those who have Certificate in Office Skills, or Certificate in Business Skills, or Technical Certificate at NTC Grade 2 level or equivalent (including Advanced Builder Certificate), or Technical Certificate at NTC Grade 1 level or equivalent, or Industrial Technician Certificate or equivalent (including Polytechnic certificates), or other advanced certificates (e.g. SIM certificates).
Polytechnic Diploma	This refers to those who have Polytechnic diploma, or Polytechnic advanced diploma (including Polytechnic advance / post / specialist / management/graduate diploma), or Polytechnic post-diploma certificate.
Other Diploma and Professional Qualification	This refers to those who have qualifications awarded by professional bodies, or National Institute of Education (NIE) Diploma, or other diploma qualifications (e.g. SIM diploma).
University	This refers to those who have Bachelor Degree, or Postgraduate Diploma (including NIE postgraduate diploma), or Masters, or Doctorate.

Field of Study

Field of study refers to the principal discipline, branch or subject matter of study that leads to the award of the highest qualification attained at polytechnic or university levels. The Singapore Standard Educational Classification 2000 is used to classify the subject matter of study.

Literacy (Language Literate In)

Literacy refers to a person's ability to read with understanding, e.g. a newspaper, in the language specified.

Language (Most Frequently Spoken at Home)

Language most frequently spoken at home refers to the language or dialect that a person uses most frequently at home when speaking to household members.

Predominant Household Language

Predominant household language refers to the language or dialect spoken by the majority of household members to other members.

ECONOMIC CHARACTERISTICS

Economic Status

The economic status of a person refers to whether a person was working during the seven days preceding the day he was enumerated. Persons aged 15 years and over are classified as either economically active or economically inactive.

Economically active persons refer to persons who were working and those who were actively looking for work if not working during the reference period.

Working	A working person is one who during the reference period, worked for pay or profit. It includes all those who had a job but were on leave during the Census, serving national service, as well as those who worked in a family business without fixed pay.
Unemployed	An unemployed person is one who was not working during the reference period but was actively looking for work or planning to start his own business. An unemployed person who had a job or business prior to the reference period is classified as "Unemployed – previously worked". A person who had never worked in any job or business prior to the reference period and was actively looking for his first job is classified as "Unemployed – never previously worked".

Economically inactive persons refer to persons who were not working and not looking for work during the reference period. They include housewives, students, pensioners, retired and disabled persons and persons with private means and are classified into the following categories :

Homemakers	This refers to persons who were engaged in household work without pay. Housewives are included in this category.
Students	This refers to persons who were attending educational institutions such as schools, colleges or universities on full-time basis.
Retired	This refers to persons who had withdrawn from the workforce or were too old to work.
Others	This refers to all other economically inactive persons such as disabled persons and persons with private means. Prisoners, patients of mental hospitals, inmates of homes for the aged as well as those who were awaiting call-up for national service are included in this category.

Occupation

Occupation of a working person refers to the kind of work he was doing during the reference period. The Singapore Standard Occupational Classification 2000, which is based on the International Standard Classification of Occupations 1988 (ISCO-88), is used to classify working persons by occupation.

Industry

Industry refers to the kind of economic activity or the nature of business of the firm, establishment or department in which the person was employed during the reference period. If the person was self-employed, industry refers to the kind of economic activity or nature of business he was operating. The Singapore Standard Industrial Classification 2000, which is based on the International Standard Industrial Classification 1990 (ISIC-90), is used to classify all working persons by industry.

Occupational Status

Occupational status refers to the status of working persons in relation to their employment. Working persons aged 15 years and over are classified into the four categories:

Employers	This refers to persons who operate either on their own or jointly with other partners a business, trade or profession and hire one or more employees.
Own Account Workers	This refers to persons who operate either on their own or jointly with other partners a business, trade or profession without any paid employee.
Employees	This refers to persons who work for individuals, firms or organisations, the government or statutory bodies and receive regular wages and salaries from them.
Unpaid Family Workers	This refers to persons who assist in the family business, trade or enterprise without receiving any fixed wage or salary.

Hours Worked

Hours worked refers to the number of hours the person worked during the week preceding the day he was enumerated. For those who were temporarily not working (e.g. on leave), the most recent week of employment is used.

Gross Monthly Income from Work

Income from work refers to income received by a working person from employment. It does not include other forms of income which are not derived from work.

For self-employed persons, gross monthly income refers to the average monthly profits from their business, trade or profession (total receipts less business expenses incurred).

For employees, gross monthly income refers to the total gross monthly wages or salaries including commissions, overtime pay, National Wages Council (NWC) supplements, tips, other allowances and one-twelfth of the annual bonus received or expected to receive. Payments in kind,

reimbursement for transport and other expenses are excluded. If they have just started work, the gross monthly income refers to the wages they would be receiving for a full-month's work plus one-twelfth of the expected annual bonus.

TRANSPORT AND GEOGRAPHIC DISTRIBUTION

Usual Mode of Transport to School or Work

Usual mode of transport to school or work refers to how a full-time student or a working person usually travels to school or work respectively. Persons who usually walk to school or work and persons who work at their place of residence are classified in the category "no transport required".

DGP Zones

DGP zones refer to zones demarcated in the Urban Redevelopment Authority (URA)'s Development Guide Plans. These are 55 planning areas for the physical development of Singapore according to their different regions and subsidiary areas. Each DGP zone covers a planning area with a population of around 150,000 served by a town centre.

HOUSEHOLD AND HOUSING CHARACTERISTICS

Household

A **private household** refers to a group of two or more persons living together in the same house and sharing common food or other arrangements for essential living. It also includes a person living alone or a person living with others but having his own food arrangements. Although persons may be living in the same house, they may not be members of the same household. A **resident private household** refers to a private household headed by a Singapore citizen or permanent resident.

Head of Household

The head of a private household is the person generally acknowledged as such by other members of the household. The head is normally the oldest member, the main income earner, the owner-occupier of the house or the person who manages the affairs of the household. Where the household comprises a group of unrelated persons, the head of household refers to the

person who manages the affairs of the household, or any responsible person who supplied the information pertaining to other members.

Household Size

Household size refers to the total number of members in the private household, including maids.

Number of Working Persons in Household

The number of working persons in the household includes members of the same household who are living and working in Singapore. Maids in the household are excluded.

Household Income from Work

Household income from work refers to the sum of income received by all members of the household from employment and business. However, it does not include the income of servants.

Household Structure

Household structure refers to the classification of a household according to the number of family nuclei and the number of generations in the household.

One Family Nucleus	This refers to a household formed by one of the following, regardless of the number of generations : (a) a married couple, with or without unmarried child(ren) and/or a parent/grandparent; (b) a family consisting of immediate related members, without presence of a married couple e.g. one parent only with unmarried child(ren).
Two Family Nuclei	This refers to a household with two family nuclei.
Three or More Family Nuclei	This refers to a household with three or more family nuclei.

No Family Nucleus	This refers to a household formed by a person living alone or living with others but which does not constitute any family nucleus. This is further classified into one-person household or household with more than one person.

Household Living Arrangement

Household living arrangement refers to the classification of a household according to the type of household, age and marital status of household head and age group of the youngest child of the head. There are two broad types of households :

Family-Based Households	This refers to households with at least one family nucleus.
Non-Family-Based Households	This refers to households with no family nucleus.

Within the family-based households, couple-based households refer to those with a married head. The couple-based households are classified under the following four categories :

Young Couples	This refers to households where the married head is below 35 years old.
Middle-Aged Couples	This refers to households where the married head is aged 35–49 years.
Mature Couples	This refers to households where the married head is aged 50–64 years.
Elderly Couples	This refers to households where the married head is aged 65 years and over.

Type of Dwelling

A dwelling refers to a building, part of a building, or a covered space used or intended to be used by one or more persons as living quarters. Each dwelling has its own separate entrance with direct access to a public road or pathway. A dwelling may be a residential building by itself, or a unit in a residential building, or part of a non-residential building such as a shop or factory with space used as living quarters.

Dwellings are classified into six categories : detached bungalows, semi-detached bungalows, terrace houses, HDB flats, other public flats, and condominiums and private flats.

Tenancy

Tenancy refers to the tenure status of the household with respect to the dwelling in which the household members live. Tenancy is classified into the following three categories :

Owner	This refers to a household where the head or any other member owns the house.
Tenant	This refers to a household which rents the dwelling or part of it.
Others	This refers to a household which occupies a dwelling provided without charge by employers, friends or relatives.

CONCEPTS AND DEFINITIONS

DEMOGRAPHIC AND SOCIAL CHARACTERISTICS

Country of Birth

Country of birth refers to the country in which the person was born as defined by current political boundaries.

Residential Status

Singapore citizens and permanent residents are classified as Singapore residents or the resident population. Singapore permanent residents refer to non-citizens who have been granted permanent residence in Singapore. The non-resident population refers to those who are non-citizens and non-permanent residents of Singapore, such as employment pass holders, work permit holders, student pass holders, dependent pass holders and long-term social visit pass holders.

Age

Age refers to the number of completed years between a person's date of birth and 30 June 2000.

Ethnic/Dialect Group

Ethnic group refers to a person's race. Those of mixed parentage are classified under the ethnic group of their fathers. The population is classified into the following four categories:

Chinese	This refers to persons of Chinese origin such as Hokkiens, Teochews, Cantonese, Hakkas, Hainanese, Hockchias, Foochows, Henghuas, Shanghainese, etc.
Malays	This refers to persons of Malay or Indonesian origin, such as Javanese, Boyanese, Bugis, etc.

Indians	This refers to persons of Indian, Pakistani, Bangladeshi or Sri Lankan origin such as Tamils, Malayalis, Punjabis, Bengalis, Singhalese, etc.
Other Ethnic Groups	This comprises all persons other than Chinese, Malays and Indians. They include Eurasians, Caucasians, Arabs, Japanese, etc.

Marital Status

Marital status refers to a person's conjugal status in relation to the marriage laws or customs in Singapore.

Single	This refers to persons who have never been married.
Married	This refers to persons who are legally married, married according to customary rites, or cohabiting with another person as man and wife.
Widowed	This refers to persons whose spouses are deceased and have not remarried.
Divorced/Separated	This refers to persons whose marriages have been legally dissolved, or persons who have been legally separated or estranged from their spouses and who have not remarried.

Ever-Married Females

Ever-married females refer to resident females who have been married before and are currently married, widowed, or divorced/separated.

Age at First Marriage

Age at first marriage refers to the age at which the resident ever-married female was first married.

Number of Children Born

Number of children born refers to all the live-born children each resident ever-married woman has given birth to. It includes those children who are currently staying with her, those who have set up their own homes and those who are no longer living.

Elderly Living Arrangement

Elderly persons aged 65 years and over are classified according to their co-residence with their spouse or children. Additional dimension on the economic status of the children is incorporated into the classification.

With Working Children	This refers to an elderly person living with his/her children in the same household, at least one of whom are working.
With Non-Working Children Only	This refers to an elderly person living with his/her children in the same household, all of whom are not working.

Elderly persons who are not living with their spouse or children are classified according to whether they are living alone or with other elderly persons. Elderly persons living alone refer to those in one-person households, with or without other occupants in the same dwelling unit.

Religion

Religion refers to the religious faith or spiritual belief of a person regardless of whether or not he regularly attends religious ceremonies in a temple, mosque, church or other religious building. He may or may not practise his faith or belief.

EDUCATION, LITERACY AND LANGUAGE

Level of Education Attending

Level of education attending refers to the grade or standard of formal education which a full-time student is attending. Students aged 5 years and over are classified into the following six main categories:

Pre-Primary	This refers to students attending kindergartens or pre-primary classes.
Primary	This refers to students attending Primary 1 to 6 and special classes for the educationally sub-normal.
Secondary	This refers to students attending Secondary 1 to 5 or courses of secondary level offered in the vocational,

	technical and commercial educational institutions, e.g. NTC Grade 3.
Upper Secondary	This refers to students attending Pre-university classes and junior colleges or other courses at upper secondary level, e.g. ITC, NTC Grades 1 and 2 and diploma courses in teacher training for those with GCE 'O' or 'A' level qualifications.
Polytechnic	This refers to students attending courses offered by the Polytechnics such as the Singapore, Ngee Ann, Temasek and Nanyang Polytechnics.
University	This refers to students attending degree or post-graduate courses in universities.

Highest Qualification Attained

Highest qualification attained refers to the highest grade or standard a person has passed or the highest level where a certificate, diploma or degree is awarded. Persons aged 15 years and over who are not attending educational institutions as full-time students are classified into the following main categories:

No Formal Qualification/Lower Primary	This refers to those who have never attended school, or have primary education but without Primary School Leaving Examination (PSLE) certificate or their equivalent, or have Certificate in Best 1-3.
Primary	This refers to those who have PSLE or other certificate of equivalent standard, or have Certificate in Best 4.
Lower Secondary	This refers to those who have secondary education without a GCE 'O'/'N' Level pass or equivalent, or have Certificate in Wise 1-3, or basic vocational certificates (incl. Basic vocational training).
Secondary	This refers to those who have at least 1 GCE 'N'/'O' Level pass, or Certificate of Competency, or Technical Certificate at NTC Grade 3 level or equivalent (e.g. Certificate of Vocational Training, BCA Builder Certificate), or other certificates/ qualifications of equivalent standard.

Upper Secondary	GENERAL – This refers to those who have at least 1 GCE 'A' Level pass, or have other certificates/ qualifications of equivalent standard. VOCATIONAL – This refers to those who have Certificate in Office Skills, or Certificate in Business Skills, or Technical Certificate at NTC Grade 2 level or equivalent (including Advanced Builder Certificate), or Technical Certificate at NTC Grade 1 level or equivalent, or Industrial Technician Certificate or equivalent (including Polytechnic certificates), or other advanced certificates (e.g. SIM certificates).
Polytechnic Diploma	This refers to those who have Polytechnic diploma, or Polytechnic advanced diploma (including Polytechnic advance / post / specialist / management/graduate diploma), or Polytechnic post-diploma certificate.
Other Diploma and Professional Qualification	This refers to those who have qualifications awarded by professional bodies, or National Institute of Education (NIE) Diploma, or other diploma qualifications (e.g. SIM diploma).
University	This refers to those who have Bachelor Degree, or Postgraduate Diploma (including NIE postgraduate diploma), or Masters, or Doctorate.

Field of Study

Field of study refers to the principal discipline, branch or subject matter of study that leads to the award of the highest qualification attained at polytechnic or university levels. The Singapore Standard Educational Classification 2000 is used to classify the subject matter of study.

Literacy (Language Literate In)

Literacy refers to a person's ability to read with understanding, e.g. a newspaper, in the language specified.

Language (Most Frequently Spoken at Home)

Language most frequently spoken at home refers to the language or dialect that a person uses most frequently at home when speaking to household members.

Predominant Household Language

Predominant household language refers to the language or dialect spoken by the majority of household members to other members.

ECONOMIC CHARACTERISTICS

Economic Status

The economic status of a person refers to whether a person was working during the seven days preceding the day he was enumerated. Persons aged 15 years and over are classified as either economically active or economically inactive.

Economically active persons refer to persons who were working and those who were actively looking for work if not working during the reference period.

Working	A working person is one who during the reference period, worked for pay or profit. It includes all those who had a job but were on leave during the Census, serving national service, as well as those who worked in a family business without fixed pay.
Unemployed	An unemployed person is one who was not working during the reference period but was actively looking for work or planning to start his own business. An unemployed person who had a job or business prior to the reference period is classified as "Unemployed – previously worked". A person who had never worked in any job or business prior to the reference period and was actively looking for his first job is classified as "Unemployed – never previously worked".

Economically inactive persons refer to persons who were not working and not looking for work during the reference period. They include housewives, students, pensioners, retired and disabled persons and persons with private means and are classified into the following categories :

Homemakers	This refers to persons who were engaged in household work without pay. Housewives are included in this category.
Students	This refers to persons who were attending educational institutions such as schools, colleges or universities on full-time basis.
Retired	This refers to persons who had withdrawn from the workforce or were too old to work.
Others	This refers to all other economically inactive persons such as disabled persons and persons with private means. Prisoners, patients of mental hospitals, inmates of homes for the aged as well as those who were awaiting call-up for national service are included in this category.

Occupation

Occupation of a working person refers to the kind of work he was doing during the reference period. The Singapore Standard Occupational Classification 2000, which is based on the International Standard Classification of Occupations 1988 (ISCO-88), is used to classify working persons by occupation.

Industry

Industry refers to the kind of economic activity or the nature of business of the firm, establishment or department in which the person was employed during the reference period. If the person was self-employed, industry refers to the kind of economic activity or nature of business he was operating. The Singapore Standard Industrial Classification 2000, which is based on the International Standard Industrial Classification 1990 (ISIC-90), is used to classify all working persons by industry.

Occupational Status

Occupational status refers to the status of working persons in relation to their employment. Working persons aged 15 years and over are classified into the four categories:

Employers	This refers to persons who operate either on their own or jointly with other partners a business, trade or profession and hire one or more employees.
Own Account Workers	This refers to persons who operate either on their own or jointly with other partners a business, trade or profession without any paid employee.
Employees	This refers to persons who work for individuals, firms or organisations, the government or statutory bodies and receive regular wages and salaries from them.
Unpaid Family Workers	This refers to persons who assist in the family business, trade or enterprise without receiving any fixed wage or salary.

Hours Worked

Hours worked refers to the number of hours the person worked during the week preceding the day he was enumerated. For those who were temporarily not working (e.g. on leave), the most recent week of employment is used.

Gross Monthly Income from Work

Income from work refers to income received by a working person from employment. It does not include other forms of income which are not derived from work.

For self-employed persons, gross monthly income refers to the average monthly profits from their business, trade or profession (total receipts less business expenses incurred).

For employees, gross monthly income refers to the total gross monthly wages or salaries including commissions, overtime pay, National Wages Council (NWC) supplements, tips, other allowances and one-twelfth of the annual bonus received or expected to receive. Payments in kind,

reimbursement for transport and other expenses are excluded. If they have just started work, the gross monthly income refers to the wages they would be receiving for a full-month's work plus one-twelfth of the expected annual bonus.

TRANSPORT AND GEOGRAPHIC DISTRIBUTION

Usual Mode of Transport to School or Work

Usual mode of transport to school or work refers to how a full-time student or a working person usually travels to school or work respectively. Persons who usually walk to school or work and persons who work at their place of residence are classified in the category "no transport required".

DGP Zones

DGP zones refer to zones demarcated in the Urban Redevelopment Authority (URA)'s Development Guide Plans. These are 55 planning areas for the physical development of Singapore according to their different regions and subsidiary areas. Each DGP zone covers a planning area with a population of around 150,000 served by a town centre.

HOUSEHOLD AND HOUSING CHARACTERISTICS

Household

A **private household** refers to a group of two or more persons living together in the same house and sharing common food or other arrangements for essential living. It also includes a person living alone or a person living with others but having his own food arrangements. Although persons may be living in the same house, they may not be members of the same household. A **resident private household** refers to a private household headed by a Singapore citizen or permanent resident.

Head of Household

The head of a private household is the person generally acknowledged as such by other members of the household. The head is normally the oldest member, the main income earner, the owner-occupier of the house or the person who manages the affairs of the household. Where the household comprises a group of unrelated persons, the head of household refers to the

person who manages the affairs of the household, or any responsible person who supplied the information pertaining to other members.

Household Size

Household size refers to the total number of members in the private household, including maids.

Number of Working Persons in Household

The number of working persons in the household includes members of the same household who are living and working in Singapore. Maids in the household are excluded.

Household Income from Work

Household income from work refers to the sum of income received by all members of the household from employment and business. However, it does not include the income of servants.

Household Structure

Household structure refers to the classification of a household according to the number of family nuclei and the number of generations in the household.

One Family Nucleus	This refers to a household formed by one of the following, regardless of the number of generations : (a) a married couple, with or without unmarried child(ren) and/or a parent/grandparent; (b) a family consisting of immediate related members, without presence of a married couple e.g. one parent only with unmarried child(ren).
Two Family Nuclei	This refers to a household with two family nuclei.
Three or More Family Nuclei	This refers to a household with three or more family nuclei.

No Family Nucleus	This refers to a household formed by a person living alone or living with others but which does not constitute any family nucleus. This is further classified into one-person household or household with more than one person.

Household Living Arrangement

Household living arrangement refers to the classification of a household according to the type of household, age and marital status of household head and age group of the youngest child of the head. There are two broad types of households :

Family-Based Households	This refers to households with at least one family nucleus.
Non-Family-Based Households	This refers to households with no family nucleus.

Within the family-based households, couple-based households refer to those with a married head. The couple-based households are classified under the following four categories :

Young Couples	This refers to households where the married head is below 35 years old.
Middle-Aged Couples	This refers to households where the married head is aged 35–49 years.
Mature Couples	This refers to households where the married head is aged 50–64 years.
Elderly Couples	This refers to households where the married head is aged 65 years and over.

Type of Dwelling

A dwelling refers to a building, part of a building, or a covered space used or intended to be used by one or more persons as living quarters. Each dwelling has its own separate entrance with direct access to a public road or pathway. A dwelling may be a residential building by itself, or a unit in a residential building, or part of a non-residential building such as a shop or factory with space used as living quarters.

Dwellings are classified into six categories : detached bungalows, semi-detached bungalows, terrace houses, HDB flats, other public flats, and condominiums and private flats.

Tenancy

Tenancy refers to the tenure status of the household with respect to the dwelling in which the household members live. Tenancy is classified into the following three categories :

Owner	This refers to a household where the head or any other member owns the house.
Tenant	This refers to a household which rents the dwelling or part of it.
Others	This refers to a household which occupies a dwelling provided without charge by employers, friends or relatives.

CENSUS COMMITTEES AND GROUPS

Census Planning Committee

Mr Khaw Boon Wan	Permanent Secretary, Ministry of Trade and Industry *(Chairman)*
Mr Lim Soo Ping	Deputy Secretary (Policy), Ministry of Community Development and Sports
Mrs Pek Siok Ching	Deputy Secretary (Manpower) Ministry of Manpower
Dr Paul Cheung	Chief Statistician Department of Statistics
Mrs Leow Bee Geok	Census Superintendent Director (Household & Population) Department of Statistics
Mr Tan Keng Hiang	Director (Corporate Development) Ministry of Communications and Information Technology
Dr Leong Choon Cheong	Director (Research & Statistics) Ministry of Home Affairs
Mr Koh Siong Ling	Director (Research & Planning) Ministry of Information and the Arts
Mr Loh Khum Yean	Director (Research & Planning) Ministry of Trade and Industry
Mr Ng Wai Choong	Director (Economics Division) Ministry of Trade and Industry
Mr Yeow Chin Wee	Director (Strategic Planning) Ministry of National Development
Mrs Tan Ching Yee	Director (Planning) Ministry of Education
Ms Phoon Lee Chaeng	Director (Planning) Ministry of Education
Mr Koh Eng Chuan	Senior Assistant Director (Census & Population) Department of Statistics *(Secretary)*

Census Technical Advisory Committee

Dr Paul Cheung	Chief Statistician *(Chairman)*
Assoc. Prof Ngiam Tee Liang	Department of Social Work and Psychology, NUS
Assoc. Prof Linda Low	Department of Business Policy, NUS
Assoc. Prof Chua Tin Chiu	Department of Statistics and Applied Probability, NUS
Dr Yap Mui Teng	Institute of Policy Studies
Dr Ooi Giok Leng	Institute of Policy Studies
Mrs Leow Bee Geok	Census Superintendent
Mr Kenneth Goh	Deputy Director (Census & Population)
Mr Koh Eng Chuan	Senior Assistant Director (Census & Population) *(Secretary)*
Mr Benny Chan	Assistant Director (Census & Population) (up to 20 Nov 1999)

Census Planning Group

Dr Paul Cheung	Chief Statistician *(Chairman)*
Mrs Leow Bee Geok	Census Superintendent
Dr Soon Teck Wong	Director (Economic Accounts)
Mrs Alice Goh	Director (Business Statistics)
Ms Sio Suat Kheng	Director (Statistical Co-ordination & Information)
Mr Kenneth Goh	Deputy Director (Census & Population)
Ms Yim Seow Hua	Deputy Director (Statistical Co-ordination & Information)
Mr Ang Chuan Huat	Manager (Corporate Services)
Mr Koh Eng Chuan	Senior Assistant Director (Census & Population) *(Secretary)*
Mrs Fiona Yip	Senior Assistant Director (Census & Population)
Mr Edward Lim	Senior Assistant Director (Census & Population)
Mr Benny Chan	Assistant Director (Census & Population) (up to 20 Nov 1999)
Miss Ang Seow Long	Assistant Director (Statistical Co-ordination & Information)
Mr Edmond Lee	Assistant Director (Statistical Co-ordination & Information)
Miss Wong Yng Yng	Statistician (Census & Population) (up to 6 May 2000)
Miss Marian Thng	Statistician (Census & Population) (up to 11 Mar 2000)
Miss Yeo Puay Kiang	Statistician (Statistical Co-ordination & Information) (up to 9 Oct 1999)

Census Planning Group on Sample Design and Selection

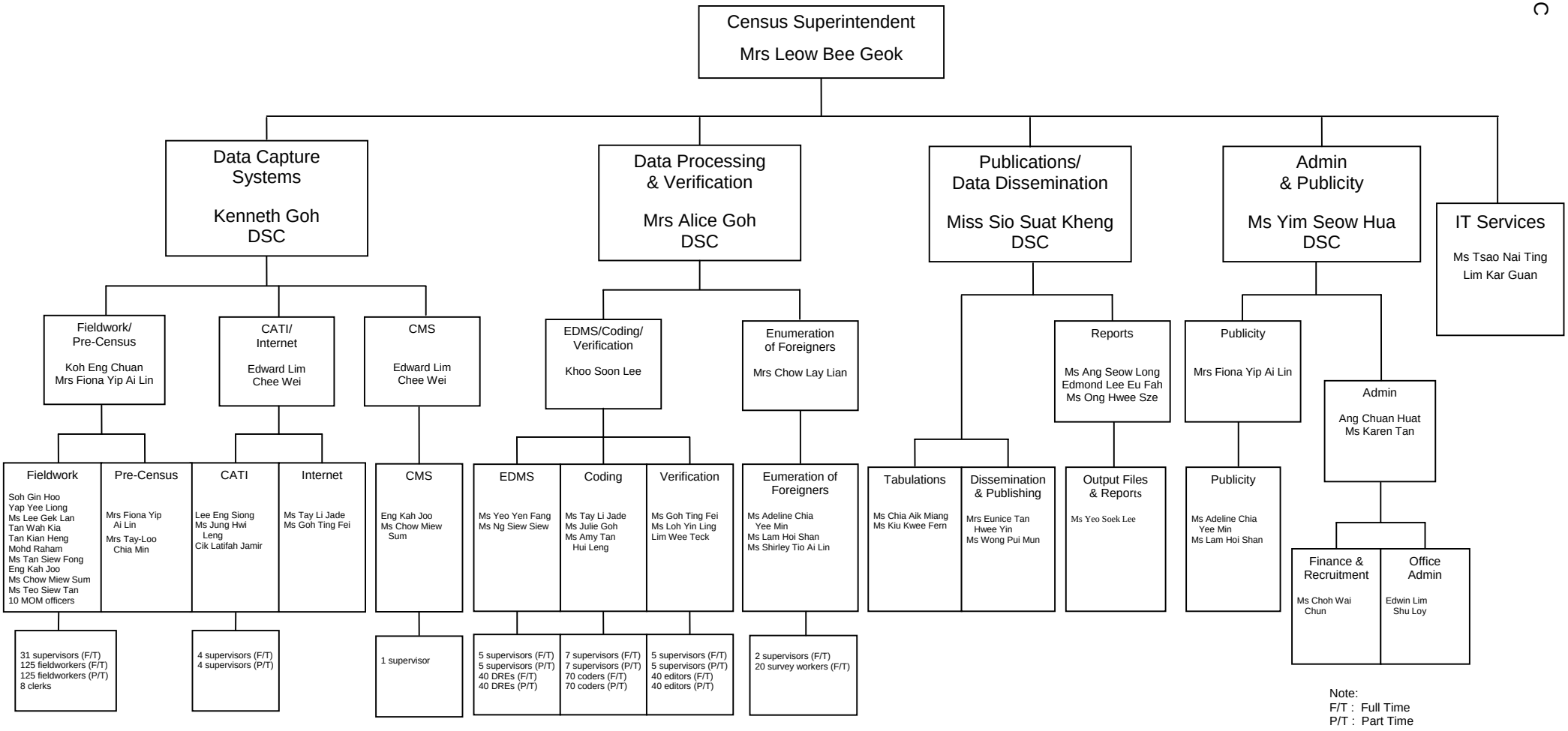
Main Census Sampling

Dr Soon Teck Wong	Director (Economic Accounts) *(Co-Chairman)*
Mrs Leow Bee Geok	Census Superintendent *(Co-Chairman)*
Assoc. Prof Chua Tin Chiu	Department of Statistics and Applied Probability, NUS
Mr Kenneth Goh	Deputy Director (Census & Population)
Mr Benny Chan	Assistant Director (Census & Population) (up to 20 Nov 1999)
Ms Wong Yng Yng	Statistician (Census & Population)
Mr Ng Wei Ping	Statistician (Economic Accounts) *(Secretary)* (up to 1 Feb 1999)
Mrs Tay-Loo Chia Min	Deputy Manager (Census & Population, Dwelling Database)

Census IT Resources and Support Group

Dr Paul Cheung	Chief Statistician *(Chairman)*
Mrs Leow Bee Geok	Census Superintendent
Mr Kenneth Goh	Deputy Director (Census & Population)
Mr Koh Eng Chuan	Senior Assistant Director (Census & Population) *(Secretary)*
Mrs Fiona Yip	Senior Assistant Director (Census & Population)
Mr Edward Lim	Senior Assistant Director (Census & Population)
Mr Benny Chan	Assistant Director (Census & Population) (up to 20 Nov 1999)
Mrs Tang-Kwong Yuk Wah	Director (Dept of Computer Information Services) (up to 29 Feb 2000)
Ms Tsao Nai Ting	Application Services Manager (IT Management) (w.e.f. 1 Mar 2000)
Ms Samantha Low	Assistant Director (Dept of Computer Information Services) (up to 11 May 1999)
Ms Ng Shok Been	Assistant Director (Dept of Computer Information Services) (up to 10 Sep 2000)
Ms Tang Lai Fun	Senior Project Manager (up to 25 Jan 2001)
Ms Gail Ngiam	Project Manager (up to 24 Apr 1999)
Mr Ee Kiam Keong	Project Manager (up to 2 Feb 2001)
Mr Christopher Low	Project Manager (up to 31 Aug 2000)
Ms Khoo Seok Teng	Project Manager (up to 13 May 1999)

CENSUS 2000 ORGANISATION CHART



Note:
F/T : Full Time
P/T : Part Time

LIST OF CENSUS OFFICERS

DEPARTMENT OF STATISTICS

Superintendent of Census

Mrs Leow Bee Geok	Director Household & Population Statistics Division

Deputy Superintendents of Census

Mrs Alice Goh Soke Ngoh	Director Business Statistics Division
Ms Sio Suat Kheng	Director Statistical Co-Ordination & Information Division
Mr Kenneth Goh Soon Ho	Deputy Director Household & Population Statistics Division
Ms Yim Seow Hua	Deputy Director Statistical Co-Ordination & Information Division

Senior Assistant Superintendents of Census

Mr Koh Eng Chuan	Senior Assistant Director Household & Population Statistics Division
Mr Khoo Soon Lee	Senior Assistant Director Business Statistics Division
Mrs Fiona Yip Ai Lin	Senior Assistant Director Household & Population Statistics Division
Mr Edward Lim Chee Wei	Senior Assistant Director Household & Population Statistics Division

Assistant Superintendents of Census

Mrs Chow Lay Lian	Manager
Mr Soh Gin Hoo	Manager
Mr Yap Yee Liong	Deputy Manager
Mr Tan Kian Heng	Deputy Manager
Ms Yeo Yen Fang	Deputy Manager
Ms Lee Gek Lan	Assistant Manager
Mr Tan Wah Kia	Assistant Manager

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Ms Adeline Chia Yee Min	Assistant Manager
Ms Tay Li Jade	Assistant Manager
Ms Ang Hwee Lin	Assistant Manager
Ms Goh Ting Fei	Assistant Manager
Ms Ng Siew Siew	Assistant Manager
Ms Jung Hwi Leng	Assistant Manager
Ms Loh Yin Ling	Assistant Manager
Ms Tan Siew Fong	Assistant Manager
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Mr Lim Wee Teck	Assistant Manager
Ms Amy Tan Hui Leng	Assistant Manager
Mr Eng Kah Joo	Assistant Manager
Mr Lee Eng Siong	Assistant Manager
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Ms Leong Mok Kam	Management Support Officer
Mrs Teo-Tay Siew Tan	Corporate Support Officer
Mdm Latifah bte Jamir	Corporate Support Officer
Mrs Ellice Tan Kum Ping	Corporate Support Officer
Mrs Chua-Wong May Yoke	Corporate Support Officer
Mdm Tan Geok Har	Corporate Support Officer
Mdm Hew Lee Kiaw	Corporate Support Officer
Ms Shirley Tio Ai Lin	Corporate Support Officer

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Mrs Tay-Loo Chia Min	Manager
Mrs Lee Wai Ching	Assistant Manager
Ms Chia Cheow Lin	Assistant Manager
Mrs Alice Chong Mui Tiang	Corporate Support Officer
Ms Irene Ng Kwai Chun	Corporate Support Officer
Ms Chow Yow Foon	Corporate Support Officer

Data Dissemination / Publication Section

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Mr Edmond Lee Eu Fah	Statistician
Ms Ong Whee Sze	Statistician
Mrs Eunice Tan Hwee Yin	Manager
Ms Yeo Soek Lee	Manager
Mr Choo Chou Foo	Deputy Manager
Ms Wong Pui Mun	Assistant Manager
Ms Chia Aik Miang	Assistant Manager
Ms Kiu Kwee Fern	Assistant Manager
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Mr Ng Keng Chye	Corporate Support Officer

Data Processing Operation

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Mdm Seah Lye Woo	Corporate Support Officer
Mdm Jamaliah bte Jamir	Corporate Support Officer
Mdm Ramlah bte Kassim	Corporate Support Officer
Mrs Pauline Tham	Corporate Support Officer
Mr Chew Thian Beng	Corporate Support Officer
Ms Yap Soon Ai	Corporate Support Officer

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Ms Choh Wai Chun	Management Support Officer
Mr Edwin Lim Shu Loy	Management Support Officer
Mrs Neo Eng Choo	Finance Supervisor
Mr Alex Ling Aik Cheng	Office Supervisor
Mrs Dixie Ho Pui Chin	Personal Assistant
Mrs Cheah Siew Geok	Stenographer
Mr Ang Cheng Bin	Corporate Support Officer
Mdm Chew Pui Kuen	Corporate Support Officer

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Mohamed Raham bin Abu Bakar

Supervisor

Yeo Shu Pin

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Ho Yit Ngoh
Jamelah Khatun bte Mohd Ali
Lim Jew Hoe
Tan Lay Kwan
Tan Lay See
Sung Ming Yin
Tan Sock Wah

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Daily-rated Office Supervisors

Yeo Hsing Pao
Hoo Chee Mun
Chan Chui Li
Chung Khim Lun
Ho Cheng Yuan, William
Tong Teck Ann, Richard
Wong Kee Siong
Kumaresan s/o Arasapam
Lazaroo Patrick Noel
Mariam bte Saim
Dyana Hayzuran binte Muhamad
Sockalingam Shantha
Tang Ka Wei
Tan Choon Eng
Raina Zabeen Hossain
Zhang Shu Ying, Anna
Kow Kim Siang
Lew Joo Hian
Pang Chi Han, Clement

Daily-rated Field Supervisors

Yong Ngee Hian
Ong Kuai Hong, Bernard
Yeoh Sin Leong, Jason
Zuwardy bin Said
Ng Kok Hong
Goh Kay Bing
Chia Soon Yew
Ang Kwee Geok
Leow Lee Lee
Cheng Chee Keong
Sai Mee Chun
Loh Pak Jung
Lim Jit Nong
Chua Hwee Eng
Ng Hong Peow

SAMPLING AND NON-SAMPLING ERRORS

Sampling Errors

Concept

Sample estimates derived from the sample enumeration are determined by the sample selected. The Census 2000 sample is one of a number of possible samples under the given sample design. If another sample had been taken, the estimate for the same attribute will be different but probably close to that of the sample actually selected. With an unbiased design, the average estimate of a specific attribute from all possible samples will, according to probability principles, coincides with the “true value” of that attribute which is generally unknown. As the sample estimates were based on a fraction of the population, they are inevitably subjects to sampling errors and non-sampling errors. Sampling errors are the result of the variability inherent in the estimates for the whole population based on a partial coverage. This variability can be assessed by computing the variance or standard error of the sample estimates. The sampling error of an estimate is the difference between the estimated value obtained from a sample and its true value or population value.

A sample estimate and an estimate of its standard error can be used to construct an interval that will, at specified levels of confidence, include the actual value. According to probability theory, about 68, 95 and 99 per cent of estimates from all possible samples will fall within the interval defined by one, two or three standard errors respectively on either side of the sample estimates of the population value. Based on this property, it is possible to construct intervals around the estimate from the particular sample selected that would contain the true value with known level of confidence. By statistical convention, the confidence interval is usually set at 95 per cent.

Computation for Census 2000 sample design

DOS adopted a 2-phase sample selection for Census 2000. During the first phase, 25% of total sampling units (dwelling units) were selected. This yielded some 275,000 households across the 44 DGP zones. From the first phase sample, 80% of the dwellings were systematically selected to form the

baseline for the second phase sample. The second phase thus had a size of 20% of total dwellings. During the second phase sampling, four random numbers were generated to pick four 1-in-5 systematic samples. This formed the final sample of 218,000 addresses.

Variance and Standard Error

The formula to be used for the computation of sampling errors for a sample estimate based on the Census 2000 sample design was devised in consultation with experts from the academia. A sample estimate can either be an absolute number, that is, the number of elements with a given attribute (T_Y) or a proportion (R_Y) – the ratio of the absolute number with the given attribute to the total population. The formula appropriate for estimating the sampling errors for T_Y and R_Y based on the Census 2000 sample design was constructed as shown below.

Let Y_{ijkl} and X_{ijkl} be the measurement obtained from the l^{th} dwelling that is in the k^{th} second stage systematic sample generated from the j^{th} first stage systematic sample in the i^{th} DGP, for i = 1, …44, j = 1, ...4 and k = 1, …5 and l = 1,…….n_{ijk} where n_{ijk} is the number of dwellings in the k^{th} second stage systematic sample generated from the j^{th} first stage systematic sample in the i^{th} DGP.

$$\text{Let } R = \frac{\sum_{i=1}^{44}\sum_{j=1}^{4}\sum_{k=1}^{5}\sum_{l=1}^{n_{ijk}} Y_{ijkl}}{\sum_{i=1}^{44}\sum_{j=1}^{4}\sum_{k=1}^{5}\sum_{l=1}^{n_{ijk}} X_{ijkl}}$$

$$\text{and } Ta = \sum_{i=1}^{44}\sum_{j=1}^{4}\sum_{k=1}^{5}\sum_{l=1}^{n_{ijk}} a_{ijkl}$$

where a = X or Y. The parameter R can be defined as the population proportion of elements that possess a certain attribute when Y is the number of elements which possess the attribute in each dwellings, X is the number of elements in the same dwelling. T can be defined as the total number of elements that possess certain attribute in the population.

Let $\bar{y}_{ijk}$ and $\bar{x}_{ijk}$ be the sample mean per dwelling of Y and X, respectively, of the k^{th} selected systematic sample in the second stage, for i = 1, …. 44; j = 1; and k = 1, …. 4. Then unbiased estimators of T_Y and T_X are, respectively,

$$\hat{T}_Y = \tfrac{1}{4} \sum_{i=1}^{44} N_i \sum_{k=1}^{4} \bar{y}_{ijk}$$

$$\hat{T}_X = \tfrac{1}{4} \sum_{i=1}^{44} N_i \sum_{k=1}^{4} \bar{x}_{ijk}$$

where N_i is the number of dwellings in the i^{th} DGP. Thus, an estimator of R is

$$\hat{R}_Y = \frac{\hat{T}_Y}{\hat{T}_X}$$

An estimator of variance of T_Y is suggested below:

$$\sum N_i^2 \left(\tfrac{1}{5}\right) \frac{1}{4-1} \sum_{k=1}^{4} (\bar{y}_{ijk} - \bar{y}_{ij})^2$$

where $\bar{y}_{ij} = \tfrac{1}{4} \sum_{k=1}^{4} \bar{y}_{ijk}$

Note that this estimator over-estimates the variance of T_Y on the average, and an estimator of the variance of $\hat{R}_Y$ is

$$\frac{1}{\hat{T}_x^2} \sum_{i=1}^{44} N_i^2 \left(\tfrac{1}{5}\right) \frac{1}{4-1} \sum_{k=1}^{4} \left(\bar{y}_{ijk} - \hat{R}\bar{x}_{ijk}\right)^2$$

The absolute standard errors (S.E.) of T_Y and $\hat{R}_Y$ will be computed as:

$$\text{S.E. } T_Y = \sqrt{\text{Variance of } T_Y}$$

$$\text{S.E. } \hat{R}_Y = \sqrt{\text{Variance of } \hat{R}_Y}$$

The absolute standard error is used to determine the range of estimate at a specified confidence interval. As a guide, the smaller the absolute standard error, the closer the grossed-up sample estimate is to its population value, and the narrower the range of the estimate at a specified level of confidence.

Relative Standard Error

To measure the relativity of a standard error, the relative standard error (RS), which is the standard error relative to the magnitude of the estimate, can be used. The RS can be applied to the standard error obtained from any sample design, inclusive of simple random sampling (SRS) or systematic sampling. The relative standard error can be expressed as:

$$RS = S.E. / A * 100$$

where RS is the relative standard error (in percentage terms);
S.E. is the standard error;
A is the grossed-up sample estimate.

The RS serves as a better indicator of the precision of the estimate in that the smaller the RS, the more precise is the estimate. As a rule of thumb, the smaller the size of an estimate, the higher would be its RS. This follows that for rare characteristics or small proportions in the population, the RS would be large and users have to be careful in making inferences.

Design Effect

Since the Census 2000 adopted systematic sampling instead of SRS, it will be useful to ascertain the relationship between the variances of the sample design used for Census and those of a simple random sample. The design effect measures the ratio of the variance based on the formula for Census 2000 vis-à-vis the variance computed based on the SRS. It gives the net effect of the various complexities of the Census sample design adopted on the variance relative to a simple random sample. The square root of the design effect gives the ratio of the standard error of the design used to that of a simple random sample. The variance and standard error of a sample estimate with a particular attribute, R_Y from simple random sampling, $S.E._{SRS}$, can be computed as shown below.

$$Var\ (R_Y)_{SRS} = \left(1 - \frac{n}{N}\right) * \left(\frac{P\ (1-P)}{N}\right)$$

$$S.E.\ (R_Y)_{SRS} = N\ X \sqrt{\frac{N-n}{N-1} * \frac{P\ (1-n)}{n}}$$

where $Var\ (R_Y)_{SRS}$ is the variance of R_Y using SRS method;
$S.E.\ (R_Y)_{SRS}$ is the standard error of R_Y using SRS method;
N is the total population i.e. obtained from the HRD;
n is the number of persons covered in the 20% sample;
P is the proportion of the grossed-up sample estimate with the attribute, A, to total population, N.

The square root of the design effect is computed as follows:

$$\sqrt{\text{Design Effect}} = \sqrt{\frac{Var\ R_Y}{Var\ (R_Y)_{SRS}}} = \sqrt{\frac{T_Y\ Var\ R_Y}{(1-f)\ R_Y\ (1-R_Y)}}$$

This ratio is then applied to the sampling errors of a simple random design to obtain the estimated sampling errors.

Assessment of Census 2000 Sampling Errors

Sampling Errors of T_Y

Table E.1 shows the sampling errors of the estimates associated with selected attributes from the Census 2000. It can be seen that the standard errors are relatively small for the various demographic and socio-economic attributes. The relative standard errors for most attributes are also minimised for most of the attributes, at less than 1 per cent.

Table E.1 Sampling Errors of Selected Attributes (T_Y)

Selected Characteristics	Grossed-up Sample Estimate of T_Y	Standard Error (Grossed-up) of T_Y	Relative Standard Error of T_Y	Range of Estimate at 95% Confidence Level	
				Lower	Upper
Resident Population					
Males	1,630,293	1,860	0.1	1,626,647	1,633,939
Females	1,632,916	1,686	0.1	1,629,611	1,636,221
Students	706,292	1,969	0.3	702,433	710,151
Working Population	1,482,579	1,796	0.1	1,479,058	1,486,100
Attributes on Economic Characteristics					
Resident Working Population:					
Earning less than $1000	173,893	805	0.5	172,316	175,470
Earning $1000-$1999	451,242	1,141	0.3	449,007	453,477
Earning $2000-$2999	350,475	1,275	0.4	347,975	352,975
Earning $3000-$3999	199,784	790	0.4	198,237	201,331
Earning $4000-$4999	100,117	584	0.6	98,972	101,262
Earning $5000-$5999	63,968	495	0.8	62,997	64,939
Earning $6000 & over	143,100	706	0.5	141,717	144,483
Occupational Status Attributes					
Employees	1,267,965	1,879	0.2	1,264,282	1,271,648
Self-employed Persons	207,034	742	0.4	205,579	208,489
Literacy Attributes					
Persons literate in English and Chinese	877,510	2,094	0.2	873,406	881,614
Persons literate in English and Malay	283,342	1,660	0.6	280,089	286,595
Persons literate in English and Tamil	64,074	763	1.2	62,578	65,570
Mode of Transport Attributes					
Working Persons travelling by Bus/MRT	205,869	1,011	0.5	203,888	207,850
Working Persons requiring no transport	90,298	716	0.8	88,894	91,702
Students travelling by Bus/MRT	55,750	518	0.9	54,734	56,766
Students requiring no transport	212,333	885	0.4	210,598	214,068
Ever-married Female Attributes					
Females 1st married under 30 years	814,402	914	0.1	812,611	816,193
Females 1st married at 30-39 years	97,509	614	0.6	97,306	98,712
Females with 1-2 children born alive	438,632	816	0.2	437,032	440,232
Females with 3-5 children born alive	300,576	853	0.3	298,848	302,304
Tenancy of Dwelling Attributes					
No. of owner-occupied households	852,483	452	0.1	851,596	853,370
No. of rented households	61,061	354	0.6	60,366	61,756

Design Effect

As the design effect gives the net effect of the various complexities of the Census sample design as compared to an SRS. Table E.2 provides the square roots of the design effects of the selected attributes.

Table E.2 Square Root of Design Effect of Selected Attributes

	$\sqrt{\text{Design Effect}}$
Resident Population	
Males	*1.714*
Females	*1.714*
Students	*3.912*
Working Population	*2.461*
Attributes on Economic Characteristics	
Resident Working Population:	
Earning less than $1000	*3.504*
Earning $1000-$1999	*3.537*
Earning $2000-$2999	*2.830*
Earning $3000-$3999	*2.356*
Earning $4000-$4999	*2.603*
Earning $5000-$5999	*2.586*
Earning $6000 & over	*5.030*
Occupational Status Attributes	
Employees	*2.572*
Self-employed Persons	*3.026*
Literacy Attributes	
Persons literate in English and Chinese	*3.756*
Persons literate in English and Malay	*6.041*
Persons literate in English and Tamil	*3.797*
Mode of Transport Attributes	
Working Persons travelling by Bus/MRT	*3.750*
Working Persons requiring no transport	*3.281*
Students travelling by Bus/MRT	*3.384*
Students requiring no transport	*4.506*
Ever-married Females Attributes	
Females 1st married under 30 years	*1.599*
Females 1st married at 30-39 years	*2.023*
Females with 1-2 children born alive	*2.033*
Females with 3-5 children born alive	*2.158*
Tenancy of Dwelling Attributes	
No. of owner-occupied dwellings	*5.006*
No. of tenanted dwellings	*5.065*

The design effect for an estimate obtained from SRS is 1. It is observed that the square roots of selected attributes range from 1.6 to 6.0, depending on the sample design effect of the attribute concerned. The bigger the subpopulation size respective to the population, the lower would be the design effect and the lower the deviation of the sample estimate from that of the SRS. Conversely, attributes with smaller subpopulation size i.e. working persons earning more than $6,000 and persons literate in English and Malay have larger design effect and hence, a higher deviation from the simple random sample.

It is not possible to estimate the sampling errors for all attributes as numerous ones can be obtained from the Census. As a guide for data users in determining the sampling errors of the grossed-up estimates for other attributes, Tables E.3 to E.5 provide the sampling errors for various size of estimates with varied values of the design effect. Table E.3 relates to SRS and is presented purely for theoretical interest.

Table E.3 Sampling Errors for Square Root of Design Effect Equals 1

Size of Estimates	Proportion of Total Population (%)	Standard Error	Relative Standard Error (%)	Range of Estimate at 95% Confidence Level	
				Lower	Upper
	Persons				
3,000,000	74.67	1,765	0.06	2,996,540	3,003,460
2,000,000	49.78	2,030	0.10	1,996,022	2,003,978
1,000,000	24.89	1,755	0.18	996,560	1,003,440
500,000	12.44	1,340	0.27	497,374	502,626
200,000	4.98	883	0.44	198,270	201,730
100,000	2.49	632	0.63	98,760	101,240
50,000	1.24	450	0.90	49,118	50,882
20,000	0.50	286	1.43	19,440	20,560
10,000	0.25	202	2.03	9,604	10,396
5,000	0.12	143	2.86	4,719	5,281
2000	0.05	91	4.53	1,823	2,177
1,000	0.02	64	6.40	874	1,126
500	0.01	45	9.06	411	589
200	0.00	29	14.32	144	256
	Households				
900,000	97.47	298	0.03	899,415	900,585
700,000	75.81	814	0.12	698,404	701,596
500,000	54.15	948	0.19	498,143	501,857
200,000	21.66	783	0.39	198,465	201,535
100,000	10.83	591	0.59	98,842	101,158
50,000	5.42	430	0.86	49,156	50,844
20,000	2.17	277	1.38	19,457	20,543
10,000	1.08	197	1.97	9,614	10,386
5,000	0.54	140	2.79	4,726	5,274
2,000	0.22	88	4.42	1,827	2,173
1,000	0.11	63	6.26	877	1,123

Given that the square root of the design effect for majority of the selected attributes presented ranges from 2 and 4, Table E.4 should generally be used for determining sampling errors of other attributes. From the tables, it is noted that the relative standard error increases as the grossed-up value (or population value) decreases.

Table E.4 Sampling Errors for Square Root of Design Effect Equals 3

Size of Estimates	Proportion of Total Population (%)	Standard Error	Relative Standard Error (%)	Range of Estimate at 95% Confidence Level	
				Lower	Upper
	Persons				
3,000,000	74.67	5,296	0.18	2,989,619	3,010,381
2,000,000	49.78	6,089	0.30	1,988,065	2,011,935
1,000,000	24.89	5,266	0.53	989,679	1,010,321
500,000	12.44	4,020	0.80	492,121	507,879
200,000	4.98	2,649	1.32	194,809	205,191
100,000	2.49	1,897	1.90	96,281	103,719
50,000	1.24	1,350	2.70	47,354	52,646
20,000	0.50	857	4.29	18,320	21,680
10,000	0.25	607	6.07	8,811	11,189
5,000	0.12	429	8.59	4,158	5,842
2,000	0.05	272	13.58	1,468	2,532
1,000	0.02	192	19.21	623	1,377
500	0.01	136	27.17	234	766
200	0.00	86	42.96	32	368
	Households				
900,000	97.47	895	0.10	898,245	901,755
700,000	75.81	2,443	0.35	695,211	704,789
500,000	54.15	2,843	0.57	494,428	505,572
200,000	21.66	2,350	1.18	195,394	204,606
100,000	10.83	1,773	1.77	96,525	103,475
50,000	5.42	1,291	2.58	47,469	52,531
20,000	2.17	831	4.15	18,372	21,628
10,000	1.08	591	5.91	8,843	11,157
5,000	0.54	419	8.37	4,179	5,821
2,000	0.22	265	13.26	1,480	2,520
1,000	0.11	188	18.77	632	1,368

If the attribute is known to exhibit larger design effect, then Table 5 could be used where the design effects equals 5. Users of the data should exercise caution when analysing data for the rarer attributes with smaller sample size. From Tables E.3 to E.5, it is observed that the smaller the sample size (and the rarer the attribute), the higher the relative standard error.

Table E.5 Sampling Errors for Square Root of Design Effect Equals 5

Size of Estimates	Proportion of Total Population (%)	Standard Error	Relative Standard Error (%)	Range of Estimate at 95% Confidence Level	
				Lower	Upper
			Persons		
3,000,000	74.67	8,827	0.29	2,982,698	3,017,302
2,000,000	49.78	10,149	0.51	1,980,109	2,019,891
1,000,000	24.89	8,776	0.88	982,799	1,017,201
500,000	12.44	6,700	1.34	486,868	513,132
200,000	4.98	4,414	2.21	191,348	208,652
100,000	2.49	3,162	3.16	93,802	106,198
50,000	1.24	2,250	4.50	45,590	54,410
20,000	0.50	1,428	7.14	17,200	22,800
10,000	0.25	1,011	10.11	8,018	11,982
5,000	0.12	716	14.31	3,597	6,403
2,000	0.05	453	22.64	1,113	2,887
1,000	0.02	320	32.02	372	1,628
500	0.01	226	45.28	56	944
			Households		
900,000	97.47	1,492	0.17	897,075	902,925
700,000	75.81	4,072	0.58	692,019	707,981
500,000	54.15	4,738	0.95	490,713	509,287
200,000	21.66	3,917	1.96	192,323	207,677
100,000	10.83	2,955	2.96	94,208	105,792
50,000	5.42	2,152	4.30	45,782	54,218
20,000	2.17	1,384	6.92	17,287	22,713
10,000	1.08	984	9.84	8,071	11,929
5,000	0.54	698	13.96	3,632	6,368
2,000	0.22	442	22.10	1,134	2,866
1,000	0.11	313	31.28	387	1,613

Non-Sampling Errors

Apart from sampling errors, sample survey results are also subjected to non-sampling errors. They are present in complete censuses as well as in sample surveys. Such errors could arise during data collection phase, e.g. varying interpretation of questions by respondents or interviewers, and the inability or unwillingness of respondents to provide correct information. They could also arise during data processing e.g. wrong codes entered or key-punching errors due to poor hand-writing.

In the Census 2000, the following measures were taken to minimise the non-sampling errors:

a) careful design of the Internet questionnaire, CATI online questioning and fieldwork questionnaires;

b) careful planning of operational procedures in data collection, processing and tabulation;

c) standardising concepts and definitions and providing intensive training to all staff involved in the Census;

d) close supervision of the CATI call centre and field interviewers;

e) verifying the returns with respondents, whenever necessary; and

f) stringent control and high standards set for data editing, coding and verification to ensure good data quality and high data consistency.

Extracts from The Census Act, Chapter 35, Revised Edition 1991

Power to direct census to be taken.

3 The Minister may by notification in the *Gazette* direct that a census be taken throughout Singapore or of and specified area of Singapore of the population, housing, agriculture, animal husbandry, fisheries, trade, labour, industry, building and construction, commerce, education, health and family planning, transportation or such other matters as he may consider necessary or desirable and may by the same or a different notification prescribe –

(a) the date on which the census is to be taken; and

(b) the particulars to be obtained for the purposes of the census.

Appointment of Superintendent of Census.

4 – (1) The Minister may appoint an officer, to be called the Superintendent of Census, to supervise the taking of any census directed to be taken under the provisions of this Act.

(2) The Superintendent, in the exercise of his powers and in the performance of his duties under this Act or any rules made thereunder, shall be subject to the control of, and shall comply with any directions given by, the Minister.

Appointment of Deputy Superintendents and Assistant Superintendents of Census.

5 The Minister may appoint for specified areas such Deputy Superintendents and such Assistant Superintendents of Census, and assign such functions to them as he considers necessary for the purpose of any census directed to be taken under the provisions of this Act.

Appointment of supervisors and enumerators.

6 The Superintendent may, by writing under his hand, appoint such supervisors, enumerators and other census officers as he considers necessary to supervise or take or aid in the taking of a census within any specified area, and may at any time revoke those appointments.

Census officers. Cap. 224.

7 – (1) Every census officer shall be deemed to be a public servant within the meaning of the Penal Code.

(2) Every census officer appointed under section 6 shall carry with him at all times when on duty the letter of appointment furnished to him under that section and shall produce the letter for inspection by any person who may in good faith question his authority as a census officer.

Occupier to allow access and permit affixing of numbers.

8 – (1) Every person occupying any dwelling-house or other premises shall allow any census officer such access thereto as may be necessary for the purposes of a census, and shall allow him to paint, mark or affix on or to the dwelling-house or other premises such as letters, marks or numbers as the Superintendent considers necessary for the purpose of the census and to make any alterations to those letters, marks or numbers.

Questions by census officers.

9 Every census officer may ask all persons within the limits of the areas for which he is appointed such questions as may be necessary to obtain the information required for the purposes of the census.

Delivery and filling in of schedule.

10 – (1) A census officer may leave at any dwelling-house or other premises within the area for which he is appointed a schedule to be filled in by the occupier of the dwelling-house or other premises or of any specified part thereof.

(2) The occupier shall, within the time mentioned therein, fill in the schedule, or cause it to be filled in, in the manner prescribed and shall thereafter deliver the schedule to an enumerator, or a supervisor appointed for the area in which the dwelling-house or other premises is situated or to any other person as the Superintendent may direct.

(3) If the occupier is unable either to fill the schedule in the prescribed manner or cause it to be filled in, he shall preserve it in the condition in which he received it and shall deliver it to the enumerator, supervisor or other person, as the case may be, who shall, after exercising the powers conferred upon him by section 9, fill in the schedule in the prescribed manner.

(4) At any time before or within one year (or such longer period as may be prescribed) after the date prescribed for the taking of a census, if directed by the Superintendent to do so, any census officer may visit any dwelling-house or other premises within the area for which he is appointed, for the purpose of checking any information obtained or of obtaining further information for the purposes of the census, and may, if satisfied that a schedule is incorrect in any material particular, make any necessary correction thereon.

Enumeration of persons in public institutions, hotels, etc.

11 – (1) The Superintendent may deliver or cause to be delivered to -

(a) every person in charge of a hospital, workhouse, prison, police station, reformatory, lock-up, or of any public, charitable, religious or educational institution; and

(b) every keeper, secretary or manager of a hotel, boarding-house, lodging-house or club,

a schedule to be filled in in respect of the persons who at the time of the taking of a census are in or upon such premises.

(2) The person to whom the schedule is delivered shall fill in the schedule or cause it to be filled in, to the best of his knowledge and belief, so far as regards the inmates of the hospital, workhouse, prison, police station, reformatory, lock-up, or public, charitable, religious or educational institution or the hotel, boarding-house, lodging-house or club within the time mentioned therein, and shall sign his name thereto, and when so required shall deliver the schedule so filled in and signed to an enumerator or a supervisor appointed for the area within which the building is situated or to such other person as the Superintendent may direct.

Request for information from competent authorities. 8/90.

13 – (1) The Superintendent may, for the purposes of a census, in writing direct any competent authority specified in the first column of the First Schedule to furnish or supply to him any particulars or information obtained by the competent authority under the written law specified in the second column of the First Schedule and, notwithstanding the provisions of any written law, the competent authority shall furnish and supply those particulars and information within such time as may be agreed to by the Superintendent and the competent authority.

(2) Notwithstanding the provisions of this Act or any other written law, no person shall be guilty of an offence under this Act or that other written law or of any breach of confidence by virtue merely of his disclosing any particulars or information to the Superintendent pursuant to any direction under subsection (1).

(3) Subsection (1) shall not apply to any particulars or information obtained under any written law relating to taxation or administered by the Monetary Authority of Singapore. [12A

Certain employers may be required to be enumerators.

14 – (1) Upon receipt of a written requisition in the prescribed form signed by the Superintendent, every employer of-

(a) employees who reside in any factory or workshop; or

(b) such other class or description of employees as the Minister may by notification in the *Gazette* specify,

shall be bound to act as an enumerator in respect of all those employees.

(2) Every such employer shall cause to be filled in in respect of his employees any schedule delivered to him for the purpose, and shall deliver the schedule filled in to the best of his knowledge and belief to the supervisor appointed for the area within which the premises are situated or to such other person as the Superintendent may direct. [13

Government employees to assist in taking census.

15 All Government employees shall be bound to assist the work of taking the census when so required by the Superintendent. [14

Schedules and returns to be delivered by enumerator to supervisor and forwarded to Superintendent.

16 Every enumerator shall deliver to the supervisor of the area for which he is appointed all schedules and all such returns as may be required by the Superintendent on the day or days to be appointed for that purpose by the Deputy or Assistant Superintendent for the district or area, and it shall be the duty of the Supervisor to verify them and to transmit them forthwith to the Deputy or Assistant Superintendent who shall, upon receipt of the schedules and returns, immediately forward them to the Superintendent. [15

Release of census information.

17 – (1) The Superintendent shall, upon receipt of the schedules and returns forwarded pursuant to this Act, cause reports to be made of them, and those reports shall be printed and published for general information. Prior to and after the publication of those reports, abstracts and special tabulations may be released for general information.

(2) In any report or abstract prepared under subsection (1), the information compiled in the report or abstract shall be so arranged as to prevent any particulars contained therein from being identified as being particulars relating to any individual person except with the previous consent in writing of that person.

(3) No particulars or information or any part thereof relating to any individual person obtained under the provisions of this Act shall, without the previous consent in writing of that person, be disclosed except –

(a) compiled statistics on the operation of an industry may be published irrespective of the number of persons engaged in that industry unless the industry is exempted by the Minister responsible for the Government department or ministry in possession of such particulars from having its data published;

(b) where the disclosure can be made without identifying the individual person and an appropriate time, in the opinion of the Minister responsible for the Government department or ministry in possession of such particulars, has elapsed;

(c) for the purposes of any proceedings for an offence under this Act or any report of those proceedings; or

(d) information of a general nature which could be obtained from other sources.

(4) It shall be the duty of the Minister responsible for the Government department or ministry in possession of such particulars to have due regard to the circumstances of various trades and industries and, in particular, to the importance of avoiding the disclosure in any return of any trade secret or of trading profit, or of any other information the disclosure of which would be likely to tend to the prejudice of the person furnishing the return. [16

Disclosure of census information. 8/90.

18 – (1) Notwithstanding section 17, the Superintendent or any census officer authorised by him in writing may, on the written request of a responsible officer of any public authority specified in the Second Schedule, disclose on a confidential basis any particulars or information relating to any individual person obtained under the provisions of this Act to the public authority if –

(a) those particulars or information could also have been obtained by the public authority under other written law; and

(b) in any case where the particulars or information have been obtained from a competent authority under section 13, that competent authority consents in writing to such disclosure.

(2) The Superintendent or any census officer authorised by him in writing shall not be guilty of any offence under any written law or of any breach of confidence by virtue merely of his disclosing any particulars of information in accordance with this section.

(3) No person employed in or by a public authority to which any particulars or information have been disclosed under subsection (1) shall use any such particulars or information for the purpose of enforcing any obligation or liability applicable under any written law.

(4) Any person employed in or by the public authority to which any particulars or information have been disclosed under subsection (1) who without the written approval of the Superintendent, or in breach of any condition of such approval, discloses any such particulars or information shall be guilty of an offence and shall be liable on conviction to a fine not exceeding $1,000 or to imprisonment for a term not exceeding one month or to both.

(5) In this section –

"public authority" includes a Government department or ministry;

"responsible officer", in relation to a public authority, means an officer designated by the Minister by notification in the *Gazette* as a responsible officer thereof for the purposes of this section. [16A

Offences by census officers. 8/90.

19 – Any census officer and any person employed by the Superintendent in the preparation of reports and abstracts who –

(a) without sufficient cause, refuses or neglects to comply with any instructions or requisitions addressed to him by the Superintendent, or fails to use reasonable diligence in performing any duty imposed on him;

(b) wilfully asks an offensive or improper question;

(c) knowingly makes any false return;

(d) asks, receives or takes from any person other than an authorised officer of Government any payment or reward; or

(e) without lawful authority publishes or communicates to any person any information acquired by him in the course of his duty or employment,

shall be guilty of an offence and shall be liable on conviction to a fine not exceeding $1,000 or to imprisonment for a term not exceeding one month or to both. [17

20 Any person who –

General offences. 8/90.

(a) refuses to answer, to the best of his knowledge and belief, any question asked of him by a census officer which is necessary to obtain any information required for the purposes of a census;

(b) knowingly makes or causes to be made, in any form or document to be filled in for the purpose of this Act or in answer to any question asked under the authority of this Act, any statement which is untrue in any material particular;

(c) hinders or obstructs a census officer in the performance of his duties;

(d) removes, obliterates, alters or destroys before the expiry of 6 months from the time of taking the census, any letters, marks or numbers which have been painted, marked or affixed for the purposes of the census;

(e) refuses or neglects to comply with any of the provisions of this Act or any rules made thereunder; or

(f) having possession of any information which to his knowledge has been disclosed in contravention of the provisions of this Act, publishes or communicates that information to any other person,

shall be guilty of an offence and shall be liable on conviction to a fine not exceeding $1,000 or to imprisonment for a term not exceeding one month or to both. [18

21 Any person who impersonates a census officer shall be guilty of an offence and shall be liable on conviction to imprisonment for a term not exceeding 6 months.

Impersonation of a census officer.

Census records not admissible in evidence.

23 No entry in any book, register or record made by a census officer or by any other person in the discharge of his duty under this Act shall be admissible as evidence in any civil or criminal proceedings, except in a prosecution instituted under this Act in respect of any entry against the person who made it or caused it to be made. [21

FIRST SCHEDULE

Section 13. 8/90.

COMPETENT AUTHORITIES

First Column	*Second Column*
Central Provident Fund Board	**Central Provident Fund Act (Chapter 36)**

SECOND SCHEDULE

Section 18. 8/90.

Central Provident Fund Board

SINGAPORE DEPARTMENT OF STATISTICS
POPULATION CENSUS 2000
(CENSUS ACT, CHAPTER 35, REVISED EDITION 1991)

House ID :

Household Form

CONFIDENTIAL

Address:

Official Use
V I D O

Type of House:

Form ID:

A. House Members' Particulars

Person 1

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

Person 2

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

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SINGAPORE DEPARTMENT OF STATISTICS
POPULATION CENSUS 2000
(CENSUS ACT, CHAPTER 35, REVISED EDITION 1991)

Census 2000

Person 3

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

Person 4

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

Person 5

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

SINGAPORE DEPARTMENT OF STATISTICS
POPULATION CENSUS 2000
(CENSUS ACT, CHAPTER 35, REVISED EDITION 1991)

Census 2000

Person 6

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

Person 7

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

Person 8

1 Identification Number (NRIC/UIN/FIN)

2 Name

3 Sex
Male Female

4 Date of Birth

5 Identification Type
Singapore Citizen
Singapore Permanent Resident
New Born Baby or New Foreigner who does not have own identification document yet
Others, specify type of pass

6 Marital Status
Single Widowed Divorced
Married Separated

7 Whereabouts
Present
Overseas for 6 months or more [Absentee Member]
Shifted Out
Deceased
Unknown Person

8 Ethnic/Dialect Group
Hokkien Malay Filipino
Teochew Boyanese Thai
Cantonese Javanese Japanese
Hakka (Khek) Tamil Eurasian
Hainanese Others, specify

B. Relationship to Head of Household

9 Select a Household Head for each household by shading the relevant box.
Next, for each and every other person, state their relationship to their respective Household Head.

	Household No.	a. Head	b. Spouse	c. Sibling	d. Parent	e. Child	f. Grand-child	g. Parent-in-law	h. Brother-in-law/ Sister-in-law	i. Son-in-law/ Daughter-in-law	j. Grandparent	k. Maid	l. Tenant	m. Others, specify
Person 1														
Person 2														
Person 3														
Person 4														
Person 5														
Person 6														
Person 7														
Person 8														

C. Identification of Parent and Spouse

10 Who is the mother of each household member?
Shade one box for each person. If the mother is not living with the household, please shade the father. If neither the father nor mother is living in the household, please leave the boxes blank.

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Form ID
Who is the parent of Person 1?									
Who is the parent of Person 2?									
Who is the parent of Person 3?									
Who is the parent of Person 4?									
Who is the parent of Person 5?									
Who is the parent of Person 6?									
Who is the parent of Person 7?									
Who is the parent of Person 8?									

Please enter Form ID if more than one Household Form is required.

11 Who is the spouse of each household member?
Shade one box for each person. If the person does not have a spouse or the spouse is not living with the household, please leave the boxes blank.

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Form ID
Who is the spouse of Person 1?									
Who is the spouse of Person 2?									
Who is the spouse of Person 3?									
Who is the spouse of Person 4?									
Who is the spouse of Person 5?									
Who is the spouse of Person 6?									
Who is the spouse of Person 7?									
Who is the spouse of Person 8?									

Please enter Form ID if more than one Household Form is required.

12 Please sign this declaration:

I declare that the information I have supplied is true and given to the best of my knowledge.

Name/Signature

Home Tel

Office Tel Ext

Pager

Handphone

Please check that all the relevant questions have been answered.

Kindly proceed to fill up the *Individual Form* for every member that was entered in Section A of this form.

SINGAPORE DEPARTMENT OF STATISTICS
POPULATION CENSUS 2000
(CENSUS ACT, CHAPTER 35, REVISED EDITION 1991)

House ID :

Individual Form

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1) This Individual Form must be filled in for every member indicated in the Household Form.
2) Absentee Members refer to:
a) Persons whose location of employment or course of study is overseas. The duration of the job or course should be 6 months or more; or
b) Persons who are not working or studying, but intend to stay abroad for 6 months or more.
*For such persons, please fill in only **Items 1-4 and Item 20** onwards of this form.*

1

Identification Number
(NRIC/UIN/FIN)

2

Name

3

Citizenship

Singapore Citizen | Malaysian | Indonesian
Chinese | Indian
Others, specify

4

a) Country of Birth

Singapore | Malaysia | India
China | Indonesia
Others, specify

b) If this person is born outside Singapore, which year did this person begin residence here?

Year

ⓘ *If person is an Absentee Member (Overseas for 6 months or more), please proceed to **Item 20**.*

5

What is this person's economic status?

Full-time student | Working | Not working & not studying

ⓘ *If person is not a full-time student, please proceed to Item 7.*

6

If this person is a full-time student,
what Level of Formal Education is this person attending now?
(eg. Kindergarten, Primary 4, Secondary 2, JC1)

Which School or Educational Institution is this person attending now?

7

If this person is not a full-time student,
what is this person's Highest Grade Passed or Qualification Attained?
(please specify the type of Certificate, Diploma or Degree obtained.
eg. PSLE, GCE 3 'O', GCE 2 'A', Poly Dip in Engineering)

8

If this person is a Polytechnic/University graduate
(*incl. Masters/Doctorate*):

a) What is his/her major Field of Study?

b) From which country did this person obtain his/her Highest Qualification?

Singapore | USA
United Kingdom | Australia
Others, specify

c) In which year did this person obtain the Highest Qualification?

Year

d) If this person had obtained a *Masters Degree or above*, what is the Field of Study of the basic degree obtained?

9

If this person is not a Polytechnic/University graduate, did he/she acquire any Technical/Commercial/Vocational Qualification?

Yes | No

If **Yes**, please specify the

a) Type of Certificate/Diploma obtained that is most related to this person's job.

b) Field of Study.

c) Educational Institution from which this person obtained the Certificate.

SINGAPORE DEPARTMENT OF STATISTICS
POPULATION CENSUS 2000
(CENSUS ACT, CHAPTER 35, REVISED EDITION 1991)

Census 2000

10

If this person is working or doing business:

a) Please answer the following:

i) What is the Name and Tel. Number of the firm / organisation this person is working in?

Name

Tel Ext

ii) What is the Main Type of Business or Activity this person's firm is engaged in and Main Type of Product(s)/Service(s)?

Main Activity

Main Products/Services

iii) What is this person's Job Title?

iv) What are this person's main tasks and duties?

b) Indicate this person's occupational status:

- Self-employed without paid help
- Self-employed with paid help
- Helping in family business without fixed or regular pay
- Working as an employee for wages or salaries
- Serving National Service

c) What was this person's gross monthly income from work (excluding bonus) last month?
(to be stated in Singapore Dollars)

S$ .0 0

d) How many months of bonus did this person receive during the last 12 months?

. months Or S$ .0 0

e) How many actual hours did this person work last week?
(incl. paid and unpaid hours worked)
For those who are temporarily not working (eg. vacation leave), the most recent week of employment should be taken into consideration.

hours

f) When did this person start work in this job?

Year

2002

11

For employees - Has this person worked for a different employer during the last 2 years?

For self-employed persons - Has this person been an employee during the last 2 years?

Yes No

If **Yes**, please answer the following:

a) What is the Name of the firm / organisation this person last worked in?

b) What is the Main Type of Business or Activity this person's last employer is engaged in and the Main Type of Product(s)/Service(s)?

Main Activity

Main Products/Services

c) What was this person's Job Title?

d) What were this person's main tasks and duties?

12

If this person is not working and not a full-time student:

a) Had this person ever worked before?

Yes No

b) Is this person looking for work?

Yes No

If **Yes**,
what action had the person taken to look for work?

- Registered with employment service or agencies
- Answered advertisement/wrote direct to firms
- Asked friends or relatives
- Others, specify

If **No**,
what is the reason for not working?

- Making preparations to start own business
- Awaiting call-up for National Service
- Awaiting enrolment in college/university
- Doing household work
- Retired / Too old to work
- Others, specify

SINGAPORE DEPARTMENT OF STATISTICS
POPULATION CENSUS 2000
(CENSUS ACT, CHAPTER 35, REVISED EDITION 1991)

Census 2000

13 How does this person usually travel to work or to school?
(*you may shade more than 1 choice*)

- Public Bus
- MRT
- Taxi
- Car (self-drive)
- Car (passenger)
- Walk only
- Others
- Private charter/Company bus or van
- Bicycle
- Boat / Ferry
- Lorry / Pick-up
- LRT
- Motorcycle / Scooter

14 Has this person travelled overseas for business or leisure (*for trips longer than 48 hours*) in the last 12 months?

Yes No

If **Yes**, please specify the number of trips to:

Malaysia Other countries

15 In what language(s) is this person able to read eg. newspaper?
(*you may shade more than 1 choice*)

- Chinese
- English
- Other language(s), specify
- Malay
- Tamil
- Not able to read in any language

16 What language or dialect does this person speak **most frequently** at home?

- Mandarin
- English
- Chinese dialect, specify
- Others, specify
- Malay
- Tamil

17 What is this person's religion?

- No Religion
- Buddhism
- Chinese Traditional Beliefs/Taoism
- Others, specify
- Islam
- Hinduism
- Sikhism
- Christianity, Roman Catholic
- Christianity, other denomination, specify

18 If this person is a female and not single:

a) At what age was she first married?

years old

b) How many children had she given birth to?

19 If this person is aged 65 years and above:

a) Can this person move about in the house independently?

Yes Yes, with help No

b) What is the main source of financial support for this person?

- Allowances given by children
- Allowances given by spouse
- Income from employment/business
- Savings / Interests earned
- Income from rental / dividends
- Other sources

20 If this person is the Head of Household:

a) Does this household own or rent the present house / flat?

- Owner-occupied, fully paid for
- Owner-occupied, with housing loan
- Rented
- Provided free by employer
- Provided free by parents / relatives / friends / others

b) What type of house / flat did this person live in previously?

- HDB 1 Room
- HDB 2 Room
- HDB 3 Room
- HDB 4 Room
- HDB 5 Room
- HDB Executive / Maisonette
- HUDC Flat
- Others, specify
- Executive Condominium
- Private Flat
- Private Condominium
- Terrace House
- Semi-detached House
- Bungalow House
- Never shifted before

c) Which year did this person move into the **present** house / flat?

Year

d) Does this person own or rent the **previous** house / flat?

- Owner-occupied, fully paid for
- Owner-occupied, with housing loan
- Rented
- Provided free by employer
- Provided free by parents / relatives / friends / others

2003

SINGAPORE DEPARTMENT OF STATISTICS
POPULATION CENSUS 2000
(CENSUS ACT, CHAPTER 35, REVISED EDITION 1991)

For Absentee Member

This section should be filled up for persons whose location of employment or course of study is overseas.
The duration of the overseas job or course should be 6 months or more. It also includes those who are not working or studying, but intend to stay abroad for at least 6 months.

21 Which country is this person currently in?

22 What is the reason for living abroad?

Working | Studying | Others (eg. Staying with related persons overseas)

23 What is this person's Highest Grade Passed or Qualification Attained?
(please specify the type of Certificate, Diploma or Degree obtained. eg. PSLE, GCE 3 'O', GCE 2 'A', Poly Dip in Engineering)

24 If this person is working or doing business:

a) Please answer the following:

i) What is this person's Occupation?

ii) What is the Main Type of Business or Activity this person's firm is engaged in?
Main Activity

b) Indicate this person's occupational status:

- Self-employed without paid help
- Self-employed with paid help
- Helping in family business without fixed or regular pay
- Working as an employee for wages or salaries
- Serving National Service

c) What is the expected duration of employment abroad?

months

25 If this person is studying,
what is the expected duration of the course of study overseas?

months

26 If this person is overseas for 12 months or more, how many times has this person returned to Singapore for home visits over the last 12 months?

times

Please check that all the relevant questions have been answered.

Thank you for completing this Census Form.

Remarks

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Form CF3

CENSUS OF POPULATION OFFICE
SINGAPORE DEPARTMENT OF STATISTICS
CENSUS OF POPULATION 2000 : EMPLOYER FORM
(THE CENSUS ACT, CHAPTER 35, Revised Edition 1991)

GENERAL NOTES

Some items are pre-printed with information to reduce form filling effort.
If the information is out-of-date, kindly delete and append the latest information above the item.

- Please use either a **blue or black ink pen.**
- Check and update the pre-printed information on the form(s).
- Note that this form only covers the **Work Permit Holders** (WPH) in your organisation.
- Employment Pass Holders should not be included.
- Delete any WPH employees that have left your organisation.
- Add any new WPH employees and include their relevant details.
- If you require extra forms, please make copies or call us.
- Make a copy for your reference.
- Mail back in the pre-paid envelope to the Census Office.
- If you need any assistance, kindly call our officer(s)-in-charge at 720 2302 / 720 2303 / 720 2304.

Foreign* Identification Number	Name of Employee*	Sex*	Date* of Birth	Citizenship*	Ethnic* Group	Marital Status	Residential Address / Postal Code	Type of Dwelling	Highest Qualification Attained	Skill Type	Occupation	Total Monthly Income	Mode of Transport to Work	No. of hours worked last week

* - Pre-printed information

I declare that the information I have supplied is true and given to the best of my knowledge.

Name/Designation/Signature

FOR OFFICIAL USE	Coded by:	Checked by:
Remarks:		

Kindly provide a contact number: _____

POPULATION CENSUS 2000

EVERY SINGAPOREAN COUNTS

Census 2000 collects key information on the population.
With good information, better decisions can be made.

SINGAPORE DEPARTMENT OF STATISTICS

Population Census 2000

About the Population Census

The Population Census of Singapore is conducted once in ten years. Census 2000 is the fourth Census after Singapore's Independence and the thirteenth in the series of Census taking in Singapore. The purpose of the Census is to collect key information on the population to be used for planning programmes and services for the community.

New Way of Collection

Singapore will conduct a register-based Census in 2000 for the first time. Basic information eg age, sex, ethnic group will be obtained from administrative records. Additional information useful for in-depth studies will be obtained from a 20% sample of households.

Three Ways of Submission

If your household is among the 20% selected for enumeration there are three ways you can submit the Census return: Internet, telephone interviews or face-to-face interviews.

Internet Submission

Census 2000 will be one of the first in the world to be conducted using the Internet. You are encouraged to submit the Census form via the Internet. Please refer to the Guide on Internet Submission to assist in your Internet filing.

If you encounter any difficulties in submitting via the Internet, please call our Census hotline at 1800-883-2000.

Telephone Interviews

You can submit the Census information via a telephone interview. Please dial 1800-883-2000, 9am-9pm, Mondays to Sundays for an immediate telephone interview or fix an appointment to be interviewed at your convenience.

Face-to-face Interviews

If you wish to be interviewed at your house, you may call the Census hotline at 1800-883-2000.

Please render us your full co-operation by submitting the Census form early. If we do not receive your return from the Internet by the due-date indicated in your letter, our telephone interviewers will call your house. The telephone interviewers will provide proper identification. Census fieldworkers who carry official ID card or appointment letter will visit you only if we are unable to contact you via telephone or have not received your Census returns from the Internet.

Confidentiality of Data Ensured

The information you provide is secure and protected. Your answers are kept in the strictest confidence, as safeguarded by the Census Act (Chapter 35, Revised Edition 1991), and are used only to compile statistics. So, although you are required by law to provide the information requested in the Census 2000, be rest assured that you are also protected by that law.

Key Information for Census 2000

The information collected includes social, demographic items as well as topics of current interest. Here are some of the information that you will need to provide.

On Households

Members living in household and their whereabouts, relationship of members with head of household.

For Persons Living Overseas

Country presently in, purpose for living abroad, duration overseas.

On Education

Level of education attending, name of school, highest qualification attained, field of study, country and year where highest qualification was attained.

For Working Persons

Economic status, occupational status, name of firm, main type of business, job title and number of hours worked last week.

On Job Mobility

Duration of present job, previous job, previous industry.

For persons not working

Whether person has worked before, action taken to look for work, reason for not working.

For elderly persons aged 65

Elderly information, ambulant status, source of financial support.

For ever-married females

Age of first marriage and number of children born.

Other Information

Language literacy, religion, mode of transport to school or work, overseas travel in the last 12 months.

For more information, please visit us at www.census.gov.sg

Appendix I

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CENSUS OF POPULATION OFFICE
SINGAPORE DEPARTMENT OF STATISTICS
40 Scotts Road, #09-00 Environment Building, Singapore 228231
Fax : 65-8349577 Census Homepage : http://www.census.gov.sg

Internet web site address: 网址: **Alamat laman web Internet:** இணைய முகவரி:	
House ID*: 住户户码: **ID Rumah*:** வீட்டு அடையாள எண்:	
Password*: 通行码*: **Kata Laluan*:** கடவுச்சொல்:	
Due Date for Internet Submission: 通过网站网络提交资料截迟日期: **Tarikh Akhir Bagi Penghantaran Melalui Internet:** இணையத்தில் அனுப்பக் கடைசி நாள்:	
Please call us by: 电话预约的截迟日期: **Sila hubungi kami menjelang tarikh ini:** எங்களை தயவுசெய்து:	

*House ID & Password printed in lower case

Dear Sir/Madam

POPULATION CENSUS 2000

Singapore's Population Census 2000 will be conducted from April to September 2000. The Census collects key information on the population to be used for planning programmes and services. You may wish to note that this is the thirteenth Census conducted in Singapore and the fourth since Independence.

We would like to inform you that your household has been selected as a respondent in the main sample of the Census. You are requested to complete and submit the Census questionnaire. For details of the Census, please refer to the enclosed pamphlet.

Internet Submission

If you have Internet access, we encourage you to fill in the on-line Census questionnaire via the Internet. We have enclosed an Internet Guide to assist you. To log in and retrieve the Census form, please enter the Internet web site address, followed by House ID and Password plus the NRIC/FIN numbers of 2 members. If you are a one-person household, you only need to enter your own NRIC/FIN number. If your NRIC/FIN entered do not match with our records due to delay in database updating, you could still proceed to retrieve a blank Internet form to fill in. For security reasons, kindly keep the Internet web site address, your House ID and Password confidential.

The due date of Internet Submission is given above. If you encounter technical difficulties, please call the Census hotline at 1800-883-2000 (9am to 9pm, Mondays to Sundays).

Telephone Interviews

As we do not have your telephone number in our record, we would like to urge you to call our hotline 1800-883-2000 for an immediate telephone interview. If you prefer to be interviewed at a later date, please call the hotline to provide your contact number eg office or home telephone number by the due date (given above) for our interviewers to call you. Our interviewers will identify themselves as Census officers and quote your House ID.

If you wish to have a face-to-face interview, you may inform us by dialling 1800-883-2000. Census fieldworkers, identifiable by an ID card and appointment letter, will only visit your house if no response is received via Internet or telephone.

The conduct of the Population Census is governed by the Census Act (Chapter 35) which requires you to provide the necessary information. The Act also ensures that the confidentiality of your return is safeguarded.

We look forward to your participation in the Population Census. In appreciation of your efforts, we are pleased to enclose the specially-designed Census souvenir with our compliments.

Thank you for your co-operation and assistance.

Yours faithfully

MRS LEOW BEE GEOK
SUPERINTENDENT OF CENSUS
SINGAPORE

2000年人口普查

统计局将在2000年4月到9月间展开2000年人口普查，收集有关新加坡人口的重要资料，供当局规划发展政策和服务之用。这次普查是新加坡有史以来的第15次，也是独立以来的第4次。

您的住户已被选为普查的抽样部分的受访住户。请您填写并呈交人口普查问卷。如果您想了解有关这次普查的详情，请参阅随函附上的小册子。

通过国际网络呈交资料

如果您可以接触国际网络，我们鼓励您通过国际网络填写网上普查问卷。请参考所附的国际网络提交资料指南。登入并阅读普查问卷表：请先输入网址、住户户码和通行码，以及两名家庭成员的国民登记身分证/外籍人士身分证号码。如果您是住户的唯一成员，则只需填写您的身分证号码即可。万一由于我们无法及时更新数据库，造成您输入的身分证号码与我们的记录不符，您仍然可以继续下去，填写一份空白问卷填写。为安全起见，网址、您的住户户码和通行码均需保密。

上面已注明通过国际网络提交资料的截止日期。如果您有任何技术问题，请拨1800-883-2000人口普查热线（星期一至星期日，上午9点至晚上9时）

电话访谈

我们的记录中没有您的电话号码。因此，请您尽快拨我们的热线1800-883-2000接受电话访谈。如果您想要约电话访谈的日期，请在信头注明的截止日期之前拨本局热线，提供您的办公室或住宅等联络电话，以便我们的访员与您联络。本局访员将会表明普查员身份，并报出您的住户户码。

如果您希望接受当面访谈，则可拨1800-883-2000通知我们。以及在网络或电话方面都没有收到任何回音时，本局的外勤人员才会登门造访，他们都携带委任证和身分卡，以资辨认。

人口普查是根据《普查法令》（第35章）进行的，它要求您提供必需的资料。《普查法令》也确保您所提供的资料严格保密。

盼您积极参与普查工作，为感谢您的支持，请附上特别设计的普查纪念品。

感谢您的合作和协助。

BANCI PENDUDUK 2000

Banci Penduduk Tahun 2000 Singapura akan dijalankan dari April hingga September 2000. Banci ini mengumpul maklumat penting mengenai penduduk yang akan digunakan untuk merancang berbagai-bagai program dan perkhidmatan. Anda mungkin ingin tahu bahawa ini merupakan Banci yang ke-15 yang dijalankan di Singapura dan yang keempat sejak negara mencapai kemerdekaan.

Kami ingin memaklumkan kepada anda bahawa keluarga anda telah dipilih sebagai responden dalam contoh ujian Banci ini. Anda diminta untuk melengkapkan dan menghantar borang soalselidik Banci. Untuk mendapatkan butir-butir mengenai Banci ini, sila rujuk kepada risalah yang disertakan.

Penghantaran Melalui Internet

Jika anda mempunyai akses Internet, kami ingin menggalakkan anda untuk mengisi borang soalselidik Banci secara on-line menerusi Internet. Kami lampirkan bersama ini Panduan Internet untuk membantu anda. Untuk memasukinya dan mengambil borang Banci, sila masukkan alamat laman web Internet, diikuti dengan ID Rumah dan Kata Laluan serta nombor Kad Pengenalan/Nombor Pengenalan Asing milik dua orang anggota keluarga. Jika anda satu-satunya seorang anggota dalam keluarga, anda hanya perlu memasukkan nombor Kad Pengenalan/Nombor Pengenalan Asing anda. Jika nombor Kad Pengenalan/Nombor Pengenalan Asing anda yang dimasukkan tidak sama dengan rekod kami disebabkan oleh keterlambatan untuk memperbaharui pangkalan data, anda masih boleh terus mengambil borang Internet yang kosong untuk diisikan. Atas sebab-sebab keselamatan, rahsiakan alamat laman web Internet, nombor ID Rumah dan Kata Laluan anda. Tarikh akhir bagi Penghantaran Melalui Internet diberikan di atas. Jika anda menghadapi masalah teknikal, sila hubungi talian segera Banci di nombor 1800-883-2000 19 pagi hingga [illegible] malam, Isnin hingga Ahad.

Temuramah Melalui Telefon

Oleh kerana kami tidak mempunyai nombor telefon anda di dalam rekod kami, kami harap anda menghubungi talian 1800-883-2000 untuk mengadakan temuramah telefon dengan segera. Jika anda ingin ditemuramah pada satu tarikh lain, sila hubungi talian tersebut untuk memberi nombor telefon bagi menghubungi anda seperti nombor telefon pejabat atau rumah anda tidak lewat daripada tarikh yang telah ditetapkan untuk membolehkan para penemuramah kami menghubungi anda. Mereka akan mengenalkan diri mereka sebagai pegawai Banci dan menyebut ID Rumah anda.

Jika anda ingin ditemuramah secara bersemuka, anda boleh memberitahu kami dengan menghubungi talian 1800-883-2000. Kakitangan Banci yang boleh dikenali dengan Kad Pengenalan dan surat perlantikan mereka, hanya akan mengunjungi rumah anda jika anda tidak memberi jawapan melalui Internet atau telefon.

Banci Penduduk yang akan dijalankan tertakluk di bawah Akta Banci (Bab 35) yang menghendaki anda memberi maklumat yang perlu. Akta ini juga memberi jaminan bahawa kandungan borang soalselidik yang anda berikan akan dirahsiakan.

Kami harap anda dapat menyertai Banci Penduduk ini. Sebagai menghargai usaha anda, dengan sukacita kami sertakan sebuah cenderamata Banci yang direka bentuk khas sebagai hadiah ikhlas daripada kami.

Terima kasih di atas kerjasama dan bantuan anda.

[illegible] 2000

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

CONFIDENTIAL

CENSUS OF POPULATION OFFICE
SINGAPORE DEPARTMENT OF STATISTICS
40 Scotts Road, #09-00 Environment Building, Singapore 228231
Fax : 65-8349577 Census Homepage : http://www.census.gov.sg

XX April 2000

Internet web site address:	
House ID*:	
Password*:	
Due Date for Internet Submission:	
Please call us by:	

* Household ID & Password printed in lower case

Sir/Madam

POPULATION CENSUS 2000 – REMINDER LETTER#

About four weeks ago, the Population Census Office sent a notification letter to inform that your household was selected for the Population Census 2000.

To date, we have not received any Census returns from your household. We would be grateful if you could submit the returns as soon as possible. You could choose to submit via the Internet, telephone or face-to-face interview.

Internet Submission
If you have Internet access, we encourage you to submit your returns via the Internet. We have extended the due-date for Internet submission in your case. If you encounter technical difficulties, please call the Census hotline at 1800-883-2000 (9 am - 9 pm, Mondays to Sundays).

Telephone Interview
Alternatively, please call our hotline at 1800-883-2000 for an immediate telephone interview or fix an appointment to be interviewed at a later date.

For some households, we do not have your telephone number in our records. We would appreciate it if you could submit either via the Internet or call in to submit via telephone before the due-date indicated above.

If we do not receive your returns via the Internet or telephone by the stipulated due-date, our Census officers will visit your household to obtain the necessary information.

Please note that the Population Census is conducted under the Census Act (Chapter 35, Revised Edition 1991) which requires you to provide the necessary information.

I look forward to hearing from you. Thank you for your co-operation and assistance.

Yours faithfully

MRS LEOW BEE GEOK
SUPERINTENDENT OF CENSUS
SINGAPORE

Please ignore this letter if you have already submitted your information for the Census.

CONFIDENTIAL

CENSUS OF POPULATION OFFICE
SINGAPORE DEPARTMENT OF STATISTICS
40 Scotts Road, #09-00 Environment Building, Singapore 228231
Fax : 65-8349577 Census Homepage : http://www.census.gov.sg

XX June 2000

House ID*:	
Final Due Date Submission:	

* Household ID printed in lower case

Sir/Madam

POPULATION CENSUS 2000 – SECOND REMINDER LETTER#

The Census Office has sent you a notification letter sometime between March and May 2000 to inform that your household was selected for the Census 2000. As there was no response, a first reminder letter was sent.

We are now in the final phase of completing the data collection for the Census 2000. Our records indicate that there are some households that have not yet responded and others with incomplete Census returns.

For the households who have not responded, you are requested to submit your Census returns as our officers have been unable to contact you. We have extended the Census hotline at toll-free number 1800-883-2000 (9am-9pm, daily) to assist you to submit your Census returns **within the next 7 days**. Please take note of the final due-date for submission indicated above.

For households with incomplete returns, our officers will visit your household to obtain the necessary information. These officers will carry letters of appointment and ID badges to identify themselves as Census officers. Alternatively, you could call the Census hotline to furnish the required information within the next 7 days.

Please note that under the Census Act (Chapter 35, Revised Edition 1991), you are required to provide the necessary information. The Census Act has provisions on the penalties for those who do not comply with the Act.

We would be grateful for your co-operation in this final phase of the Census operation.

Yours faithfully

MRS LEOW BEE GEOK
SUPERINTENDENT OF CENSUS
SINGAPORE

Please ignore this letter if you have already submitted your information for the Census.

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CENSUS OF POPULATION OFFICE
SINGAPORE DEPARTMENT OF STATISTICS
100 High Street, #05-01 The Treasury, Singapore 179434
Fax : 65-720 2313 Census Homepage : http://www.census.gov.sg

29 Mar 2000

Dear Sir/Madam

CENSUS OF POPULATION: ENUMERATION OF WORK PERMIT HOLDERS

The Census of Population Office will be conducting the 2000 Census of Population from April to September 2000. Census 2000 collects key information on the population in Singapore. To obtain a complete profile of all persons living in Singapore, we need to enumerate the work permit holders.

2 In this connection, we would appreciate it if you, or a **senior personnel** in your organisation, could fill in the enclosed Census questionnaire. Some information on the work permit holders from your organisation, which are available from existing records, have been pre-printed. Please check or update the pre-printed information and provide the additional information in the questionnaire(s).

3 Census 2000 is conducted under Census Act (Chapter 35, Revised Edition 1991). You are obliged under the Act to provide the information as specified. Information supplied by you will be treated in the strictest confidence and used for statistical purposes only. We would appreciate receiving your questionnaire by **15 Apr 2000**.

4 If you need additional questionnaires or assistance in completing the form, kindly contact our officer(s)-in-charge at 720 2302 / 720 2303 / 720 2304.

Thank you for your kind co-operation and prompt reply.

Yours faithfully

MRS LEOW BEE GEOK
SUPERINTENDENT OF CENSUS
SINGAPORE

EXPLANATORY NOTES TO ASSIST YOU IN FORM FILLING

Pre-printed Information

The pre-printed information should be checked or updated. They include the employee's: Foreign Identification Number, name, sex, date of birth, citizenship and ethnic group.

Information Asked

The additional information listed below should be filled in by the employer. Some options are provided to assist you in form filling.

Marital Status

The employee's Marital Status could include one of the following: single (never married), married, widowed, separated or divorced.

Residential Address in Singapore

This refers to the employee's place of residence in Singapore. If no official address is available, please indicate the 6-digit postal code. If the 6-digit postal code is not available, please provide the 2-digit sector code (that is, the last 2 digit of the *old* 4-digit postal code).

Type Of Dwelling

The type of dwelling could include one of the following:

- HDB 1-Room
- HDB 2-Room
- HDB 3-Room
- HDB 4-Room
- HDB 5-Room
- Executive/Maisionette Apartment
- HUDC Flat
- HDB 6-Room or more/Multi-generation
- HDB residential dwelling units other than flats
- Government Executive Flat
- Other Public Flat
- Shophouses other than HDB
- Floor of Shophouses other than HDB
- Executive Condominium
- Condominium Private Flat
- Semi-Detached Bungalow/House
- Other Private Flat/Apartment
- Bungalow/Detached House/Linked House
- Terrace House/Town House
- Condominium Bungalow/Detached House
- Condominium Semi-Detached Bungalow/House
- Condominium Terrace House
- Attap/Zinc-Roofed/Wooden House
- Labour Lines/Quarters
- Construction Sites, makeshift quarters
- Non-residential Buildings (eg. Factories, warehouses, workshops, office premises, etc)

Highest Qualification Attained

The Highest Qualification Attained could include one of the following:

- No formal education
- Lower Primary *(equivalent to Primary education without PSLE)*
- Primary *(equivalent to PSLE)*
- Lower Secondary *(equivalent to Secondary education without GCE 'O'/ 'N' level or basic vocational certificate)*
- Secondary *(equivalent to at least 1 GCE 'N'/ 'O' level pass or NTC Grade 3)*
- Upper Secondary *(equivalent to GCE 'A' level or NTC Grade 2/ NTC Grade 1)*
- Diploma from Polytechnic/Qualification by professional bodies *(equivalent to diploma, advanced diploma or post-diploma)*
- University *(bachelor degree/first degree)*
- University Postgraduate Studies *(postgraduate diploma, Masters or Doctorate)*

Occupation

This reflects the employee's job title and/or main task of duties performed by him/her.

Total Monthly Income

This refers to income earned from work, including overtime pay and monthly bonuses (if any). To obtain monthly bonus, please take annual bonus divided by 12 months. The figure entered should be expressed in Singapore dollars.

Mode of Transport to Work

The Mode of Transport to Work refers to the usual means of transport taken by the employee to work. It could consist of one or more of the following modes of transport:

- Public bus
- Private Charter/Company bus or van
- MRT
- Taxi
- Car (self-drive)
- Car (passenger)
- Lorry/Pick-up
- Motorcycle/Scooter
- Bicycle
- Boat/Ferry
- Walk only – No transport required
- LRT
- Others

No. of Hours Worked Last Week

This should include paid/unpaid overtime hours. If the employee was not working last week, please indicate the no. of hours worked in the week prior to the reference week.

Skill Type

The Skill Type refers to the type of pass that has been issued by the Ministry of Manpower.

It should include one of the following: R passes, Q1 passes, Q2 passes, P1 passes and P2 passes.

Acronyms Used in Census 2000

Acronym (in alphabetical order)	Description
ACE	Advanced Coding Environment
ADR	Advanced Data Release
AHM	Absentee Household Members
ASC	Assistant Superintendent of Census
CATI	Computer Assisted Telephone Interviewing
CED	Census Enumeration Database
CEIS	Commercial Establishment Information System
CMS	Census Management System
CPC	Census Planning Committee
CR Number	Company Registration Number
DCS	Data Coding System
DGP	Development Guide Plan
DMZ	Demilitarised Zone
DOS	The Singapore Department of Statistics
DVD	Data Verification Database
DVS	Data Verification System
EDMS	Electronic Data Management System
EPH	Employment Pass Holders
ESS	Electronic Submission System
ETR	Electronic Transmission of Returns
FAQs	Frequently-Asked Questions
FASTAB	Flexible and Swift Tabulation
FIN	Foreign Identification Number
FW	Fieldwork
FWCT	Fieldwork Coordinating Team
FWS	Fieldwork System
GHS	General Household Survey
GUI	Graphical User Interfaces
HRD	Household Registration Database
IBM	International Business Machines Pte Ltd
ICR	Intelligent Character Recognition
ID	Identification Number
IDA	Infocomm Development Authority of Singapore
ILO	International Labour Organisation
ISCO-88	International Standard Classification of Occupations 1988
ISIC	International Standard Industrial Classification
IT	Information Technology
KRDL	Kent Ridge Digital Labs
LAN	Local Area Network
MCDS	Ministry of Community Development and Sports

Acronym (in alphabetical order)	Description
MCIT	Ministry of Communications and Information Technolgy
MHA	Ministry of Home Affairs
MINDEF	Ministry of Defence
MITA	Ministry of Information and the Arts
MND	Ministry of National Development
MOE	Ministry of Education
MOM	Ministry of Manpower
MRT	Mass Rapid Transit
MTI	Ministry of Trade and Industry
NCA	National Coded Address
NCS	National Computer Systems Pte Ltd
NDD	National Database on Dwellings
NRIC	National Registration Identity Card
OCR	Optical Character Recognition
ODBC	Open Database Connectivity
OMR	Optical Mark Recognition
PC	Personal Computer
PDs	Postal Districts
POH	Persons living Overseas with their Household
PR	Permanent Resident
PWD	Public Works Department
RO	Regional Office
SCS	Singapore Computer Systems Pte Ltd
SFS	Survey of Foreigners in Singapore
SI	Systems Integrator
SIF	Singapore International Foundation
SingPost	Singapore Post Pte Ltd
Singtel	Singapore Telecommunications Pte Ltd
SIR	Singapore Immigration and Registration
SSEC	Singapore Standard Education Classification
SSIC	Singapore Standard Industrial Classification
SSN	Statistics Singapore Newsletter
SSOC	Singapore Standard Occupational Classification
TCS	Television Corporation of Singapore Pte Ltd
TPL	Table Programming Language
TV	Television
UIN	Unique Identification Number
UN	United Nations
URA	Urban Redevelopment Authority
WPH	Work Permit Holders

PROJECT TEAM

Editors :		Mrs Leow Bee Geok Mr Kenneth Goh	
Consultant on sample design and sampling variance write-up:		Assoc. Prof Chua Tin Chiu	
Chapter 1	Writers:	Kenneth Goh	Koh Eng Chuan
Chapter 2	Writers:	Kenneth Goh	Mrs Fiona Yip
Chapter 3	Coordinator:	Kenneth Goh	
	Writers:	Koh Eng Chuan Mrs Fiona Yip Edward Lim	Mrs Tay-Loo Chia Min Tan Kian Heng Ms Lee Gek Lan
Chapter 4	Coordinator:	Kenneth Goh	
	Writers:	Koh Eng Chuan Khoo Soon Lee Mrs Fiona Yip Edward Lim Ms Chow Lay Lian Ms Yeo Yen Fang	Ms Lee Gek Lan Ms Tay Li Jade Ms Rachel Goh Ms Ng Siew Siew Ms Jung Hwi Leng Ms Loh Yin Ling
Chapter 5	Coordinator:	Ms Yim Seow Hua	
	Writers:	Khoo Soon Lee Mrs Fiona Yip Edward Lim Ang Chuan Huat	Ms Lee Gek Lan Ms Jung Hwi Leng Ms Lam Hoi Shan
Chapter 6	Writers:	Koh Eng Chuan	Ms Tan Yeow Lip
Appendices prepared by:		Koh Eng Chuan Mrs Fiona Yip Ang Chuan Huat	Mrs Tay-Loo Chia Min Tan Kian Heng Ms Adeline Chia
Administrative Support:		Mrs Tay-Loo Chia Min Ms Goh Ting Fei	Mdm Latifah Bte Jamir Ms Shirley Tio