

Services, Science and Technology Division Division des services, des sciences et de la technologie



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DATA SOURCES ON SCIENTISTS, ENGINEERS AND TECHNOLOGISTS

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1.0 Introduction

The purpose of this document is to provide relevant information on a selection of sources of data produced by Statistics Canada allowing identification of the labour force in science and technology. This basic information will serve as a guide for people wishing to obtain elementary data or carry out in-depth research in this subject.

In this document, the information will be presented in such a way that the reader will be able to become familiar with the variables, determine what the data are, find the relevant information on the processing of the responses, and evaluate the comparability of the sources of data.

The Services, Science and Technology Division of Statistics Canada defines scientists, engineers and technologists in accordance with the professions listed in the Standard Occupational Classification.¹

Scientists and technologists are divided into the two following major professional categories:

Natural Sciences

- specialized workers in the physical sciences
- specialized workers in the biological and agricultural sciences
- architects and engineers
- other workers in architecture and engineering
- mathematicians, statisticians, and systems analysts

Social Sciences

- · specialized workers in the social sciences
- social workers and workers in related fields
- specialized workers in libraries, museums, and archives
- other workers in the social sciences and related fields

Also included in the category of workers in science and technology are university and community college professors, who contribute to the advancement of knowledge in science and technology and to the training of a qualified workforce in these scientific areas. According to the Standard Occupational Classification, this category is defined as follows:

Professors and Ranked Staff

- university professors and ranked staff
- technical and professional school professors
- postsecondary professors, n.e.c.

In addition to their professions, scientists, engineers and technologists may be identified by their academic profiles. For this purpose, it is necessary to know their main field of study or professional course. This variable makes it possible to analyze the human capital stock available to provide new generations of workers in science and technology, and to evaluate their academic profiles. By introducing this variable as a source of identification of persons working in science and technology, we widen the field of analysis of the labour force to include the population as a whole (generally 15 years of age or older).

In the absence of data on the field of study, degrees are a useful source of information on the educational level of the labour force in science and technology.

By combining the data on occupation and academic background, we come close to the UNESCO definition of scientists, engineers and technologists as persons who work in these professions and have postsecondary training in the sciences.²

We will examine the sources of data as a function of the presence of one or more indicators, such as data on the profession or field of study, which demonstrate the presence of persons working in science and technology.

2.0 Sources of Statistical Data on Scientists, Engineers and Technologists: Inventory and Discussion

Scientists, engineers and technologists contribute to the production, dissemination, and application of scientific knowledge and techniques that allow Canadians to improve their productivity, export their expertise, and stimulate Canada's economic growth.

In a world of constant technological change in a very competitive market, it is vital to draw a valid portrait of the stock of human capital in the areas of science, engineering, and technology. Like all industrialized countries, Canada is no exception to this rule. The human potential employed in these areas is an important indicator that makes it possible to measure the dynamism of scientific activity in Canada.

The Services, Science and Technology Division of Statistics Canada carries out a series of surveys on scientific and technical activities, which make it possible to obtain data on human resources in federal, provincial, commercial, higher education and non-profit organizations.

By scientific activities, we mean those related to research and experimental development (R&D) and those in related scientific activities (RSA). The human resources allocated to scientific activities are defined in terms of person-years. They are counted according to whether they work in R&D or in RSA.

The purpose of all of these surveys is to examine the number of person-years allocated to science and technology as one of the indicators of scientific activity in Canada. Nevertheless, these surveys do not make it possible to draw a complete socio-economic portrait of scientists, engineers and technologists.³ In order to determine the socio-demographic characteristics of this target population, it is necessary to review the data produced by other surveys or censuses.

The first step of this source analysis involves the isolation of variables that may be used to identify persons working in these areas. This exercise made it possible to identify the following sources of data, which will be briefly analyzed in the next chapter. These are:

- the 1971, 1981, and 1986 Population Censuses;
- the 1973 Postsecondary Highly Qualified Manpower Survey;
- the 1976, 1982, and 1986 National Graduates Surveys;
- the Labour Force Survey;
- the Current Population Profile Survey;
- the Labour Market Activity Survey, carried out annually since 1986;
- the cyclical General Social Survey;
- the Annual Survey of Educational Staff in Community Colleges and Universities; and
- the Annual Surveys of Students in Community Colleges and Universities.

The background, objective(s), concepts and definitions, methodology, data collection and processing, and edit and imputation for each source of data will be discussed.

The information discussed is not exhaustive. However, the reader will find a general overview of the nature of the surveys or censuses, as well as a complete list of reference documents in the bibliography.

The comparison of data sources will be carried out on the basis of the following criteria:

- (1) concepts and definitions;
- (2) coverage;
- (3) date of data collection;
- (4) methodology;
- (5) data linkages.

Concepts and Definitions

In the 1971, 1981, and 1986 censuses, the 1970 and 1980 Standard Occupational Classifications were used. The codes for the classifications used in the censuses to identify scientists, engineers and technologists may be found in Appendix III.

The "profession" variable introduces the concept of the labour force. Before carrying out the chronological analyses, it is important to emphasize that this concept changed between the 1971 census and the 1986 census. The aspects that were modified are (1) the exclusion of inmates in institutions from the non-working population in 1981 and 1986; (2) in 1981 and 1986, the inclusion in the labour force of persons who had been looking for work for at least four weeks before the census (one week in 1971), not taking into account, as was the case in 1971, any reasons that might prevent them from looking for work; (3) the exclusion, in 1981, of persons who were in school full-time and could not start in a new job; and (4) the inclusion, in 1981 and 1986, of unemployed people who would start in a new job within the four weeks following the census (no time limit in 1971).⁴

The concepts of the censuses and the Labour Force Survey are roughly comparable. In the same way, it is possible to establish comparability between the concepts of these sources of data and those of the Labour Market Activity Survey. The National Graduates Surveys, the General Social Survey, and the Current Population Profile Survey also provide data on professions in accordance with the Standard Occupational Classification. However, not all these surveys use the same time frames for the concepts of working, unemployed, or inactive persons.

Finally, it is possible to obtain annual data on the educational staff at colleges and universities, but these data only include persons who are working or on sabbatical.

Coverage

In relation to a source of data, coverage means the geographical coverage and the area of observation of the survey or census.

The censuses, the postcensal Highly Qualified Manpower Survey, the Surveys of Staff and Students in Community Colleges and Universities, and the 1982 and 1986 National Graduates Surveys cover all of Canada.

The other surveys exclude the Northwest Territories and the Yukon. However, unlike the surveys, the censuses may produce reliable data at subprovincial levels with low population densities.

The Surveys of Students in Community Colleges and Universities cover all Canadian teaching institutions; while the other surveys are based on specific samples from each of them.

Like the National Graduates Survey, the Surveys of Students in Community Colleges and Universities cover the population registered in Canadian teaching institutions. One of the peculiarities of these surveys is that one can analyze their results from the point of view of the flux of entries, as the registration at all academic levels is known on an annual basis.

The 1973 Postcensal Highly Qualified Manpower Survey and the 1976, 1982, and 1986 National Graduates Surveys also cover the population holding diplomas, degrees, or certificates. The comparability of these surveys stops at this level, as the sampling frames are different. In fact, the Postcensal Highly Qualified Manpower Survey's samples came from the 1971 census, while the National Graduates Survey takes its samples from graduates of Canadian teaching institutions.

As for the censuses, the 1981 and 1986 long population questionnaires include one out of five households, in comparison with one out of three in 1971.

The sampling plan for the Labour Force Survey (LFS) is the basis of the sampling plans for these two surveys: the Current Population Profile Survey and the Labour Market Activity Survey.

The censuses, the LFS, the Current Population Profile Survey, and the General Social Survey all deal with the population over 15 years of age, with the exception of inmates in institutions (except in the 1971 census, which included inmates in institutions).

The Labour Market Activity Survey covers the population between 16 and 69 years of age.

The Surveys of Students in Community Colleges and Universities and the National Graduates Surveys do not include any age limits.

Date of Data Collection

The 1986 and 1981 censuses took place on June 3rd of each of those years; while the 1971 census took place on June 1st.

The Survey of Students in Community Colleges and Universities takes place on December 1st of each year.

The National Graduates Surveys took place in April 1980, 1986, and 1988. The postcensal Highly Qualified Manpower Survey took place between September and December 1973, and the Current Population Profile Survey was held in August 1982.

The Labour Force Survey is carried out every month, with the survey ending by about mid-month.

The Labour Market Activity Survey has been held in January and February since 1986, at the same time as the Labour Force Survey.

Finally, the General Social Survey was held between January 20th and February 25th in 1989.

Methodology

The censuses, the 1973 Postcensal Highly Qualified Manpower Survey, the Labour Market Activity Survey, and the National Graduates Survey all require the respondents to fill out questionnaires and return them by mail. An exception to this general rule is that, in certain census regions, on-site collections or interviews are carried out (for more details, please see Section 3.1.4). This type of survey is usually accompanied by instructions to guide the respondent.

The other surveys were conducted by telephone from the Statistics Canada offices.

More details on the survey methodology of each of these sources may be found in the next chapter.

Data Linkages

The 1986 and 1971 censuses, the 1976, 1982, and 1986 National Graduates Surveys, and the Postcensal Highly Qualified Manpower Survey provide a complete academic and professional picture of scientists, engineers and technologists. These sources of data provide information on occupation, academic background and field of study. Nevertheless, it must be pointed out that the 1973 Postcensal Highly Qualified Manpower Survey dealt only with persons at the university level.

The 1981 census does not indicate the major field of study of scientists, engineers and technologists, but it does provide information on their occupations and level of education.

The Current Population Profile Survey and the General Social Survey make it possible to define the occupations and the major field of study of the respondents.

Finally, the Labour Force Survey and the Labour Market Activity Survey provide data on the profession. However, the regularity of the LFS is an essential asset to determine the economic characteristics of the labour market on a monthly basis.

3.0 Summary Presentation of Data Sources on Scientists, Engineers and Technologists

3.1 1971, 1981, and 1986 Population Censuses

3.1.1 Background

The Canadian Census Act dates from 1870, shortly after the British North America Act came into force in 1867. The first census was held in 1871, and covered the provinces of Quebec, Ontario, Nova Scotia, and New Brunswick. Until 1951, the census was held every ten years. However, due to the rapid growth of the population in the Canadian West, this was changed to every five years.

More recently, the 1970 Statistics Act stipulates that "A census of population shall be taken by Statistics Canada in the month of June in the year 1971, and every fifth year thereafter, in a month to be fixed by the governor in council."⁵

3.1.2 Objectives

The implementation of a wide range of laws and regulations, such as the 1977 Federal-Provincial Fiscal Arrangements and Federal Postsecondary Education and Health Contributions Act, the Official Languages Act, and the Canada Health Act, etc. is based on census data. Furthermore, the number of seats allocated to each province in the House of Commons is also based on census data.

It is possible to identify scientists, engineers, and technologists on the basis of census data according to the following variables: profession (1971, 1981, and 1986 censuses); major field of study (1986 census); and type of professional course (1971 census).

The question of the major field of study was asked for the first time in the 1986 census, in order to determine the skills of the labour force and to plan basic academic and retraining programs.

The question on profession was asked in the 1971, 1981, and 1986 censuses in order to forecast future needs in the labour market, and train people for new jobs.

Finally, the question on degrees, certificates, and diplomas in the 1971, 1981, and 1986 censuses made it possible to determine whether our human resources were sufficient to meet future needs in the areas of technology, the sciences, engineering, and social services.

In the 1971 census, the purpose of the question on professional training was to "establish the elements of information upon which the policy to be followed in this area would be based" (i.e. manpower training and adult retraining programs).⁶

3.1.3 Concepts and Definitions

Vocational Training

The data on variables concerning vocational training were derived from question 25 of the 1971 census.

Within the framework of that census, there were questions about the date of completion, and the duration, field, and type of vocational training. The field of vocational training is defined as the "area of apprenticeship or other full-time vocational course, for example carpentry, hair-dressing, drafting, etc."⁷

Educational Level

The data on variables involving educational level were derived from question 22 in the 1986 census, question 34 in the 1981 census, and questions 23 and 24 in the 1971 census.

The data on educational levels were derived from the variables of the highest level of schooling included in the 1981 and 1986 censuses, and from the questions on postsecondary education (in or out of the university) in the 1971 census.

In the 1981 and 1986 censuses, the highest level of schooling reached is defined as "the last year of study, completed or not, at the primary or secondary levels, or last completed year of university."⁶

In the 1971 census, non-university postsecondary education is defined as "attendance at trade or business schools, technical institutes, community colleges, CEGEPs, normal schools, nursing schools, etc."⁹ On the other hand, postsecondary university education is defined as the "number of years of university education."¹⁰

Major Field of Study

The data on the major field of study variable were derived from question 23 in the 1986 census.

The 1986 census dictionary defines this variable as "the main discipline or major field of study or training of the respondents, where they received their highest postsecondary degree, certificate or diploma."¹¹

Based on the definition of the major field of study used in the 1986 Canadian census, training in science and technology may be defined in accordance with the fields of study described in Appendix II.

In contrast to profession, the major field of study, like the type of professional training, does not guarantee that a person works in the field of science and technology, despite his or her specific training. However, data on the major field of study or type of professional training provide valuable additional information on the level of training of scientists, engineers and technologists.

Profession

The data on the profession variable were derived from question 29 in the 1986 census, question 43 in the 1981 census, and question 36 in the 1971 census.

The 1981 and 1986 censuses defined this variable as the type of work in which the respondents were engaged during the reference week (one week before the census - the 3rd of June in 1981 or 1986).¹² If the person was unemployed during the week before the census, the data deal with the employment that he/she occupied for the longest time since January 1st of 1980 or 1985. Persons with two or more jobs had to provide information on the job at which they worked the most hours.

The profession applies to the population who had worked since the 1st of January in 1985, 1980, or 1970. This work period is an integral part of the activity concept. The 1981 and 1986 censuses attribute activity in the job market to all persons of working age who, during the week before the 3rd of June in 1981 or 1986, were part of the employed labour force or the unemployed labour force. Other persons of working age who were neither working nor unemployed were classified as inactive. Data are available for all persons aged 15 years and older, with the exception of inmates in institutions.

The working labour force includes all persons aged 15 years and older, except for inmates in institutions, who worked for the last time during 1980 (1985) or 1981 (1986). They had to be either working or absent during the reference week.

The unemployed labour force includes all persons aged 15 years and older, except inmates in institutions, who: (1) have looked for work during the last four weeks; (2) have found a new job that will start within four weeks or less; or (3) are temporarily laid off. In the 1971 census, activity followed the same concepts as those of the above censuses, except that inmates in institutions were included in the universe, and were categorized as inactive.

3.1.4 Methodology

The main stages of census-taking are: (1) consultation with users, in order to discuss the contents of the census; (2) production of questionnaires, including the national test; (3) public consultation to define the line of products; (4) data collection; (5) assimilation of the data; (6) edit and imputation; (7) evaluation of the quality of the data; and (8) marketing the products of the census.

This document will deal with points 4 to 7.

Population Coverage

The census produces a series of documents including the short and long questionnaires for the population living in private or collective households. The basic questions that make it possible to identify persons working in science and technology are found on the long questionnaire distributed to the sampled population. This questionnaire went to one household in five in 1981 and 1986, and one household in three for the 1971 census.

The questions on education covered the population aged 15 years and older, but excluded inmates in institutions (except for the 1971 census, which included inmates in institutions).

The question dealing with the major field of study in the 1986 census covered the population aged 15 years and older with a postsecondary degree, certificate or diploma.

The question on type of vocational training in the 1971 census covered the population aged 15 years and older who had already finished a full-time vocational training course lasting at least 3 months.

The question on profession in the 1971, 1981 and 1986 censuses covered the population aged 15 years and older, except for inmates in institutions (in 1971 they were considered inactive). However, the person must have worked since January 1st of 1985, 1980 or 1970, depending upon the census year. The person also had to provide information on the job held during the reference period. If this person was unemployed during this week, he or she had to provide information on the longest period since January 1st of the year in question. If unemployed since January 1st of the year in question, and not looking for other work, the person was considered inactive.

Sampling

Since its introduction, the census has used the "jure" method, which counts the population at their usual place of residence. Since the 1971 census, the collection of basic data, has been essentially based on self-enumeration in large urban centres. This method has been found to be effective and inexpensive.

In addition to this self-enumeration method, there are other data collection methods suitable for particular field conditions. Thus, in small towns and rural areas, the questionnaire collection method is used. Finally, less than 2% of the population are enumerated in interviews. These include households located in remote areas, and Indian reserves.

Geographic Coverage

The census applies to all of Canada. Each household is enumerated. A household corresponds to one housing unit. The statistical information may be obtained at the level of the census area that corresponds to the minimum geographic base for the collection of information (each census-taker being responsible for collection in one area).

Statistical tables may be produced on the basis of standard geographic census regions, but non-standard geographic regions may also be created (economic regions, for example). These non-standard geographic regions are constructed on the basis of the blocks face, which consist of one side of the street between two intersections.

3.1.5 Data Collection and Processing

The censuses were held on the 3rd of June in 1986 and 1981, and the 1st of June in 1971.

The process of data assimilation is first done at the regional offices, where the integrity and coding of certain questions are manually verified, the data are entered directly into a computer system, and are manually and automatically checked.

The questionnaires and documents are then sent to the head office, where all of the documents are checked by comparing them with the number of persons enumerated.

3.1.6 Edit and Imputation

At the edit and imputation stage, the data are examined for errors such as illogical entries or missing values. In some cases, these are errors made by the respondents, but some are produced during coding or processing. After detection of the errors, the missing or incomplete entries are imputed, by assigning values in accordance with "deterministic" or "probabilistic" imputation.

Both methods were used in the census. In "deterministic" imputation, the errors are corrected by inferring the "correct value" on the basis of other responses on the questionnaire. The "probabilistic" approach selects an entry that has a given number of characteristics in common with the false entry, and imputes the missing information from the "donor" entry.

Two automatic systems are used to process census data: SPIDER and CANEDIT.

SPIDER is a system that works with logical tables that consist of a series of conditional operational statements that determine the logical steps followed by the computer. This system was developed to process the more complex census variables.

CANEDIT looks for a donor entry with characteristics similar to those of the entry that must be imputed. If no equivalent is found, the criteria are widened until a donor entry is found. The donor imputes a value that replaces the illogical or missing value.

The census imputation systems are used to correct inconsistencies in the variables themselves.

The quality of the education variables is controlled by comparing them with the age of the respondent. If there is a problem, the level of education is corrected, not the age. Furthermore, a certain coherence between the education variables is ensured. For example, the variable "major field of study" only applies to people who have studied at the postsecondary level, whether or not they completed their course. For this variable, a second check is made, by comparing the major field of study and the level of education. For example, a doctor should have a university education. In cases of non-response for this variable, a value is imputed according to the highest educational level and the profession. If the respondent has no profession, a response of "no specialization" is imputed.

The quality control of data on the profession is done by comparing them with data from previous censuses and with data from the Labour Force Survey. For the profession response to be valid, we ensure that the respondent forms part of the labour force aged 15 years and older. Edit and imputation of profession data are done by the CANEDIT system.

3.2 1973 Postcensal Highly Qualified Manpower Survey

3.2.1 <u>Background</u>

The survey was held in 1973, on the basis of data from the 1971 census.

3.2.2 Objective

The objective of this survey was to supplement the 1971 Census data on Canadian university graduates with additional information on their types of degree, their fields of study, their occupations, and their career profiles. The results of this study were used to formulate policy to plan educational programs for the training of a highly qualified workforce.

3.2.3 Concepts and Definitions

The concept of a highly qualified workforce involves a population holding a university degree, regardless of field of study.

The concepts of occupation and industry are based on the Standard Occupational and Industry Classification.

The concepts and definitions applied to the major field of study or to the level of education follow the Canadian University and College Standards (USIS and CCSIS).

3.2.4 <u>Methodology</u>

The survey included all respondents from the 1971 Census who reported a university degree.

Population Coverage

The questions on education involved a population sample from one in three households. This population must have reported a university degree.

Sampling

The sample was stratified by region, level of degree, occupation and whether or not the person worked in 1970 and/or 1971.

Each stratum was divided according to broad occupational groups, sex, and age. Three types of sub-strata were identified in each of these divisions: (a) a sub-stratum from which all persons were selected; (b) a sub-stratum from which random samples were selected; and (c) a sub-stratum from which no persons were selected for the purposes of the survey. Selected persons who were absent were not replaced.

Taking into account the socio-demographic characteristics of the population, the total population was weighted according to the size of the regions, level of education and occupation.

The final stage weighted the entries of each person for the following conditions: (1) persons outside the country for an indeterminate period; (2) refusal, outside the country during the survey, outside the country on government business, error of name or address and no degree; and (3) no response and no follow-up.

Geographic Coverage

The survey covered all of Canada. The data were published in the following regions: the Maritimes, Quebec, Ontario, the Prairies, British Columbia, the Yukon and the Northwest Territories.

3.2.5 Data Collection and Processing

Census files were chosen from the population sample. Each file carried a census identification number, the geographic region, background of the persons and the household, and certain characteristics of the selected person, as well as the address.

A mailing list was drawn up and the mailings and returns were carried out by Statistics Canada Regional Offices. As far as possible, wrong addresses were corrected. Questionnaires with errors were the subject of a telephone follow-up.

Next, the questionnaires were sent to the Central Office, for data processing, and were classified according to the type of response, in preparation for weighting. Socio-demographic characteristics such as education, sex, and age were coded.

The coded information was then transcribed into a data file which was combined with the census data in order to obtain the maximum amount of information on the selected persons.

3.2.6 Edit and Imputation

Edit and imputation of the data was done by combining the survey data with that from the census. This was done by computer, using an edit and imputation program to detect errors, make corrections, and reject cases needing manual corrections.

When there was doubt as to the actual identity of a survey respondent, that person's sex and date of birth were compared with the Census file.

Quality control of the data also involved comparing address and name files. Any inconsistencies were corrected.

3.3 1976, 1982, and 1986 National Graduates Surveys

3.3.1 <u>Background</u>

Statistics Canada carried out the survey for the first time in 1978 in all of Canada except Quebec. The survey was repeated in 1984 and 1988, and Quebec was included from 1984 onward.

3.3.2 Objectives

One of the survey's main objectives was to evaluate the quality and efficiency of the programs of postsecondary education, in order to provide graduates with the tools and knowledge necessary for the job market.

The survey also provided information needed to develop a projection model of supply and demand and to analyze the results of differences between supply and demand with respect to the job market.

3.3.3 Concepts and Definitions

The major area of study was one of the main base variables for the stratification of the survey sample. Among other things, it allowed the identification of persons involved in science and technology.

The description of the major fields of study came from the universities and colleges. When respondents reported fields of study other than those on the descriptive list, they were assigned a variable "derived" from the major field of study; this made possible the completion of the universities' and colleges' descriptive lists, by adding fields of study reported by the respondents.

Graduate

In 1984, for survey purposes a "graduate" was defined as any student who, in 1982, had completed a university program leading to a degree, diploma, or certificate from a university, a college, or an accredited trades and vocational school or other similar teaching establishment.

3.3.4 <u>Methodology</u>

Population Coverage

The survey covers the population registered in postsecondary institutions granting diplomas or degrees, regardless of whether the student is registered part-time or full-time.

The 1976 survey excluded those with diplomas from vocational programs, students enrolled in continuing education programs, recipients of a university degree other than a bachelor's, a master's, or a doctorate, and foreign students and graduates whose permanent place of residence at the time of the survey was outside Canada.

The 1982 survey excluded students who had completed a university transfer program, graduates of military colleges, graduates of preparatory vocational courses, graduates of pre-employment training and of language courses, and graduates living outside the country in June 1984. Furthermore, the survey only included programs lasting at least three months.

Sampling

In 1978, the target population was subdivided into five sub-groups: persons who, in 1976, had completed a 1 or 2 year training program in community colleges or teaching hospitals; persons who, in 1976, had completed a 3 or 4 year training program in community colleges or teaching hospitals; persons who, in 1976, had completed a program leading to a bachelor's degree; persons who, in 1976, had completed a program leading to a master's degree; and persons who, in 1976, had completed a program leading to a doctorate.

In 1976 and 1982 the sample was stratified by province, major field of study, and qualifications of the graduates.¹³

Geographic Coverage

The survey covered all the Canadian provinces and territories. The 1978 survey, however, excluded Quebec. In 1984 the Quebec universities were partially represented, as undergraduate and graduate students could not be separated.

3.3.5 Data Collection and Processing

The 1976 and 1982 surveys were telephone interviews done by Statistics Canada Regional Offices.

3.3.6 Edit and Imputation

There is no technical information available on quality control of the survey data.

However, the results of the survey were weighted so that the persons sampled would be representative of the entire target population. Weighting of the data resulted in estimations with sampling errors which may be calculated on request, in order to gauge the quality of the data.

3.4 Labour Force Survey

3.4.1 <u>Background</u>

The Canadian Labour Force Survey (LFS) has been carried out on households since 1945. From 1945 to 1952, the LFS was done on a quarterly basis, but, since 1952, this survey, the largest in Canada, provides information on a monthly basis.

Generally the survey sample is modified in order to reflect geographical distribution and the evolution of the population on the basis of the Canadian censuses every decade. Between censuses, the programs are updated, to include population growth.

In 1973, the sampling plan for the survey was changed dramatically, following the results of the 1971 census. During the period from 1972 to 1975, both the sampling plan and the methodology of the Labour Force Survey underwent indepth restructuring. Since then, the LFS has provided new information describing more precisely the current state of the job market. By selecting a household for a monthly survey period of six months, the LFS created data allowing the dynamic aspect of the labour force to be studied. Furthermore, in 1977 the LFS increased the size of its sample, from 35,000 to 55,000 households. This increase in the sample size greatly improved the quality of the data on the subregional level.

3.4.2 <u>Objectives</u>

The Canadian Labour Force Survey provides monthly information on the size, composition, and characteristics of the labour force. This information allows Canadian economic trends to be noted and interpreted.

The statistical objectives are to provide descriptive and explanatory information on three target sectors of the labour force: (1) employed persons; (2) unemployed persons; and (3) persons not in the labour force.

3.4.3 Concepts and Definitions

According to the Labour Force Survey Data Usage Guide, "the concepts of employed and unemployed persons are based on the concept of a job offer, meaning a production factor measured for a short period, production being defined as goods or services figuring in the Gross National Product."¹⁴

As a result, the labour force is classified as employed persons, unemployed persons, and persons who are not in the labour force. The concept of the job offer implies: 1) the existence of a free market, in which all workers may offer or withdraw their services as a result of factors, related or not, to the current market; and 2) a lack of information on supply and demand.

Based on this concept, employed persons, unemployed persons, and persons not in the labour force may be defined as follows:

Employed Persons

Persons aged 15 years and over (with the exception of inmates in institutions, persons on Indian reserves, and full-time members of the Canadian Armed Forces), who, during the reference week, did any sort of work or had a job but were not at work due to illness or disability, personal or family responsibilities, or were prevented from working by bad weather or labour disputes (except dismissed persons and persons whose job would begin at a future date).

"Work" includes any work for pay or profit, either for an employer or independently. Unpaid family work is also included.

Unemployed Persons

Persons aged 15 years and over (with the exception of inmates in institutions, persons on Indian reserves, and full-time members of the Canadian Armed Forces), who, during the reference week, were: (1) without work, had actively looked for work in the previous four weeks (including the reference week), and were available for work; (2) not actively looking for work in the previous four weeks, but had been on layoff (and had been expecting to return to work) for 26 weeks or less, and were ready to work; or (3) not actively looking for work in the past four weeks, but had a new job starting in four weeks or less from the reference week, and were available for work.

Persons Not in the Labour Force

Persons aged 15 years and over (with the exception of inmates in institutions, persons on Indian reserves, and full-time members of the Canadian Armed Forces), who, during the reference week, did not wish or were unable to offer or provide their services.

3.4.4 <u>Methodology</u>

Population Coverage

The Labour Force Survey is done monthly on 98% of the population aged 15 years and older. The population of the Northwest Territories and the Yukon is excluded from the survey.

Foreign students with residence permits, people with temporary work permits, representatives of foreign nations and their families, inmates of institutions, members of the Canadian Armed Forces and those on Indian reserves are also excluded.

However, the civilian non-institutional population in hospitals, on military bases, and in remote regions have been included in the estimations of the economic regions since 1985.

Sampling

This description of the Labour Force Survey sampling is not exhaustive. Its purpose is to provide a brief overview of the proposed methodology. Please note references 71-526 and 71-528 listed in the Bibliography for further details.

Labour Force Survey sampling is done using a random multi-stage stratified sample. The base sample units found independently in each province are composed self-representing units (SRU) and non-self-representing units (NSRU).

The self-representing units (SRU) include all the large cities sampled directly so they are represented in the study by a sample of their own population. Cities are divided into sub-units of about 15,000 persons each. A cluster sample corresponding to a city block is drawn from each of these sub-units. From these clusters, a list of households is drawn up and computerized to allow a systematic selection from all the households. Each month, 30 households per cluster are selected for the survey. These include computer-selected households and households selected manually by the interviewer from recent additions to the list.

Non-self-representing units (NSRU) are formed from rural regions and small urban centres. Due to the low population, and to reduce the inherent longdistance data collection costs, there are three or four stages of NSRU sampling. This multi-stage sampling plan concentrates the sample in certain selected areas where the population is representative of the entire NSRU.

In the NSRUs, the main sampling unit (MSU) is an area of 3,000 to 5,000 inhabitants. In small urban centres, the NSRU is the subject of a two-stage subsampling. The sampling plan produces a sample of 50 households in each MSU.¹⁵ In the MSUs of rural areas, the supplementary stage of the sampling involves selecting regions of 100 to 200 households, each selected unit defined as a cluster. The choice of households is done in the same manner as for SRUs.

Each household remains in the sample for a period of six consecutive months (without pay). If, during the course of this six month period, the composition of the household changes completely or partially, the new members are part of the sample for the remainder of the period. Persons who are no longer members of the household are withdrawn from the sample.

The Labour Force Survey sample includes about 55,000 households. This sample allows the publication of estimates for the provinces, the census metropolitan areas and the economic regions.

The quality of the Labour Force Survey data depends on the quality of the estimation, the sampling error, and other sources of error not due to sampling.¹⁶

The sampling error depends on the size of the sample, the variability of population growth, the sampling plan and the estimation method. The Canadian Labour Force Survey publications show sampling errors for most of the characteristics, in relation to the estimations or monthly proportions.

Non-sampling errors include coverage, response errors or non-response and analysis mistakes. These errors are evaluated by a re-interview program, to determine their causes and make the necessary corrections. One of these errors is due to the fact that only one member of the household answers for all the admissible members of the same household.

Geographic Coverage

The Labour Force Survey data are published for all of Canada, the provinces, the census metropolitan areas and the economic regions.

3.4.5 Data Collection and Processing

The week after the reference week, households selected manually or by computer from a recent list are visited or telephoned by the interviewer who accepts answers for all admissible members of the household from any responsible member aged 14 years or older.¹⁷

The basic information is then collected and pre-entered for the six-month period when the household was part of the sample. This includes demographic information, the employment status of the household members, the employer's name, industry, profession and type of work. This is only updated when one or more of these items change during the 6-month period.

The completed questionnaires are sent to the Regional Offices, to be checked and entered into the micro-computers. That same day the questionnaires are sent to Head Office, which clears each file (or questionnaire) of any inconsistencies, or sends it on to the edit and imputation stage.

The source of data for processing at the Head Office is the basic elements file, which provides and receives the elementary data on each household selected by the Regional Office. Each file (or questionnaire) of the group of base elements is examined, processed, selected, and entered into the master file for computer processing.

Edit and imputation of the data should be done within two weeks. Weighting is done during the third week after data collection.

3.4.6 Edit and Imputation

The edit and imputation of the data vary according to the nature of the variables processed. Thus, age and sex are processed differently than profession, search for work, or number of hours worked.

Coded information such as demographic data is edited and imputed by the SPIDER system, which processes it on the basis of a series of complex decision tables. Information rejected by SPIDER is interpreted and corrected by the verification supervisors.

Written information, such as branch of work or profession, is read by an optical recognition system, which assigns a code for the value found. All rejected values are interpreted and coded by the verification supervisors.

When information in a file is missing or false, it is compared with an "average" file with similar socio-demographic characteristics for the same geographic region. The missing or false value is replaced by the "average" value. Missing values may also be found by comparing the data in the current file with the previous file when the household was already part of the sample.

Once the data have passed the edit and imputation stage, they are weighted, in order to be representative of the labour force.

The basic principle of a probabilistic sample is that each sample person "represents" the non-sampled population as a whole.

The estimation of the population on the basis of a group of selected persons (dossier) is determined by a weighting coefficient. The data are weighted as a function of demographic estimations provided monthly by province, age, and sex.

The final weight of each dossier is the result of five stages: basic weighting; the rural-urban factor; the non-response compensation factor; the cluster subweighting factor; and weighting in agreement with the extrapolation of the population.

Reliability of estimations at the provincial and subprovincial levels varies due to the size of the population, the sample size, and the frequency of measured characteristics.

Reliability of the data decreases at the subprovincial level, and is even less valid when detailed statistical information is used. Thus, we recommend producing statistical data at the provincial level, and carefully analyzing the breakdown of detailed variables such as four-digit occupation codes.¹⁸

3.5 Current Population Profile Survey

3.5.1 Background

The Current Population Profile Survey (CPPS) was carried out in mid-August 1982. It was done jointly by Alberta's Manpower Service and Higher Education Service, the British Columbia Ministry of Employment, the Ontario Labour. Commission, Employment and Immigration Canada, the Treasury Council, and Statistics Canada.

3.5.2 Objectives

The purpose of this survey was to provide data on migrants' characteristics and travels, on the knowledge and use of the official languages, and on postsecondary studies by field.

3.5.3 <u>Concepts and Definitions</u>

Please refer to section 3.4.3.

3.5.4 <u>Methodology</u>

The CPPS included five-sixths of the 55,000 base households of the Labour Force Survey (LFS). Households participating in the LFS for the first time were excluded from the LFPS sample.

Excluding the difference of the sample size mentioned above, the methodology was the same as described in Section 3.4.4.

3.6 Labour Market Activity Survey (carried out annually since 1986)

3.6.1 Background

Since 1978, Statistics Canada has sponsored a survey program whose purpose is to complete estimates obtained using the Labour Force Survey.

The Activity Survey has the special responsibility of conducting follow-up interviews with households interviewed the previous year. This makes it possible to analyze employment characteristics covering a two-year period.

The Annual Activity Survey (AAS) was carried out from 1978 to 1981 and 1983 to 1986. This survey collected information on the five last jobs held by the respondent, using the same concepts and definitions as the Labour Force Survey (LFS). However, unlike the LFS, the Annual Activity Survey collected data for the previous 12 months, not just the reference week. Thus, the data available cover the period 1977 to 1985, except for 1981.

In 1981, the AAS was replaced by the Labour Market Activity Survey (LMAS). Sponsored jointly by Statistics Canada and Labour Canada, this survey was to "provide information on the length of periods of employment and when they occurred during the year."¹⁹

It also provided information on the characteristics of all jobs filled by paid workers in 1981. However, this study did not collect information on job searches during inactive periods. In 1987 the Labour Market Activity Survey replaced the Annual Activity Survey, in order to obtain more valid information over a continuous period.

3.6.2 <u>Objectives</u>

The main objectives of the Labour Market Activity Survey are:

- (1) to provide annual employment and unemployment figures for a 24-month period, using the concepts and definitions of the Labour Force Survey;
- (2) to provide information on the characteristics of paid jobs to supplement the information available from the Labour Force Survey;
- (3) to develop socio-economic/demographic profiles of "market segments" for specific programs offered by Employment and Immigration Canada;
- (4) to produce estimations of labour force activity and work characteristics; and

(5) to identify participants in special programs sponsored by Employment and Immigration Canada.

3.6.3 <u>Concepts and Definitions</u>

The concepts and definitions of the survey arise from its basic objective; the collection of data on working Canadians. Thus, the LMAS is essentially based on the definitions of employment and change of employment.

Employment

Jobs are defined in terms of duties performed for a specified salary. A job change is recognized if there are changes in duties or salary.

Work Interruptions

A work interruption is defined by an unpaid absence from work of one week and/or more, followed by a return to the same job. The reasons for this interruption may be: (1) temporary layoffs due to seasonal or production factors; (2) strikes; (3) unpaid maternity leave; and (4) unpaid sick leave.

Profession

The professions are described on the basis of the Standard Professions Classification, and are encoded in four digits. However, in the public data file, the professions are divided into 49 groups. The LMAS can also provide data on working, unemployed, or inactive persons, and on the amount of time spent in one state or another.

3.6.4 <u>Methodology</u>

The Labour Market Activity Survey involves an initial interview of an individual selected from households in the Labour Force Survey. Demographic information is provided by the LFS, while the LMAS provides information on activity for the previous year. The LMAS is done on a monthly basis, and generally excludes households taking part in the LFS for the first time.

The following year, the LMAS updates the demographic data and collects new data on activity for the previous year. Households whose composition has changed completely between the two interviews are excluded.

In the second interview cycle, original interviewees who could be traced are interviewed again in their current household. In cases where households have completely changed since the last interview, the new occupants are interviewed. The third year, the LMAS again supplements the LFS.

Population Coverage

The Labour Market Activity Survey includes the civilian, non-institutionalized population between 16 and 69 years of age, with the exception of residents of the Yukon, the Northwest Territories, and Indian reserves, and full-time members of the Canadian Armed Forces.

Sampling

The sample for the Labour Market Activity Survey is drawn from that of the Labour Force Survey (please see Section 3.4.4).

The Labour Market Activity Survey is a sub-set of the LFS sample. The 48,000 households are subdivided into six groups of about 8,000 households. Each month, one of these groups is removed from the sample and replaced by a new group of 8,000 households. This sub-sample includes five-sixths of the households selected from the LFS.

The next year, an additional sample of households is added, representing households that have come together during the twelve months between the two survey periods. Part of this sample is taken randomly in all the provinces, while the rest of the sample increase is taken from the eight census metropolitan areas.

It is possible to obtain qualitative and quantitative estimations of the sampling error on request.

Geographic Coverage

The survey covers the ten Canadian provinces. The Northwest Territories and Yukon are excluded. Subregional data is available on the economic regions, census metropolitan areas, census divisions, urban regions, and areas served by Employment Centres.

3.6.5 Data Collection and Processing

The data collection for the Labour Market Activity Survey is closely related to that of the Labour Force Survey (please see Section 3.4.5). However, to respect the nature and application of information in the Labour Market Activity Survey, modifications have been made to the collection of data used in the LFS. These modifications include the data collection period, lengthened and sometimes advanced in relation to that of the LFS; the absence of activity interviews for households that changed their composition in 1987; and, finally, the interview method, requiring the interviewer to approach the target person, and not a different person (this rule is not followed for the LFS).

The collection, monitoring and editing of data are done at the Statistics Canada Regional Offices. The data are also entered into the computer in the Regional Offices before being sent to Head Office in Ottawa.

When a household does not answer the questionnaires, two reminders are mailed to them. Non-respondent households are not replaced.

3.6.6 <u>Edit and Imputation</u>

The process of editing the data is carried out on the basis of these three principal stages:

(1) replacement of "non-representative" values with null values;

- (2) selection of jobs with sufficient base information for analysis;
- (3) verification of the results in order to identify errors, omissions, or inconsistencies. These errors are:
 - a) answers to irrelevant questions;
 - b) unanswered questions that are identified, then imputed using a similar file;
 - c) incomplete answers;
 - d) inconsistencies between answers that are compared with a daily activity vector and then corrected by a computerized control system. The remaining inconsistencies are analyzed and corrected by the senior analysts.

Finally, after the edit and imputation stage, the data are weighted.

3.7 General Social Survey

3.7.1 <u>Background</u>

The General Social Survey fills a gap in the collection of socio-economic data. It has been conducted annually since 1985. It has three main components: (1) data indicating where classification variables allow demographic groups to be defined; (2) a principal theme aimed at obtaining information needed to follow long-term social trends or to measure the evolution of society in its life-style or comfort; and (3) a specific theme for data collection about a specific policy or problem.

3.7.2 <u>Objectives</u>

The objectives of this survey are, first, to gather data on social trends so that the evolution of Canadian society can be studied, and, second, to provide information on specific policy questions.

The General Social Survey is a permanent program with an annual cycle repeated every four years. Users of data on the population involved in science and technology will take note of the fourth cycle dealing with work and education.

3.7.3 Concepts and Definitions

The Interviewer's Manual contains instructions and terminology definitions. Thus, two variables identify people involved in science and technology: major field of study and type of work.

Major Field of Study

According to the Interviewer's Manual, the major field of study is defined as the general sphere into which most of the respondent's courses fall.

Type of Work

According to the Interviewer's Manual, the type of work is defined by listing the respondent's main functions or duties.

3.7.4 <u>Methodology</u>

Population Coverage

The data collected for the main survey cover a sample of 10,000 households, divided among the ten Canadian provinces, and including the population aged 15 years and older.

Sampling

The sampling is based on a method known as random telephone number selection by computer.

The survey is done by telephone interviews from the Statistics Canada Offices. In each household selected, the interviewer randomly chooses one person aged 15 years or older. The response rate is 80% for the fourth cycle.

Geographic Coverage

The survey covers the ten Canadian provinces. The data may be published at the national and provincial levels.

3.8 Surveys of Staff and Students of Community Colleges and Universities

The Education, Culture, and Tourism Division carries out a series of surveys allowing the collection of statistical information on the staff and student population registered in educational establishments in Canada. To meet the objectives of this document, only the surveys carried out on establishments offering postsecondary programs were retained.

3.8.1 Background

Data collection on education clientele started when Statistics Canada was created. The contemporary data included in the perspective analyses start with the school year 1970-71.

3.8.2 <u>Objectives</u>

The objective of the Annual University Staff Study is to collect data on the characteristics of full-time professors in degree-granting institutions.

The objective of the Annual Community College Staff Study is to collect statistical information on the full-time teaching and senior administrative staff of community colleges and public vocational schools.

The data on the student populations of universities and community colleges come from surveys carried out by the provincial departments, who provide the data in the name of the establishments under their jurisdiction; or the teaching institutions themselves provide the data. These annual surveys collect the sociodemographic and academic characteristics of the student body.

3.8.3 <u>Concepts and Definitions</u>

To respect the objective of this working paper, only the concepts and definitions of the variables allowing scientists, engineers, and technologists to be identified were kept. Using these survey variables, the postsecondary study program, teaching personnel, and field of teaching can be identified.

Non-University Postsecondary Programs

Non-university postsecondary programs are defined according to whether they lead to a career, whether they are transfer programs for university, or whether they provide vocational training.

Programs Leading to a Career

"Programs leading to a career require a secondary school diploma or equivalent; they last at least one academic year (24 weeks or more), and prepare a student for a profession, placing him between a university graduate and a skilled tradesperson."²⁰

University Transfer Programs

"University transfer programs require a secondary school diploma; they provide the student with training equivalent to the first or second year of a university program, and allow him to pursue his studies at a higher level in a degreegranting establishment."²¹

Vocational Training Programs

"Generally, these programs do not require a secondary school diploma; they usually last at least one academic year, and prepare the trainee for work primarily dependent on manual aptitudes and on the performance of precise or well-established duties, rather than on the application of ideas or principles."²²

University Level Study Programs

Fields of study to obtain a degree, certificate, or diploma issued by an authorized postsecondary teaching institution.

Educational Staff

At the non-university postsecondary establishment level, this includes all staff who have teaching duties, including: administrators who must perform both teaching and administrative duties, teachers themselves, and guidance counsellors. At the level of degree-granting institutions, teaching staff include all who assume teaching or supervisory duties. Senior administrators, teachers in training hospitals, and guest or visiting lecturers are also included.

Main Area of Instruction

The name of the main area of instruction given in the statistical data does not necessarily indicate the exact program or course taught or administered by the teacher or administrator in question. In fact, the terms in the questionnaires are approximate and general.

3.8.4 <u>Methodology</u>

Area of Observation

The quality of survey coverage varies from one year to the next. Generally, the surveys cover all teaching institutions, but at times information is lacking for many reasons, including incomplete data collection, presentation of data with conflicting informational support, refusal to distribute confidential data, etc.

The Education, Culture, and Tourism Division provides information on coverage quality in its regular publications, adding the list of establishments participating in the survey and any specific problems encountered in the collection of data. Nevertheless, it can be stated that, on the whole, the surveys on teaching staff and students in degree-granting institutions cover about 100 universities and community colleges across Canada. Surveys covering staff and students of non-degree-granting postsecondary institutions include all colleges and schools in Canada (except for 1984 when Quebec was excluded from the survey on teaching staff).

Geographic Coverage

All the provinces and territories are covered by the surveys.

3.8.5 Data Collection and Processing

The provincial departments or teaching institutions send in the data on the registration of students or staff in the form of computer tapes, standardized questionnaire forms, or coded sheets.

The data on students are collected, processed, and stored in two databases known as the Community College Student Information System (CCSIS) and the University Student Information System (USIS).²³

The data are validated and verified by the teaching establishments, the provinces, and Statistics Canada. Summary tables of the university student data are approved by the establishments before publication.

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Footnotes

- ¹ The professions are based on the Statistics Canada Standard Occupational Classification. A complete list of occupations (and their codes) identifying persons involved in science and technology may be found in Appendix III.
- ² UNESCO, 1989 Statistical Yearbook, p. 5-3
- ³ Catalogue 88-508E
- ⁴ Catalogue 99-101E, pp. 155-159
- ⁵ Catalogue 99-101E, p. 7
- ⁶ Catalogue 99-740, p. 149
- ⁷ Catalogue 12-540, p. 8
- ⁶ Catalogue 99-101E, p. 56
- ^e Catalogue 12-540, p. 34
- ¹⁰ Catalogue 12-540, p. 35
- ¹¹ Catalogue 99-101E, p. 58
- ¹² Ibid to ¹
- ¹³ Please refer to table H-1, p. 158 of the document entitled "The Class of 82", cited in the bibliography.

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- ¹⁴ Catalogue 71-528, Out of Print, p. 15
- ¹⁵ The minimum number of households per sampling unit is the 20 households normally assigned to an interviewer.
- ¹⁶ The comments on the sampling for the Labour Force Survey are taken from publication 71-526, chapters 11 to 13, mentioned in the Appendix.
- ¹⁷ Catalogue 71-526, pp. 61-64
- ¹⁸ In 1985, a sampling error of 20% or less to a standard deviation (or a coefficient of variation of 20% or less) was set as a reliability goal for data for the monthly unemployment estimations in the CMA.
- ¹⁹ Labour Force Survey, Information Manual, p. 4
- ²⁰ See the Education, Culture, and Tourism Division questionnaire. Full-time and Part-time Staff and Graduates of Postsecondary College Programs
- ²¹ Ibid
- ²² Ibid
- ²³ For further details on the CCSIS and USIS, please see the "Concordance Table of Data Bases for the Major Fields of Study" in Appendix II.

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Appendix I. Questions and Instructions Identifying Scientists, Engineers and Technologists, by Source

Source	Questions and Instructions
1986 Census	22. What degrees, certificates or diplomas have you ever obtained? (See Guide)
	Mark as many boxes as applicable
	 None Secondary (high) school graduation certificate Trades certificate or diploma Other non-university certificate or diploma (obtained at community college, CEGEP, institute of technology, etc.) University certificate or diploma below bachelor level Bachelor's degree(s) (e.g., B.A., B.Sc., B.A.Sc., LL.B.) University certificate or diploma above bachelor level Master's degree(s) (e.g., M.A., M.Sc., M.Ed.) Degree in medicine, dentistry, veterinary medicine or optometry (M.D., D.D.S., D.M.D., D.V.M., O.D.) Earned doctorate (e.g., Ph.D., D.Sc., D.Ed.)
	Secondary (high) school graduation certificate: Mark this box if yo graduated from a high school where the certificate was classed as junior or senior matriculation, general or technical-commercial.
	Trades certificate or diploma: Mark this box if you received a certificate or diploma obtained through apprenticeship (journeyman's training and/or in-school training in trades-level vocational and pre-vocational courses at community colleges, institutes of technolo and similar institutions where the minimum entrance requirement was less than secondary (high) school, junior or senior matriculation, o equivalent.
	Other non-university certificate or diploma: Mark this box if you obtained a certificate or diploma (other than a trade certificate or diploma) granted by a community college (both transfer and semi-professional career programs), CEGEP (both general and professional), institute of technology, or any other non-degree-granting educational institution.
	If you obtained a teaching certificate awarded by a Provincial Department of Education at an approved institution such as a normal school or a college of education, mark this box. However, if you obtained your teacher's qualification in a faculty of education associated with a university, mark backelor's decrea(s)

	Questions and Instructions
····	University certificate or diploma: If you have a diploma, certificate or licence, awarded by a professional association (e.g., in accounting, banking, insurance) on the basis of successful completion of courses conducted through or by a university, you should indicate these as either:
	(a) university certificate or diploma below bachelor level, if a bachelor degree is not a normal prerequisite; or
	(b) university certificate or diploma above bachelor level, if a bachelor degree is a normal prerequisite.
	23. What was the major field of study of your highest degree, certificate or diploma (excluding secondary or high school graduation certificates)? (See Guide)
	(For example, accounting, civil engineering, history, legal secretary, welding.)
	If you have no degree, certificate or diploma or have a secondary (high) school graduation certificate only , mark below.
	14 > Go to Question 24
	Be as specific as possible in indicating a subfield of specialization within a broader discipline or area of training, especially in the case of graduate studies or other advanced training.
	If you have earned more than one highest degree, certificate or diploma (e.g., two bachelor's degrees or two master's degrees), then indicate the major field of study for the one that was most recently conferred.
	If you have specialized in more than one major field of study in your degree, certificate, or diploma, then indicate the one in which you experienced the greatest degree of specialization (e.g., the field in which you received the most number of courses or credits).

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Source	Questions and Instructions			
	29. (a) What kind of work were you do	29. (a) What kind of work were you doing?		
	For example, accounting clerk, engineer, secondary school tea processing labourer, fishing g give rank.)	, door-to-door salesperson, civil acher, chief electrician, food guide. (If in the Armed Forces,		
	(b) In this work, what were your π duties?	most important activities or		
	For example, verifying invoice the research department, teach construction electricians, cle fishing parties.	es, selling cosmetics, managing hing mathematics, supervising eaning vegetables, guiding		
	The description should be as precise as need to use two, three or more words in description should avoid using terms su favour of specific descriptions of the	possible and you will probably a each part of the question. The ach as worker, employee, etc., in kind of work.		
	Use specific descriptions in both parts In part (b) be sure to indicate if your management.	a (a) and (b) of the question. b job involves supervision or		
	See examples below:			
	Complete responses	incomplete responses		
	(a) maintaining electrical equipment (b) repair and maintenance of electric motors	(a) maintenance (b) repair work		
	(a) typing, general office work(b) typing and filing	(a) office work (b) clerical		
	(a) inspecting electronic equipment(b) supervising electronic equipment inspection	(a) inspecting (b) supervising		
	Members of religious orders engaged in a school teaching, nursing, etc. should re religious activity.	activities such as primary eport these rather than		

Source	Questions and Instructions
1981 Census	34. What degrees, certificates or diplomas have you ever obtained? (See Guide for further information.)
	Mark as many boxes as apply
	 None Secondary (high) school graduation certificate Trades certificate or diploma Other non-university certificate or diploma (obtained at community college, CEGEP, institute of technology, etc.) University certificate or diploma below bachelor level Bachelor's degree(s) (e.g., B.A., B.SC., B.A.SC., LL.B.) University certificate or diploma above bachelor level Master's degree(s) (e.g., M.A., M.SC., M.Ed.) Degree in medicine, dentistry, veterinary medicine or optometry (M.D., D.D.S., D.M.D., D.V.M., O.D.) Earned doctorate (e.g., Fh.D., D.SC., D.Ed.) Secondary (high) school graduation certificate: Mark this box if you graduated from a high school where the certificate was classed as a junior or senior matriculation, general, or technical-commercial. Trades certificate or diploma: Mark this box if you received a certificate or diploma ebtained through apprenticeship (journeyman's) training and/or in-school training in trades-level vocational and pre-vocational courses at community colleges, institutes of technology and similar institutions where the minimum entrance requirement was less than secondary (high) school, junior or senior matriculation, or equivalent. Other non-university certificate or diploma: Mark this box if you obtained a certificate or diploma (other than a trade certificate or diploma j granted by a community college (both transfer and semi-professional career programmes), CEGEP (both general and professional), institute of technology, or any other non-degree-granting educational institution.
	Department of Education at an approved institution such as a normal school or a college of education, mark this box. However, if you obtained your teacher's qualification in a faculty of education

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Source	Questions and Instructions	
	University certificate or diploma: If yo or licence, awarded by a professional ass banking, insurance) on the basis of succe conducted through or by a university, you either:	u have a diploma, certificate ociation (e.g., in accounting ssful completion of courses should indicate these as
	(a) university certificate or diploma be bachelor degree is not a normal prer	low bachelor level, if a equisite; or
	 (b) university certificate or diploma ab bachelor degree is a normal prerequi 	ove bachelor level, if a site.
	43. (a) What kind of work were you doing	7
	For example, accounting clerk, s engineer, secondary school teach worker.	ales representative, civil er, chief electrician, metal
	(b) In this work, what were your mos duties?	t important activities or
	For example, verifying invoices, managing the research department supervising construction electric the Armed Forces give rank.)	selling electrical tools, , teaching mathematics, cians, operting lathe. (If i
	This two-part question is asked to ensure information to place people who do simila: occupational group.	that there is enough r kinds of work in the same
	Use specific descriptions in both parts (a In part (b) be sure to indicate if your jo management. See examples below:	a) and (b) of the question. bb involves supervision or
	Complete response	Incomplete response
	(a) Maintaining electrical equipment(b) Repair and maintenance of electric motors	(a) Maintenance (b) Repair work
	 (a) Typing, general office work (b) Typing and filing (a) Inspecting electronic equipment (b) Supervising electronic equipment 	(a) Office work (b) Clerical (a) Inspecting (b) Supervising

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	Questions and Instructions
971 Census	24. Do you have a university degree, certificate or diploma?
	Mark highest academic qualification.
	No university degree, certificate or diploma.
	Yes, a university certificate or diploma (below Bachelor level)
	Yes, First Professional degree
	Yes, a Master's or equivalent, or earned Doctorate (e.g., Ph.D., Ed.D.)
	25. Have you EVER COMPLETED a full-time vocational course of three months or longer?
	Do not include university or high school courses.
	Yes, apprenticeship course No> Go to question 26 Yes, other full-time vocational
	 (a) Describe course or apprenticeship of longest duration (e.g. auto mechanic, chemical technology, drafting, commercial an X-ray technician, accounting, barbering)
	(b) How long was this course or apprenticeship?
	. 3-5 months . 1-2 years . More than
	. 6-12 months . 2-3 years 3 years
	(c) When did you complete this course or apprenticeship?
	. Before 1946 . 1956-1960 . 1966-1968
	. 1946–1955 . 1961–1965 . 1969–1971
	. 1946-1955 . 1961-1965 . 1969-1971 36. Occupation
	. 1946-1955 . 1961-1965 . 1969-1971 36. Occupation (a) What kind of work were you doing? E.g., selling shoes, civil engineering, motor vehicle repairing, metal machining, clerical work.
	. 1946-1955 . 1961-1965 . 1969-1971 36. Occupation (a) What kind of work were you doing? E.g., selling shoes, civil engineering, motor vehicle repairing, metal machining, clerical work. (b) What were your most important activities or duties? E.g., fitting shoes, designing bridges, auto body work, operating lathe, posting invoices.

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Source	Questions and Instructions
1976 Bational Graduates Survey	 First, I would like to ensure that certain administrative information is correct. Did you obtain a(read line B) in 1976?
	 What was the major field of study or specialization for you (read line B)? (If two, enter both)
	46. What kind of work were you doing? (Give full description: e.g. posting, selling shoes)
1982 Mational Graduates Survey	9. What was the major field of study or specialization of the respondent? (If more than one, enter both)
	22. What kind of work were you doing? (Give full description: e.g. elementary school teacher, manager of a biological research department, shoe salesperson)
1986 National Graduates Survey	3. What degree, diploma or certificate did you obtain or complete the requirements for in 1986? (Do not read list; check one only; if more than one, check the highest-level degree etc.)
	6. What was your MAJOR field of study or specialization for your (read line A) program in 1986? (If two of equal importance, enter both)
	7a. Did you have any other MAJOR field(s) of study or specialization for your(read line A) program in 1986?
	7b. What was your other MAJOR field of study or specialization? (If more than one, enter all)
	25. What kind of work did you do? (Give full description, e.g. elementary school teacher, manager of a biological research department, shoe salesperson)
The Labour Force Survey	75A. What kind of work was doing? (Give full description: e.g., office clerk, factory worker, forestry technician.)
Current Population Profile Survey	19. What was's major field of study?
	38. What kind of work was doing?
Labour Market Activity Survey	14. What kind of work was doing?

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Appendix I. Questions and Instructions Identifying Scientists, Engineers and Technologists, by Source (Continued)

Source	Questions and Instructions
General Social Survey	A15. What was the major field of study or specialization for your degree, diploma or certificate?
	C10. What kind of work were you doing?
	(Give a full description: e.g. accounts clerk, dairy farmer, primary school teacher)
University Student Information System (USIS)	Report on Degrees, Diplomas and Certificates Granted for the Convocation of Grades
	1A. Major field(s) of study, by organizational unit (faculty, school or department), title of degree, normal duration of course (3-4 years), and sex
	Report on Students Attending Canadian Universities and Colleges Distributed by Place of Permanent Residence, Citizenship, Level and Sex as of December 1st
	Report on Graduate Students by Programme of Study, Specialization, Citizenship and Sex
	Report on Age of Students Enrolled in Canadian Universities and Colleges as of December 1st
Full-time and Part-time Enrolment and Graduates of Postsecondary Programs of	Preliminary Report on Fall Enrolments in Postsecondary Programs of Community Colleges and Related Institutions as of November
Community Colleges	Part A: Career program for full-time or part-time students including foreign student enrolment and graduates and students who graduated in the spring of the year.
University and College Academic Staff System	Characteristics of Full-Time Academic Staff in Universities and Colleges
	Report on University Salary Scales for Academic Year

Source	Questions and Instructions		
Highly Qualified Manpower Survey	Question 5. Do you have a university degree? If yes, please list below all university degrees which you have been awarded, or for which you are currently studying, in the order in which they were (or will be) obtained. Please refer to Lists I and II below when coding and entering degree titles and major fields of study.		
	Question 7.(iv) What kind of work did you do in this job? (e.g., chemical research; civil engineering; management consulting; teaching; etc.)		
	Question 7.(v) What were your main activities, duties, responsibilities or functions? (e.g., directing chemical research; designing bridges; advising on business organization; teaching history; etc.)		
	Question 7.(vi) What was the title of your job? (e.g., director of chemical research; highway engineer; management consultant; professor; etc.)		

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Appendix II. Concordance Table of Data Bases for the Major Fields of Study

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	Data Bases				
Major Field of Study	1986 Census	1971 Census	USIS ¹	ccsis ²	HQM3
	Variable Rame/Corresponding Codes				
	DG_MFSR	CRSTYPE	N/A	N/A	N/A
Agriculture Science				· · · · · · · · · · · · · · · · · · ·	
Agricultural Science	221–229	37, 39	5.03.10 5.03.22 5.03.26 5.03.99	61000 61200* 61520 61540 61640 61500	49
Agricultural Technology	230-233 ,	40		61100 61300 61200* 61700	
Animal Science Technologies	234–238	38	···.	61600 61620 61630 61650 61660 61670 65420 65440	
Biochemistry	239	••	5.06.00*		50
Biology	240-244		5.09.10 5.06.00* 5.09.12 5.09.99		51
Biophysics	245	••	5.12.00		
Botany	246-248		5.15.00	61510	52
Household Science and Related Fields	249254	31, 35 45	5.18.08 5.18.99	72700 84100 84111 84112 84120 84120 84200 44100 25200-25202 25204	53, 55
Veterinary Medicine/Science	255–256	••	5.21.00 5.22.00 5.23.00		56
Zoology	257-262	••	5.24.00	61610	57
Other Agricultural and Biological Sciences/Technologies	263–266	41	5.16.00	63300 63310 63320 63400 65400 65410 65460	
Forestry	294-298		6.20.00		54

	Data Bases						
Major Field of Study	1986 Census	1971 Census	USIS ¹	ccsis ²	HQMS ³		
	Variable Name/Corresponding Codes						
	DG_MFSR	CRSTYPE	N/A	N/A	N/A		
Engineering and Applied Sciences							
Architecture and Architectural Engineering	267–269		6.03.00	••	60		
Aeronautical and Aerospace Engineering	270	••	6.05.00		58		
Biological and Chemical Engineering	272-273		6.06.00 6.14.00*	61400	62, 63		
Civil Engineering	274		6.07.00	••	64		
Design/Systems Engineering	275		6.08.00	••			
Electrical/Electronic Engineering	276-278	••	6.09.00	••	65		
Industrial Engineering	279	••	6.10.00	••	68		
Mechanical Engineering	280-282	••	6.12.00		69		
Mining, Metallurgical and Petroleum Engineering	283-286		6.11.00 6.13.00 6.14.00*		67; 70 71, 72		
Resources and Environmental Engineering	287-289	86*	6.14.00*		59, 73*		
Engineering Science	291-292	••	6.15.00	••	66.		
Engineering, n.e.c.	293		6.16.00	••	73*		
Landscape Architecture	299-301	••	6.22.00	61530	61		

Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Continued)

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Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Continued)

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	Data Bases								
Major Field of Study	1986 Census	1971 Census	USIS ¹	CCSIS ²	HQMS ³				
	Variable Name/Corresponding Codes								
	DG_MFSR	CRSTYPE	N/A	N/A	N/A				
Engineering and Applied Science Technologies and Trades									
Architectural Technology	302-303	••		55310					
Chemical Technology	304-307	46, 63	••	51000 51200 51300 51410 51420 51440 51700					
Building Technologies	308-317	49, 54, 58 76-81		55300 55312 55320-55324 55326-55327 55340 55350					
Data Processing and Computer Science Technologies	322–327	56, 57 74, 75 93		52000 52100 52200* 52500 52510 52600					
Environmental and Conservation Technologies	328–332	42		67000 67100 67200 67300 67300 67500 67500 67600					
General and Civil Engineering Technologies	333-339	03, 04, 73 82		55110-55114 55120 55130-55134 55140	••				
Industrial Engineering Technologies	340-348	48, 50, 51 55, 59, 72 89, 53, 62		55314 555500 555520 555527 555527 555530 555540 55550 55550					
Mechanical Engineering Technologies	349-358	64-69, 71 91, 96, 86*		52300 52400 52410 55150 55220 55220 55220 55220 55220 55220 55220 55220 55220 55220 55220 55220 55220 55220 55220 55220					
Primary Industries/Resource Processing Technology	359–362	43, 44, 47		63000 63100 63200 63210 63500 63500 65500 655100 655100 655120 65520					
Transportation Technologies	363-368	83-85 87, 88	••	54110* 54110* 54120 54130 54130 54140 54400 54410					
ther Engineering/Applied Science echnologies, n.e.c.	369			55000 55100 55180					

			Data Bases		
Major Field of Study	1986 Census	1971 Census	usis ¹	CCSIS ²	HQMS ³
		Variable	Name/Correspond	ing Codes	
	DG_MPSR	CRSTYPE	N/A	N/A	N/A
Mathematics, Statistics and System Design and Analysis					
Data Processing and Computer Science and Technologies	318–321	05		53000 53200 53230 53210 53240	
Actuarial Science	442	••	8.12.00*	82210*	93*
Applied Mathematics	443447		8.06.00 8.12.00*	53220	90, 93*
Mathematics	463-464		8.12.00*	53100	92, 93*
Physics Sciences and Technologies					
Chemistry	448-454	• ••	8.15.00	••	86-89
Geology and Related Fields	455-462	••	8.18.00	••	91
Metallurgy and Materials Science	465	••	8.21.00	••	94
Meteorology	466		8.24.04 8.24.99	••	95
Oceanography and Maritime Sciences	467	••	8.27.00		96
Physics	471-478		8.30.01 8.30.02 8.30.99		85, 97
General Science	479-480	••		••	98

Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Continued)

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Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Continued)

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			Data Bases								
Major Field of Study	1986 Census	1971 Census	USIS ¹	ccsis ²	HQMS 3						
	Variable Rame/Corresponding Codes										
	DG_MFSR	CRSTYPE	N/A	N/A	N/A						
Social Sciences											
Anthropology	125-129	10*	4.03.00	••	27						
Archeology	130	10*	4.06.00		28						
Area Studies (Non languages or Literature)	131–137	10*	4.08.00 4.09.10* 4.09.20 4.09.40 4.09.99*		29						
Economics	138-143	10*	4.27.00	••	33*, 35 26						
Geography	144-152	10*	4.30.00	••	36						
Man/Environment Studies	158-161	10*	4.40.08 4.40.10	72800	39						
Political Science	162-166	10*	4.43.00	••	40						
Psychology	167-171	10*	4.46.00	••	41, 43						
Sociology	172-177	10*	4.13.00 4.15.00 4.52.00	71300*	47						
War and Military Studies	185	10*	4.55.00	••	••						
Other Social Sciences and Related Fields	186-187	10*	4.57.00*	70000 76900	48						
Psychology Social (Including Industrial Psychology, but not Educational)			••	••	42						
Criminology			•••		34						
Social Work and Related Fields											
Social Work and Social Services	178-184	07, 30 36	4.49.00	71000 71100 67300	46						

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	Data Bases									
Major Field of Study	1986 Census	1971 Census	USIS ¹	ccsis ²	HQMS ³					
	Variable Name/Corresponding Codes									
	DG_MFSR	CRSTYPE	N/A	N/A	N/A					
Health Professions, Sciences and Technologies		···.			<u> </u>					
Dentistry	370		7.03.00 7.04.00		74					
Medicine - General	375	••	7.05.00	••	76					
Medicine - Basic Medical Science	376–383		7.06.04 7.06.08 7.06.10 7.06.12 7.06.14 7.06.22 7.06.28 7.06.28 7.06.99		75					
Medical Specializations (Non-surgical)	384-388		7.08.00	••	77					
Paraclinical Sciences	390-393	•••	7.10.10 7.10.06 7.10.14 7.10.99	••	78					
Surgery and Surgical Specializations	394-398	••	7.12.00	••	79					
Nursing	399-406	14*	7.15.00*	41000 41100 41400 41500 41500	80					
Nursing Assistance	407-410	14*	7.15.00*	41200 44400 72400						
Optometry	411	••	7.18.00	••						
Pharmacy and Pharmaceutical Sciences	412-413		7.21.00	42800	81					
Public Health	414-418	17*	7.24.00	44600 41600 42700	82					
Rehabilition Medicine	421-424	15	7.27.02 7.27.04 7.27.06 7.27.99	42600	83					
Medical Laboratory and Diagnostic Technology	425–429	16*	7.36.00* 7.99.00*	42300 42400* 42900 43100 44500*	84*					
Medical Treatment Technologies	431–439	16*	7.36.00*	42000 42100 42200 42500 44200 42400*	84*					
Medical Equipment and Prosthetics	440	17*		43000 43200 43300	84*					
Other Health Professions, Sciences and Technologies, n.e.c.	441		7.99.00*	40000	84*					
Nursing Refresher				41300	••					
Other Health Related Technology	••	••	••	44000						

Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Continued)

Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Continued)

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			Data Bases							
Major Field of Study	1986 Census	1971 Census	USIS ¹	CCSIS ²	HQMS ³					
	Variable Hame/Corresponding Codes									
	DG_MFSR	CRSTYPE	N/A	N/A	N/A					
Commerce, Management and Business Administration										
Business and Commerce	188-191	02	4.12.00*	81000*	30, 33*					
Financial Management	192–195	01, 26 28	4.12.00*	82200 82210* 82220 82230 82240 82900* 83200 83300	31					
Industrial Management and Administration	196–200	98	4.12.00* 4.14.01	82300 81000* 82500 82600 82700 82800 82900*	25, 44					
Institutional Management and Administration	201–205	32, 33	4.14.02 4.14.03 4.14.99	82400 82410 82420 82430 82900*						
Marketing, Merchandising, Retailing and Sales	206–210	21*, 29		83000 83100 83400 83500						
Secretarial Science — General Fields	211–220	23–25 27	4.47.00	81000* 81100 81200 81210 81300 81310 81310 81320 81410 81410 84500	45					
Commerce				•••	32					

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	Data Bases									
Major Field of Study	1986 Census	1971 Census	USIS ¹	ccsis ²	HQMS ³					
	Variable Rame/Corresponding Codes									
	DG_MFSR	CRSTYPE	N/A	N/A	N/A					
Bumanities, Law and Belated Fields		····		· · · · · · · · · · · · · · · · · · ·						
Classics, Classical and Dead Languages	80-82	••	3.03.00	••	15					
History	83-87	••	3.09.00	• •	16					
Library and Records Science	88-89	08	3.12.00* 3.13.00*	32000 32100 32200	17					
Mass Media Studies	90–93	20*, 94 92	3.17.00 3.10.00*	26000 26100 26200 26300 31000	24*					
English Language and Literature	94-98	••	3.05.00*	••	18					
French Language and Literature	99–102	••	3.06.00	••	19					
Other Languages and Literature	103-109		3.11.01 3.11.02 3.11.03 3.11.04 3.11.99* 3.14.00		20, 38					
Philosophy	110-114	••	3.21.00	••	21					
Religious Studies	115–119	11	3.24.00 3.25.00	33000	22					
Other Humanities and Related Fields	120-124	20*	3.05.00* 3.11.99* 3.27.00	10000 20000 30000	00, 23 24*					
Law and Jurisprudence	153-157	10*	4.33.00	• ••	37					
Fine and Applied Arts										
Fine Arts	47–52	18*	2.03.00	21000 21200 21400	12					
Music	53-57	19*	2.05.00	21120	13					
Other Performing Arts	58-61	19*	2.08.00	21100 21110 21130	14*					
Commercial and Promotional Arts	62–64	19*, 21*		22000 22100 22200 22300 22400	14*					
Graphic and Audio-visual Arts	65–70	19*, 90 95	2.14.01* 2.14.99*	23000 23100 23200 23400 23500	14*					
Creative and Design Arts	71–73	19*	2.14.01* 2.14.99*	21300 24000 24100 24400 24500 24600	14*					
Other Applied Arts	74–79	34, 60 61, 70		25100 25101 25102 25000 25300 29210 29220*	14*					

Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Continued)

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Appendix II. Concordance Table of Data Bases for the Major Fields of Study (Concluded)

			Data Bases							
Major Field of Study	1986 Census	1971 Census	USIS ¹	CCSIS ²	HQMS ³					
	Variable Name/Corresponding Codes									
	DG_MTSR	CRSTYPE	N/A	N/A	N/A					
Educational, Recreational and Counselling Services										
Education General	1	12*	1.18.00*	74260 74200	10*					
Elementary - Primary Education	2-4	12*	1.18.00* 1.36.00	74210	01					
Secondary Education (Basic)	5-12	12*	1.18.00*	••	05					
Secondary Education (Specialized)	13-19	12*	1.18.00*	••	04, 06 11*					
Special Education	21-26	12*	1.18.00*	74220	02					
Non-teaching Educational Fields	27-32	·	1.38.01 1.38.02 1.38.03 1.38.07* 1.38.08* 1.38.99* 1.38.06	74230	08, 09 11*					
Physical Education, Health and Recreation	33-39	22	1.39.00 1.40.00 1.41.00	73000 73100 73200 73300 73310 73320 73340 73400 84400	03					
Counselling Services and Personal Development	40-44	09	1.38.05	74000 74100 74120 75000 75200 75400 75500	07					
All Other Fields				,5500						
Other Education	45-46	13*	1.23.00		11*					
All Other, n.e.c.	481		••							
No Specialization	482	••	••		••					
No Postsecondary Qualification	485	••	••		••					
discellaneous	••	99	••	••	••					
Other Service Industries					••					

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University Student Information System Community College Student Information System Highly Qualified Manpower Survey 3

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N/A not applicable.
* partially comparable.
.. codes not available.

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Appendix III. Occupation Codes in Census Data Bases Used to Obtain Data to Identify Scientists, Engineers and Technologists, According to the Standard Occupational Classification for 1980 and 1970; 1986, 1981 and 1971 Censuses

	1980 Classification			1970 Classification				
				Censu	15 Years			
Occupations	soc1	1986	1981	1971	soc1	1986	1981	1971
		Available	Not Av	ailable			Available	
Occupations in Physical Sciences	<u></u>							
Imputed	211	38	••	••			••	
Chemists	2111	39	••		2111	34	34	34
Geologists	2112	40		••	2112	35	35	35
Physicists	2113	41		••	2113	36	` 36	36
Meteorologists	2114	42	••	••	2114	37	37	37
Physical Sciences Technologists and Technicians	2117	43		••	2117	38	38	38
Occupation in Physical Sciences, n.e.c.	2119	44	••	••	2119	39	39	39
Occupations in Life Sciences								
Imputed	213	45	••	••	••	••		
Agriculturists and Related Scientists	2131	46	••	••	2131	40	40	40
Biologists and Related Scientists	2133	47	••	••	2133	41	41	41
Life Sciences Technologists and Technicians	2135	48			2135	42	42	42
Occupations in Life Sciences, n.e.c.	2139	49	••	••	2139	43	43	43
Architects, Engineers and Community Planners								
Imputed	214/215	50	••					
Architects	2141	51			. 2141	44	44	44
Chemical Engineers	2142	52			2142	45	45	45
Civil Engineers	2143	53			2143	45	45	45
Electrical Engineers	2144	54			2144	47	40	40
Industrial Engineers	2145	55			2145	48	49	47
Agricultural Engineers	2146	56		••	2145	10	40	40
Mechanical Engineers	2147	57	••	•••	••	••		
Metallurgical Engineers	2151	58	••	••	2147	49	49	49
Mining Engineers	2153	59	••	••	2151	50	50	50
Petroleum Engineers ²	2154	60	••	••	2103	51	51	51
Aerospace Engineers ³	2155	61	••	••	2124	52	52	52
Nuclear Engineers ⁴	2133	63 01	••	••	2155	53	53	53
Tomminity Disease	2130	02	••	••	2157	54	54	54
Community rianners	2157	63	••	••	••	••	••	••
roressional Engineers, 1.e.c.	2159	64	••	••	2159	55	55	55

Appendix III. Occupation Codes in Census Data Bases Used to Obtain Data to Identify Scientists, Engineers and Technologists, According to the Standard Occupational Classification for 1980 and 1970; 1986, 1981 and 1971 Censuses (Continued)

	1980 Classification				1970 Classification			
	Census Years				sus Years			
Occupations	soc1	1986	1981	1971	soc ¹	1986	1981	1971
		Available	Not	Available			Available	
Occupations in Mathematics, Statistics, Systems Analysis and Related Fields						·	- <u> </u>	
Imputed	218	72	••	••	••	•••		
Mathematicians, Statisticians and Actuaries	2181	73	••	••	2181	61	61	61
Systems Analysts, Computer Programmers and Related Occupations	2183	74	••		2183 `	62	62	62
Occupations in Mathematics, Statistics, Systems Analysis and Related Fields, n.e.c.	2189	75	••	••	2189	63	63	63
Architectural, Engineering and Related Technologists and Technicians								
Imputed	216	65		••		••	••	
Supervisor: Other Occupations in Architecture and Engineering	2160	66	••		2160	56	56	56
Surveyors	2161	67	••	••	2161	57	57	57
Drafting	2163	68	••	••	2163	58	58.	58
Architectural Technologists and Technicians	2164	69	••				••	
Engineering Technologists and Technicians	2165	70	••	••	2165	59	59	59
Other Occupations in Architecture and Engineering, n.e.c.	2169	71	••		2169	60	60	60
Occupations in Social Sciences				•				
Imputed	231	76	••	••		••	••	••
Economists	2311	77	••	••	2311	64	64	64
Sociologists, Anthropologists and Related Social Scientists	2313	78	••	••	2313	65	65	65
Psychologists	2315	79	••		2315	66	66	66
Occupations in Social Sciences, n.e.c.	2319	80	••	••	2319	67	67	67
Occupations in Social Work and Related Fields						v		
Imputed	233	81	••	••	••	••		••
Social Workers	2331	82		••	2331	68	68	68
Occupations in Welfare and Community Services	2333	83	••		2333	69	69	69
Occupations in Social Work and Related Fields, n.e.c.	2339	84	••		2339	70	70	70

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Appendix III. Occupation Codes in Census Data Bases Used to Obtain Data to Identify Scientists, Engineers and Technologists, According to the Standard Occupational Classification for 1980 and 1970; 1986, 1981 and 1971 Censuses (Concluded)

		1980 Classification				1970 Classification		
				Censu	IS Years			
Occupations	soc1	1986	1981	1971	soc1	1986	1981	1971
		Available	Not Av	ailable			Available	
Occupations in Library, Museum and Archival Sciences		· · · · · ·				·		
Imputed	235	89	••	••	••	••	••	
Supervisors: Occupations in Library, Museum and Archival Sciences	2350	90	••	••	2350	74	74	74
Librarians, Archivists and Conservators	2351	91	••	••	2351	75	75	75
Technicians in Library, Museum and Archival Sciences	2353	92	••		2353	76	76	76
Occupations in Library, Museum and Archival Sciences, n.e.c.	2359	93	••		2359	77	77	77
Other Occupations in Social Sciences and Related Fields								
Imputed	239	94	••	••	••	••	••	
Educational and Vocational Counsellors	2391	95			2391	78	78	78
Other Occupations in Social Sciences and Related Fields, n.e.c.	2399	96	. 		2399	79	79	79
Management Occupations, Natural Sciences and Engineering	1131	10	••	••	1131	9	9	9
Management Occupations, Social Sciences and Related Fields	1132	11			1132	10	10	10
University and Community College Teachers								
University Teachers	2711	102	••		2711	83	83	83
University Teaching and Related Occupations, n.e.c.	2719	103	••	••	2719	84	84	84
Community and Vocational School Teachers	2791	109	••		2791	88	88	88

1 The Standard Occupational Classifications for 1970 and 1980. 2

According to the 1971 Census Data Base Manual, this category was named "Petroleum extraction engineers". According to the 1971 Census Data Base Manual, this category was named "Aeronautical engineers". According to the 1971 Census Data Base Manual, this category was named "Aeronautical engineers". According to the 1971 Census Data Base Manual, this category was named "Atomic engineers". 3

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codes not available. ...

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Source Concepts Definition Coverage 1. 1986 Census Major Field of Refers to the predominant Population aged 15 years and Study discipline or area of learning over excluding inmates. This of a person's highest postpopulation is Canadian or secondary degree, certificate landed immigrants. or diploma Occupation Refers to the kind of work Population aged 15 years and done during the reference over (Canadian population or week landed immigrants) excluding inmates who had worked in 1985 or 1986 Highest Level of Refers to the highest grade Population aged 15 years and Schooling or year of elementary or over (Canadian population or secondary high school attended. landed immigrants) excluding or the highest year of univerinmates sity or other non-university completed 2. 1981 Census Occupation Refers to the kind of work Population aged 15 years and done during the reference over (Canadian population or week landed immigrants) excluding inmates who had worked in 1980 or 1981 Highest Level of Refers to the highest grade Population aged 15 years and over (Canadian population or Schooling or year of elementary or secondary high school attended, landed immigrants) excluding or the highest year of univerinmates sity or other non-university completed 3. 1971 Census Occupation Refers to the kind of work Population aged 15 years and done during the reference over (Canadian population or landed immigrants) excluding week inmates who had worked in 1970 or 1971 Highest Level of Refers to the highest grade Population aged 15 years and Schooling or year of elementary or over (Canadian population or secondary high school attended, landed immigrants) excluding or the highest year of univerinmates sity or other non-university completed Vocational Training Refers to area of apprentice-Population aged 15 years and ship or other full-time vocaover (Canadian population or tional course, for example, landed immigrants) excluding carpentry, hairdressing, draftinmates ing, etc. 4. 1976, 1982 Major Field of Major field of study defined Canadian or foreign student and 1986 Study by the institutions population registered in National degree-granting institutions Graduates Surveys 5. Labour Force Occupation Refers to the kind of work 98% of the population aged 15 Survey done by the person selected years and over excluding popin the household ulation of Northwest Territories and Yukon, foreign

students with residence permits, people with temporary work permits, representatives of foreign nations and their families, inmates of institutions, members of the Canadian Armed Forces, and those

on Indian reserves.

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Appendix IV. Summary Table on the Comparability of Sources of Data on Scientists, Engineers and Technologists

Sou	ICO	Concepts	Definition	Coverage
6.	Current Population Profile Survey	Occupation	Refers to the kind of work done by the person selected in the household	98% of the population aged 15 years and over excluding pop- ulation of Northwest Terri- tories and Yukon, foreign students with residence per- mits, people with temporary work permits, representatives of foreign nations and their families, inmates of institu- tions, members of the Cana- dian Armed Forces, and those on Indian reserves.
		Major Field of Study	Major discipline studied by the person interviewed	98% of the population aged 15 years and over excluding pop- ulation of Northwest Terri- tories and Yukon, foreign students with residence per- mits, people with temporary work permits, representatives of foreign nations and their families, inmates of institu- tions, members of the Cana- dian Armed Forces, and those on Indian reserves.
7.	Labour Market Activity Survey	Occupation	Refers to the kind of work done by the person interviewed	Civilian, non-institutional- ized population between 16 and 69 years of age, exclud- ing residents of Northwest Territories and Indian reserves, and full-time mem- bers of the Canadian Armed Forces
8.	General Social Survey	Occupation	Refers to the kind of work done by the person interviewed	Population aged 15 years and over excluding residents of Northwest Territories and Yukon
9.	1973 Postcensal Highly Qualified Manpower Survey	Highest Level of Schooling	Refers to the university degree for which the person interviewed has been awarded, or for which he/she is currently studying and his/her major field of study	Population aged 15 years and over with a university degree
		Occupation	Nature of work done by the person interviewed	Population aged 15 years and over with a university degree
10.	Educational Staff Survey	Occupation	N/A	All academic staff within faculties who are teaching or performing administrative duties. Also included are senior administrative staff, academic staff in teaching hospitals and visiting aca- demic staff
		Main Area of Instruction	Refers to the major area of instruction from the teacher	All academic staff within faculties who are teaching or performing administrative duties. Also included are semior administrative staff, academic staff in teaching hospitals and visiting aca- demic staff

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Appendix IV. Summary Table on the Comparability of Sources of Data on Scientists, Engineers and Technologists (Continued)

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Appendix IV.	Summary Table on the Comparability of Sources of Data on Scientists, Engineers and Technologists
	(Continued)

Source	Concepts	Definition	Coverage
11. Community College and Universities Clientele	Degrees	Refers to the level of schooling of the student	Canadian or foreign student population registered in degree-granting institutions
Surveys	Major Field of Study	Refers to the educational program of the registered student	Canadian or foreign student population registered in degree-granting institutions



Methodology Data Collection Variables Available 1. 1986 Census Sample population of one out June 3, 1986 Occupation, level of schooling, of five households major field of study

Appendix IV. Summary Table on the Comparability of Sources of Data on Scientists, Engineers and Technologists (Concluded)

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2.	1981 Census	Sample population of one out of five households	June 3, 1981	Occupation and level of schooling
3.	1971 Census	Sample population of one out of three households	June 1, 1971	Occupation, level of schooling, vocational training
4.	1976, 1982 and 1986 National Graduates Surveys	Population registered in the post-secondary degree-granting institutions	1978, 1984, 1988	Occupation, level of schooling, major field of study
5.	Labour Force Survey	Sample of 55,000 households	Monthly	Occupation
6.	Current Population Profile Survey	Sample of 5 out of 6 of the 55,000 households from the Labour Force Survey	August 1982	Occupation, major field of study
7.	Labour Market Activity Survey	Sample of 48,000 households from the Labour Force Survey sample	Annual	Occupation
8.	General Social Survey	Sample of 10,000 households	January - February 1989	Occupation, major field of study
9.	1973 Postcensal Highly Qualified Manpower Survey	Sample population with a university degree or diploma based on one third of the households	1973	Occupation, university level, major field of study
10.	Educational Staff Survey	Close to 100 post-secondary degree-granting institutions in Canada (non-constant from one year to another)	Annual, in fall	Occupation
11.	Community Colleges and Universities Student Surveys	Close to 100 post-secondary degree-granting institutions in Canada (non-constant from one year to another)	Annual, December 1	Level of schooling, major field of study

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