



Statistics Canada

Business Survey Methods Division

**Methodology of the National Survey of Information
Technology Occupations, 2002**

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1. INTRODUCTION

The National Survey of Information Technology Occupations, 2002 (NSITO) is being conducted on behalf of the Software Human Resource Council to collect statistical information on employment trends in information technology (IT) occupations. It will provide government and businesses with up-to-date labour-market information for IT occupations within various industries and regions. The results will be used to help shape policies relating to this important group of occupations.

A pilot survey was conducted in 2000. It covered only the following three sectors: insurance companies in Ontario; architectural, engineering and related services in Quebec; and computer systems design and related services throughout Canada. It also collected data on only 21 IT occupations. In the national survey, five major sectors were surveyed across the country. The public sector (federal and provincial) was also included in the survey on the same footing as the private sector. In addition, the survey covered 25 IT occupations.

The NSITO is a three-stage survey. First, a sample of employers in both private and public sectors is selected; this is stage 1. The questions asked in stage 1 are essentially about the IT workforce. Stage 2 involves selecting a maximum of two occupations (out of 25) per employer. The questions asked in this stage deal with hiring, training and retaining employees in the selected occupations. In stage 3, a maximum of 10 employees are sampled for each occupation selected in stage 2. Among the subjects that employees are asked about are training, previous employment and demographic characteristics.

This paper provides a detailed description of the survey's methodology in the areas of sample design, data collection and processing, production of estimates, and the rules governing their dissemination.

2. TARGET POPULATION

2.1 PRIVATE SECTOR

In the private sector, the NSITO's target population consists of all locations in Canada that are in Statistics Canada's Business Register on June 1, 2002, have at least six employees and are operating in the computer and electronic product manufacturing industry (NAICS-3 code=334), the information and cultural industries (NAICS-2 code=51), finance and insurance (NAICS-2 code=52) and professional, scientific and technical services (NAICS-2 code=54). There are 55,981 locations in the private-sector frame.

These industries were selected using data collected in the Labour Force Survey (LFS). According to the LFS, of the 450,010 IT employees in Canada, 39,507 (8.8%) are in the public sector and 410,503 (91.2%) are in the private sector. The LFS also shows that 76% of IT employees in the private sector work for businesses whose NAICS code is 334, 51, 52 or 54.

In the private sector, the 15 NAICS-4 codes that have the most IT employees are listed in the table below.

Table 1
List of NAICS-4 where IT workers are concentrated

NAICS-4	Number of IT employees	% of total number of employee in IT (without public sector)
5415	177 224	43.17%
5133	19 799	4.82%
5221	17 120	4.17%
3342	14 279	3.48%
5413	12 267	2.99%
5241	8 940	2.18%
5414	8 598	2.09%
6113	8 026	(Not included in the survey)
3341	7 898	1.92%
2211	7 218	(Not included in the survey)
5141	6 201	1.51%
5112	5 715	1.39%
6220	5 012	(Not included in the survey)
4173	4 737	(Not included in the survey)
3344	4 572	1.11%

Table 2
List of the 5 NAICS codes in scope for the survey

NAICS	Number of IT employee	% of total number of employee in IT (without public sector)
5415	177 224	43.17%
51	39 981	9.74%
52	32 248	7.86%
54	31 333	7.63%
334	29 411	7.16%

For the private sector, then, the survey covers about 76% of IT employees.

2.2 PUBLIC SECTOR

According to the LFS, the distribution of IT employees in the public sector is as shown below.

Table 3
Distribution of IT employees by level of government

NAICS	Number of IT employees	% of total number of employee in IT for the public sector	% cumulative
9110 (federal government public administration)	19 875	50.31%	50.31%
9120 (provincial and territorial public administration)	12 554	31.78%	82.09%
9130 (local, municipal and regional public administration)	5 390	(Not in the survey)	
9111 (Defence services)	1 476	(Not in the survey)	
9191 (International and other extra-territorial public administration)	165	(Not in the survey)	
9141 (aboriginal public administration)	47	(Not in the survey)	

The federal and provincial governments employ about 82% of the public-sector IT workforce. Only those two levels of government are covered in the survey.

2.2.1 Federal government

At the federal level, the target population is composed of all divisions of the 15 departments that employ the largest number of people in the CS group. Those 15 departments include 75% of federal public servants and 90% of employees in the CS category. The list of divisions was developed using *Scott's Government Index*. For the list of federal government departments covered by the survey, see Appendix 1.

2.2.2 Provincial and territorial governments

For the provinces and territories, a list of ministries with the number of IT employees and the total number of employees was obtained from the Chief Information Officer (CIO) of each province and territory (except New Brunswick and British Columbia).

The ministries for each province and territory were arranged in order from highest number of IT employees to lowest. They were selected from the top of the list down until the desired 90% coverage of IT employees was attained.

Since there was no information for New Brunswick and British Columbia, the list of ministries for those provinces was based on the ministries covered in other provinces. For example, since the ministries of health and education were covered in most provinces, they were also covered in New Brunswick and British Columbia.

Then the list of divisions within each ministry was developed using *Scott's Government Index*. For the list of ministries covered in each province, see Appendix 2.

3. SAMPLE DESIGN

The NSITO uses a three-stage sampling plan. Stage 1 is the selection of locations (private sector) or divisions (public sector). In stage 2, a maximum of two occupations (out of 25) are selected for each location or division that responded in stage 1. In stage 3, a maximum of 10 employees are sampled for each occupation selected in stage 2. The sampling plan is described in detail below.

3.1 STAGE 1

Stage 1 involves the selection of locations (private sector) or divisions (public sector). The term "employers" is often used to refer to stage 1 units. For both private and public sectors, the stage 1 sample design is stratified simple random sampling. Details concerning the stratification, size and selection of the sample for each sector are provided below.

3.1.1 Private sector

3.1.1.1 Stratification

The locations were stratified on the basis of three components: size, region and industry code.

Table 4

Possible categories for the stratification variable "size"

Size of the location
6 to 25 employees
26 to 50 employees
More than 50 employees

Table 5

Possible categories for the stratification variable « region »

Region
Newfoundland
Prince Edward Island
Nova Scotia
New Brunswick
Quebec (without Montréal and Gatineau CMAs)
Ontario (without Toronto and Ottawa CMAs)
Manitoba
Saskatchewan

Alberta (without Calgary and Edmonton CMAs)
British Columbia (without Vancouver and Victoria CAMs)
Territoires (Yukon, Nunavut et Northwestern Territories)
Montréal CMA
Gatineau CMA
Ottawa CMA
Toronto CMA
Calgary CMA
Edmonton CMA
Vancouver CMA
Victoria CMA

Table 6
Possible categories for the stratification variable « industry sectors »

Industry Sectors
334 (Computer and electronic product manufacturing)
51 (Information and cultural industries)
52 (Finance and insurance)
54, except 5415 ("Professional, scientific and technical services without Computer systems design and related services)
5415 (Computer systems design and related services)

Since we have three possible values for the size variable, 19 possible values for the region, and five possible values for the industry code, the number of possible strata is $3 \times 19 \times 5 = 285$; since 10 of them are empty, we have a total of 275 strata.

The distribution of the population in those strata is shown in Appendix 3.

3.1.1.2 Sample size

The sample size for the private sector is 32,150 locations.

Originally, the private-sector sample size was set at 21,000 for various reasons, including interviewing costs. Because of the large number of out-of-scope units, 11,150 extra units were added.

3.1.1.3 Sample allocation

The private-sector sample was selected in five waves.

Wave 1

The units in wave 1 (12,600) were allocated to the strata in such a way that the standard deviation (if we estimate a proportion of 50%) would be the same in all strata.

Wave 2

The units in wave 2 (5,000) were allocated to the strata in proportion to the number of pre-contacted units whose status was one of the following: out of business, cannot locate, out of scope, refused, no contact, inactive, fewer than six employees, no IT employees.

Wave 3

The units in wave 3 (3,506) were allocated so that all strata would have the same number of units to be sampled. Hence, if there are 34 or fewer units left in the stratum, we take whatever is left or we take 34. However, this gives us 3,479 units instead of the 3,500 we want. So we make all strata with 41 or fewer units take-all strata. In the other strata, we take 34. That yields a total of 3,506 units.

Wave 4

The units in wave 4 were allocated so that all strata would have the same number of units to be sampled. Hence, if there are 135 or fewer units left in the stratum, we take whatever is left or we take 135. That gives us a total of 8,044 units.

Wave 5

Wave 5 was selected in order to find more employees. To allocate the 3,000 units in wave 5 among the 46 strata in which units could still be selected, the ratio of the number of questionnaires received (as of February 12, 2003) to the sample size was computed for each stratum. The 3,000 units were allocated in proportion to this ratio so that units would be sampled in strata where it was more likely they'd respond.

The sample allocation is shown in Appendix 4.

3.1.1.4 Sample selection

To avoid placing too great a response burden on the locations targeted by the survey, locations that were already in the Workplace and Employee Survey (WES) sample had no chance of being sampled for this survey.

A random number between 0 and 1 was generated for all units in the sample frame (WES units were assigned a value of 2). For each stratum, the units were arranged in ascending order based on the random number assigned. The sample is selected as follows: if the wave 1 sample in a stratum has to be 50 units, units 1 through 50 are chosen. If a subsequent wave requires 20 units, locations 51 through 70 will be selected.

3.1.2 Public sector

3.1.2.1 Stratification

Each unit in the frame was classified as either take-some or take-all on the basis of the division's name. If the division had a strong likelihood of having IT employees, it was assigned to the take-all category. If not, it was placed in the take-some category.

For each of the 10 provinces and for all three territories combined, two strata were created: one stratum containing units pre-identified as possibly having IT employees, and another stratum containing all other units. All strata containing the pre-identified units are take-all strata.

For the federal government, four strata were created. The units were divided into two groups on the basis of whether they were located in the National Capital Region or not. Each group was then divided into two strata, as the provinces and territories were.

Hence, the sample frame contains 26 strata.

The distribution of the population in those strata is shown in Appendix 5.

3.1.2.2 Sample size

Originally, the sample was to have consisted of about 2,000 units (the sample size was determined by collection costs). During the project, the decision was made to add some 500 units. In all, 2,520 units are included in the sample.

Since there were 1,590 units in the take-all strata, the remaining 930 units were selected in take-some strata.

The sample allocation in the strata is shown in Appendix 5.

3.1.2.3 Sample allocation

Of the 4,846 units in the frame, 1,590 were identified as having IT employees. Those units form the take-all strata. They were selected to be in the sample with a probability of 1.

In the take-some strata, part of the sample, 430 units, was allocated so that all strata would have the same standard deviation, 0.0778 (if we want to estimate a proportion of 50%). A further 500 units were subsequently allocated in the same way, with the aim of having a standard deviation of 0.0451 in each stratum. The sample consists of a total of 2,520 units.

3.1.2.4 Sample selection

As in the case of the private sector, a random number between 0 and 1 was generated for all units in the frame. For each stratum, the units were arranged in ascending order based on the random number assigned. The sample was selected as follows: if the wave 1 sample in a stratum has to be 50 units, units 1

through 50 are chosen. If the additional wave requires 20 units, locations 51 through 70 will be selected.

3.2 STAGE 2

In stage 1, all employers were asked to state how many employees they had working in each of the 25 occupations of interest to the survey. Stage 1 and 2 data were collected by computer-assisted interview, and the computer system randomly selected two occupations out of the ones in which the employer reported having at least one employee (other than contractors or volunteers). Random selection was performed in cases where the employer had employees in at least three of the 25 occupations. If the employer had only one or two of the occupations, they were selected with certainty.

Then, for each sampled occupation, the employer was asked questions about hiring, retention and training.

Only employers who had employees other than contractors or volunteers in at least one occupation were considered in-scope for stage 2. In addition, only occupations in which there were employees other than contractors or volunteers had a chance of being sampled in stage 2.

The distribution of stage 1 private-sector units by number of occupations present is shown in Appendix 6a.

The distribution of stage 2 public-sector units by number of occupations present is shown in Appendix 6b.

3.3 STAGE 3

Stage 3 involves the selection of a maximum of 10 employees for each occupation sampled in stage 2. To make this selection, the employer is offered two alternatives: provide a list of all employees working in the sampled occupations, or distribute the survey questionnaires at random to a maximum of 10 employees per occupation. The survey includes questions on salary, training, education, career path, etc.

3.3.1 “Supplementary employees” for the private sector

Because the response rate was so low in stage 3 for the private sector (for more details, see section 7), the decision was made to add a new component to the survey: “supplementary employees”. This component consisted in revisiting employers who had previously agreed to let their employees participate in the survey and asking them to distribute questionnaires to employees of all occupations not selected in stage 2.

The goal was to increase the number of employees responding in stage 3.

4. WEIGHTING

4.1 STAGE 1 UNITS

4.1.1 Sampling weight and adjustment

Stage 1 respondents can be divided into three groups. The first group contains employers who have permanent IT employees (this group is clearly in-scope); the second group contains employers who have no permanent IT employees but currently have contract IT employees (this group is in-scope in stage 1, but not in stage 2); and the third group contains employers who have no permanent IT employees, usually hire contract IT employees but do not have any at the moment (this group is out of scope). Employers with fewer than six employees, excluding contractors, are also out of scope.

In stage 1, the weighting process is simple. The final weight (W_{loc}) for stage 1 is just the product of the sampling weight (W_h) and a non-response adjustment factor (d_{loc}). More specifically:

? sampling weight (W_h):

$$W_h = \frac{N_h}{n_h}$$

where N_h = the number of units in the population in stratum h and n_h = the number of sample units in stratum h

? stage 1 non-response adjustment (d_{loc}):

$$d_{loc} = \begin{cases} \frac{n_r + n_{nr} + n_{oos}}{n_r + n_{oos}} & \text{if the unit is respondent or out of scope} \\ 0 & \text{if the unit is non-respondent} \\ 1 & \text{if the unit is out of business} \end{cases}$$

? final stage 1 weight (W_{loc})

$$W_{loc} = W_h * d_{loc}$$

For both private and public sectors, these adjustments are made at the stratum level.

4.1.2 Merged strata

In the private sector, strata with one or zero respondents were merged with other strata. The process of finding a similar stratum was subject to the following rules:

1. If it is a size 1 stratum, take the size 2 stratum in the same region with the same NAICS code.
2. If it is a size 3 stratum, take the size 2 stratum in the same region with the same NAICS code.
3. If it is a size 2 stratum, take the stratum (size 1 or 3 in the same region with the same NAICS code) in which the sampling weights are closest to the weights in the size 2 stratum.
4. If collapsing the size 1 and 2 strata is insufficient, add the size 3 stratum in the same region with the same NAICS code. Similarly, if collapsing the size 2 and 3 strata is insufficient, add the size 1 stratum in the same region with the same NAICS code.

These rules do not apply to strata AB_E1_3340 and GA_E3_3340 and most strata in the territories. Non-respondents in strata AB_E1_3340 and GA_E3_3340 will be considered out of scope, so that these strata do not have to be merged with other strata (since there are no strata similar to AB_E1_3340 and GA_E3_3340). All strata in the territories were collapsed into one stratum.

The list of merged strata is presented in Appendix 7.

In the public sector, there were enough respondent units in every stratum, so no mergers were necessary. However a division had not been identified as having to be included in a take-all stratum, was assigned to a take-some stratum with a weight of 3. Because this division had a large number of IT employees and a high weight, the survey's estimate of the total number of IT employees in the province is far above the actual number (provided by the province's Chief Information Officer). As a result of this and the fact that the division is unique in the province, it was decided to assign it to a special stratum and give it a weight of 1. The weights of the units in the original stratum were recomputed.

4.2 STAGE 2 UNITS

In stage 2, the stage 1 weight has to be adjusted to reflect the fact that a maximum of two occupations were selected from the occupations present (*d_selec*). It is also necessary to add a "number of employees" adjustment factor (*d_emp*) to ensure that the number of employees calculated in stage 2 for each new_stratum/occupation is the same as the number computed in stage 1. (The new strata are essentially the same as the original strata, except for some collapsed regions: Newfoundland, Prince Edward Island, Nova Scotia (excluding Halifax) and New Brunswick to form the Atlantic region; Ottawa and Gatineau to form the Ottawa-Gatineau region; Calgary and Edmonton to form the Calgary-Edmonton region; British Columbia (excluding Vancouver), Victoria and the territories to form the region of British Columbia and the territories; and

Manitoba, Saskatchewan and Alberta (excluding Calgary and Edmonton) to form the Prairie region.)

In the public sector, the adjustment was made at the region level (NCR and non-NCR for the federal government, and the Atlantic region, Quebec, Ontario and the West for provincial governments). Thus, the number of employees computed in stage 1 in each region/occupation is the same as the number calculated in stage 2 for the same level.

? stage 2 sampling weight (d_selec):

$$d_selec = \begin{cases} \frac{k}{2} & \text{where } k = \text{number of occupations with at least 1 employee, } k \geq 2 \\ 1 & \text{if and only if } k = 1 \end{cases}$$

We can then compute W_selec , which is the product of W_loc and d_selec :

$$W_selec = W_loc * d_selec$$

? “number of employees” adjustment factor (d_empl):

$$d_empl = \frac{\sum_{\text{Stage 1}} w_loc * QB1_Z}{\sum_{\text{Stage 2}} W_selec * QB1_Z}$$

where Z is the occupation for which we are making the adjustment.

Note: A different d_empl has to be computed for each new_stratum/occupation (region/occupation for the public sector).

? stage 2 final weight (W_occ)

$$W_occ = W_selec * d_empl$$

4.3 STAGE 3 UNITS

The required adjustments for stage 3 are as follows: a series of four adjustments (d_{nr1} , d_{nr2} , d_{nr3} , d_{nr4}) were applied to compensate for occupations for which no employee responded; a second adjustment (d_{empl}) was applied for employee non-response; and a final adjustment (d_{fin}) ensured that the number of employees computed in stage 3 for each new_stratum/occupation is the same as the number computed in stage 1 (region/occupation for the public sector).

? adjustment for locations where no employees responded (d_{nr1} to d_{nr4}):

$$d_{nr} = \begin{cases} \frac{\sum_r W_{occ} + \sum_{nr} W_{occ}}{\sum_r W_{occ}} & \text{if the unit is respondent} \\ 0 & \text{if the unit is non-respondent} \end{cases}$$

Four adjustments were needed to compensate for stage 2 units where no employee responded.

Adjustment d_{nr1} was made at the stratum/occupation level.

Adjustment d_{nr2} was made at the new_stratum/occupation level (region/occupation for the public sector).

Adjustment d_{nr3} was made at the region/occupation level (occupation only for the public sector).

Adjustment d_{nr4} was made at the occupation level (all units for the public sector).

With these values, we can calculate the new weight for location/occupation, W_{occ}^* :

$$W_{occ}^* = W_{occ} * d_{nr1} * d_{nr2} * d_{nr3} * d_{nr4}$$

? adjustment for non-respondent employees in a location/occupation

$$d_{empl} = \left\{ \frac{\text{number of employees in the location/o ccupation}}{\text{number of respondent employees in the location/o ccupation}} \right.$$

This enables us to calculate the new employee weight:

$$W_{loc.occ} = W_{occ}^* * d_{empl}$$

? adjustment to ensure that the sum of the employee weights in the new_stratum/occupation (region/occupation for the public sector) is the same as the sum in stage 1

$$d_{fin} = \frac{\sum_{stage1} w_{loc} * QB1_Z}{\sum_{stage3} W_{loc.occ}}$$

where Z is the occupation for which we are making the adjustment.

The final weight (W_{empl}) is calculated as follows:

$$W_{empl} = W_{loc.occ} * d_{fin}$$

5. ESTIMATION AND VARIANCE

5.1 STAGE 1

Stage 1 involves stratified simple random sampling. The estimates were produced with Statistics Canada's Generalized Estimation System (GES). Some 25 tables were generated.

5.2 STAGE 2

For the stage 2 estimates, an in-house SAS program was developed, and the usual formulae for a two-stage design were used. About 100 tables were generated.

5.3 STAGE 3

The stage 3 estimates were also computed with an in-house SAS program. An iterative method was used to calculate the variance; see Appendix 8 for details.

6. COLLECTION

6.1 STAGES 1 AND 2

First, sampled employers were pre-contacted. The purpose was to confirm the location's name and address, the number of employees, the industry and the name of the person best able to complete the survey. The pre-contact was also supposed to be an opportunity to find out whether the location had any IT employees. However, this question was quickly dropped when suspicion arose that respondents who almost certainly had IT employees had answered no. Questionnaires were sent to all employers who answered no.

Following the pre-contact, CD-ROMs containing the questionnaire in electronic form were mailed out. Note that there is no paper questionnaire for stage 1. Two weeks after the mailing, telephone follow-up was carried out for employers who had not yet responded. During the follow-up call, these employers were offered the opportunity to complete the survey by computer-assisted interview. About 70% of the respondents chose this option. The remaining respondents sent in their responses over the Internet.

Because of the low response rate, a number of measures were taken. Faxes and letters were sent to non-respondents, telephone lines were set aside at call reception, and the collection people worked evenings.

6.2 STAGE 3

Employees had the option of responding electronically, by computer-assisted interview or on a paper questionnaire. However, since most employers chose to distribute the questionnaires to their employees, following up directly with employees was nearly impossible. As a result, the response rate for this stage was very low. Two steps were taken to address this problem: employers who had refused to let their employees participate were contacted and asked to take part in stage 3, and a “supplementary employees” component was added (see section 3.3.1).

7. RESPONSE RATE

7.1 STAGE 1

7.1.1 Private sector

In stage 1, 32,150 units were sampled. Of those, 23,002 units were out of scope (units with no IT employees, units with fewer than six employees, units that had gone out of business, etc.). Of the remaining 9,148 units, 4,418 responded, which gives a response rate of 48%.

Table 7

Distribution of the first stage units for the private sector by their status

Status	Number of units
Respondent	4 418
Out of scope	23 002
Non respondent	4 730

In stage 1, the response rate (defined as the number of respondent units over the number of in-scope units) is computed as follows:

$$\text{response rate} = \frac{\text{\#respondent units}}{\text{\#respondent units} + \text{\#non - respondent units}} = \frac{4418}{4418 + 4730} = 48.3\%$$

7.1.2 Public sector

Stage 1 in the public sector involved a sample of 2,520 units. Of those, 1,531 were out of scope. Of the remaining 989 units, 610 responded, for a response rate of 62%.

Table 8
Distribution of first stage units in the public sector by their status

Statut	Nombre d'unités
Répondant	610
Hors champ	1 531
Non-répondant	379

7.2 STAGE 2

7.2.1 Private sector

In stage 1, 3,977 employers were eligible to move on to stage 2, while 441 were dropped because they had only contract employees. Within the stage 1 population of 3,977 employers, 6,710 occupations were sampled in stage 2. Complete data were obtained for 6,584 occupations, for a response rate of 98%.

7.2.2 Public sector

In stage 1, 589 respondents were eligible to move on to stage 2, while 21 were dropped because they had only contract employees. Within the stage 1 population of 589 employers, 1,035 occupations were sampled in stage 2. Complete data were obtained for 1,025 occupations, for a response rate of 99%.

7.3 STAGE 3

7.3.1 Private sector

Of the 15,309 employees sampled, 3,702 responded, which gives a response rate of 25%. (These figures do not include the supplementary employees, i.e., employees in occupations that were not sampled in stage 2.)

7.3.2 Public sector

Of the 1,417 employees surveyed, 1,000 responded, which gives a response rate of 37%.

8. DATA QUALITY

The table below presents the ranges of values of the coefficients of variation (CVs) and standard deviations assigned to quality codes A (very good), B (good), C (use with caution) and F (not published).

The CVs are used as a quality indicator for totals and averages. The standard deviations are used for percentages and ratios.

code	description	CV	Standard deviation
A	Very good	<=5.0%	<=2.5%
B	Good	>5.0% and <=15.0%	>2.5% and <=7.5%
C	Use with caution	>15.0% and <=30.0%	>7.5% and <=15.0%
F	Data not published	>30%	>15.0%

In stages 1 and 2, to publish a cell (domain), there had to be at least three employers in the domain.

In stage 3, to publish a domain, there had to be at least six employees from three different employers.

Because of the low response rate in stage 3, there may be a bias in some estimates. The bias could be caused by the fact that an employee with quite different characteristics from the other respondent employees in the same domain had a higher weight than the other employees.

For each domain published, an indicator of possible bias was produced. If, for a given domain, the sum of the weights of the observations with the highest weights (we take the top 50% of the observations arranged in descending order of weight) makes up more than 85% of the domain's total weight, an indicator shows the possibility of a bias.

Appendix 1: List of federal department covered by the survey

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Canadian Custom and Revenue Agency	44 998	3 320	3 320	23,76%
Human Resource Development Canada	24 257	2 239	5 559	39,78%
National Defence	18 578	1 227	6 786	48,56%
Department of public works and government services	12 633	1 174	7 960	56,96%
Statistics Canada	6 307	941	8 901	63,69%
Health Canada	8 105	556	9 457	67,67%
Environment Canada	5 381	496	9 953	71,22%
Industry Canada	5 343	494	10 447	74,75%
Citizenship and Immigration	4 850	403	10 850	77,64%
Fisheries and Oceans	10 496	400	11 250	80,50%
Foreign affairs and international trade	4 747	326	11 576	82,83%
Correctional service du Canada	14 190	304	11 880	85,01%
Natural Resources Canada	4 416	289	12 169	87,08%
Agriculture and Agri-food	5 565	286	12 455	89,12%
Veterans Affairs	3 531	174	12 629	90,37%
Transports Canada	4 441	147	12 776	91,42%
Indian Affairs and Northern Development	3 811	136	12 912	92,39%
Canadian Heritage	1 858	127	13 039	93,30%
Justice	4 253	124	13 163	94,19%
...				

Only departments in bold are covered in this survey; they account for 90% of the CS federal employees.

Appendix 2 : List of provincial and territorial departments covered by the survey

1. Newfoundland and Labrador

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Executive Council	344	29	29	16,96%
Justice	1344	21	50	29,24%
Forest Resources and Agri-foods	635	20	70	40,94%
Health and Community Services	240	19	89	52,05%
Municipal and Provincial Affairs	152	16	105	61,40%
Human Resources and Employment	554	15	120	70,18%
Works, Services and Transportation	1873	15	135	78,95%
Education	178	12	147	85,96%
Government Services and Lands	501	4	151	88,30%
Industry, Trade and Rural Development	196	4	155	90,64%
Mines and Energy	132	4	159	92,98%
Finance	169	3	162	94,74%
Labour	93	3	165	96,49%
Environment	77	2	167	97,66%
Tourism, Culture and Recreation	507	2	169	98,83%
Legislature	138	2	171	100,00%
Fisheries and Aquaculture	114	0	171	100,00%
Labrador and Aboriginal Affairs	32	0	171	100,00%
Youth Services and Postsecondary Education	106	0	171	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

2. Prince Edward Island

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Provincial Treasury	207	72	72	44,72%
Education	66	25	97	60,25%
Health and Social Services	133	20	117	72,67%
Agriculture and Forestry	190	17	134	83,23%
Community and Cultural Affairs	134	8	142	88,20%
Development and Technology	64	8	150	93,17%
Transportation and Public Works	522	6	156	96,89%
Fisheries, Aquaculture and Environment	86	2	158	98,14%
Liquor Control Commission	98	2	160	99,38%
Tourism	98	1	161	100,00%
Employment Development Agency	8	0	161	100,00%
Attorney General	299	0	161	100,00%
Council of Maritime Premiers	0	0	161	100,00%
Executive Council	9	0	161	100,00%
Interministerial Women's Secretariat	2	0	161	100,00%
Office of the Auditor General	15	0	161	100,00%
P.E.I. Public Service Commission	53	0	161	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

3. Nova Scotia

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Community Services	1750	39		
Education	700	27		
Finance	925	22		
Health	650	23		
Justice	1550	27		
Natural Resources	1800	31		
Human Resources				
Environment and Labour				
Agriculture and Fisheries				
Service Nova Scotia and Municipal Relations	2000	39		
Economic Development				
Tourism and Culture				
Transportation and Public Works	850	21		
Corporate Strategies¹		24		
Corporate IT Operations¹		50		
IWAN		20.2		
Other		77.25		

1. Is now part of « Economic Development ».

Nova Scotia situation is different from other provinces. Since many IT employees available are in the Corporate Services Unit (CSU) (except for the ones in the category « Other » that contains many IT employees that are not part of the CSU and are distributed across departments), it is difficult to determine which department employs most of IT employees. It was decided to covert all departments in this province.

4. New Brunswick

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Agriculture, Fisheries and Aquaculture	n.d.	n.d.	n.d.	n.d.
Business New Brunswick	n.d.	n.d.	n.d.	n.d.
Education	n.d.	n.d.	n.d.	n.d.
Environment and Local Government	n.d.	n.d.	n.d.	n.d.
Family and Community Services	n.d.	n.d.	n.d.	n.d.
Finance	n.d.	n.d.	n.d.	n.d.
Health and Wellness	n.d.	n.d.	n.d.	n.d.
Intergovernmental Affairs	n.d.	n.d.	n.d.	n.d.
Investment and Exports	n.d.	n.d.	n.d.	n.d.
Justice	n.d.	n.d.	n.d.	n.d.
Natural Resources and Energy	n.d.	n.d.	n.d.	n.d.
Public Safety	n.d.	n.d.	n.d.	n.d.
Supply and Services	n.d.	n.d.	n.d.	n.d.
Training and Employment Development	n.d.	n.d.	n.d.	n.d.
Transportation	n.d.	n.d.	n.d.	n.d.
Executive Council Office	n.d.	n.d.	n.d.	n.d.
General Government	n.d.	n.d.	n.d.	n.d.
Legislative Assembly	n.d.	n.d.	n.d.	n.d.
Maritime Provinces Higher Education Commission	n.d.	n.d.	n.d.	n.d.
Office of the Comptroller	n.d.	n.d.	n.d.	n.d.
Office of the Premier	n.d.	n.d.	n.d.	n.d.

In New Brunswick, the number of IT employees in each department was not available. The choice was made based on the most frequently chosen departments in other province. For example, the Health and Education departments were chosen in most provinces, thus were chosen for New Brunswick.

5. Quebec

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Revenu	9260	1241	1241	17,53%
Transports	10558	916	2157	30,46%
Emploi et solidarité sociale	8975	796	2953	41,70%
Travail	6012	611	3564	50,33%
Santé et services sociaux	2521	559	4123	58,23%
Conseil du trésor	2369	539	4662	65,84%
Ressources naturelles	4748	355	5017	70,85%
Sécurité publique	6814	284	5301	74,86%
Éducation	2096	259	5560	78,52%
Finances	1354	241	5801	81,92%
Justice	3754	219	6020	85,02%
Relations avec les citoyens et immigration	2803	200	6220	87,84%
Agriculture, Pêcheries et Alimentation	3156	158	6378	90,07%
Environnement	1999	142	6520	92,08%
Affaires municipales et métropole	1188	126	6646	93,86%
Culture et Communications	1287	111	6757	95,42%
Famille, enfance et condition féminine	552	60	6817	96,27%
Personnes désignées par l'assemblée nationale	422	51	6868	96,99%
Tourisme	421	44	6912	97,61%
Industrie et commerce	774	42	6954	98,21%
Assemblée nationale	650	40	6994	98,77%
Relations internationales	452	31	7025	99,21%
Conseil exécutif	441	27	7052	99,59%
Faune et parcs	1155	12	7064	99,76%
Recherche, science et technologie	218	10	7074	99,90%
Régions	192	7	7081	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

6. Ontario

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Management Board Secretariat	3167	642	642	19,93%
Health and Long Term Care	7938	507	1149	35,67%
Natural Resources	6587	344	1493	46,35%
Public Safety and Security	17251	295	1788	55,51%
Transportation	5135	275	2063	64,05%
Finance	4228	272	2335	72,49%
Community, Family and Children's Services	7333	236	2571	79,82%
Environment	2474	121	2692	83,58%
Labour	1434	107	2799	86,90%
Education and Training, Colleges and Universities	2068	101	2900	90,03%
Attorney General	7610	88	2988	92,77%
Municipal Affairs and Housing	1059	65	3053	94,78%
Agriculture and Food	914	44	3097	96,15%
Citizenship	916	33	3130	97,17%
Consumer and Business Services	1483	30	3160	98,11%
Northern Development and Mines	641	27	3187	98,94%
Tourism, Culture and Recreation	1872	21	3208	99,60%
Energy	237	8	3216	99,84%
Enterprise, Opportunity and Innovation	380	3	3219	99,94%
Cabinet Office	179	1	3220	99,97%
Francophone Affairs	15	1	3221	100,00%
Intergovernmental Affairs	41	0	3221	100,00%
Lieutenant-Governor	9	0	3221	100,00%
Premier's Office	39	0	3221	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

7. Manitoba

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Finance	484	69	69	19,27%
Transportation and Government Services	2630	50	119	33,24%
Health	1142	47	166	46,37%
Family Services and Housing	1961	43	209	58,38%
Education, Training and Youth	799	33	242	67,60%
Justice	2580	30	272	75,98%
Conservation	1116	15	287	80,17%
Intergovernmental Affairs	308	11	298	83,24%
Agriculture and Food	455	9	307	85,75%
Industry, Trade and Mines	257	9	316	88,27%
Consumer and Corporate Affairs	132	7	323	90,22%
Elections MB	21	7	330	92,18%
Culture, Heritage and Tourism	320	6	336	93,85%
Civil Service Commission	57	5	341	95,25%
Labour and Immigration	268	4	345	96,37%
Fleet Vehicles	49	4	349	97,49%
Merlin	16	4	353	98,60%
Public Trustee	80	2	355	99,16%
Advanced Education	78	1	356	99,44%
Office of the Auditor General	44	1	357	99,72%
Mail Management Agency	30	1	358	100,00%
The Property Registry	152	0	358	100,00%
Land Management Services	28	0	358	100,00%
Materials Distribution	58	0	358	100,00%
Aboriginal and Northern Affairs	78	0	358	100,00%
Executive Council	36	0	358	100,00%
Legislative Assembly		0	358	100,00%
Seniors Directorate	9	0	358	100,00%
Status of Women	14	0	358	100,00%
C.S.C. Organization & Staff Development	6	0	358	100,00%
Pineland Forest Nursery	32	0	358	100,00%
MB Securities Commission	34	0	358	100,00%
The Companies Office	32	0	358	100,00%
Vital Statistics	34	0	358	100,00%
MB Textbook Bureau	8	0	358	100,00%
Healthy Child Initiatives	19	0	358	100,00%
Civil Legal Services	57	0	358	100,00%
Office of the Fire Commissioner	51	0	358	100,00%
Office of the Childrens Advocate	7	0	358	100,00%
Ombudsman	27	0	358	100,00%
Other non-core enterprises	21	0	358	100,00%
Sport	1	0	358	100,00%
Emergency Expenditures	14	0	358	100,00%
Community Support Programs	3	0	358	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

8. Saskatchewan

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Environment	1069,8	77	77	19,06%
Learning	523,2	67	144	35,64%
Health	563,5	64	208	51,49%
Finance	357	35	243	60,15%
Highways and Transportation	1353,8	28	271	67,08%
Industry and Resources	431,9	28	299	74,01%

Agriculture, Food and Rural Revitalization	449,4	19	318	78,71%
Public Service Commission	117,9	19	337	83,42%
Social Services	2128,5	16	353	87,38%
Justice	838	14	367	90,84%
Corrections and Public Safety	1580,2	10	377	93,32%
Government Relations & Aboriginal Affairs	200,5	10	387	95,79%
Labour	175,9	7	394	97,52%
Culture, Youth and Recreation	81,5	4	398	98,51%
Executive Council	83	3	401	99,26%
Legislative Assembly	75	3	404	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

9. Alberta

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Government Services	1547	201	201	35,33%
Energy	499	62	263	46,22%
Learning	879	61	324	56,94%
Innovation and Science	170	42	366	64,32%
Justice	1790	33	399	70,12%
Environment	691	31	430	75,57%
Health and Wellness	608	22	452	79,44%
Agriculture, Food and Rural Development	804	21	473	83,13%
Revenue	262	18	491	86,29%
Sustainable Resource Development	1277	18	509	89,46%
Solicitor General	1770	12	521	91,56%
Infrastructure	774	9	530	93,15%
Finance	164	8	538	94,55%
Human Resource and Employment	1802	8	546	95,96%
Community Development	1889	7	553	97,19%
Legislative Assembly	349	7	560	98,42%
Senior's	207	6	566	99,47%
Municipal Affairs	294	2	568	99,82%
Children's Services	2358	1	569	100,00%
Aboriginal Affairs and Northern Development	51	0	569	100,00%
Economic Development	172	0	569	100,00%
Gaming	29	0	569	100,00%
International and Intergovernmental Relations	45	0	569	100,00%
Transportation	761	0	569	100,00%
Executive Council	15	0	569	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

10. British Columbia

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Advanced Education	n.d.	n.d.	n.d.	n.d.
Agriculture, Food and Fisheries	n.d.	n.d.	n.d.	n.d.
Attorney General	n.d.	n.d.	n.d.	n.d.
Children and Family Development	n.d.	n.d.	n.d.	n.d.
Community, Aboriginal and Women's Services	n.d.	n.d.	n.d.	n.d.
Competition, Science and Enterprise	n.d.	n.d.	n.d.	n.d.
Education	n.d.	n.d.	n.d.	n.d.

Energy and Mines	n.d.	n.d.	n.d.	n.d.
Finance	n.d.	n.d.	n.d.	n.d.
Forests	n.d.	n.d.	n.d.	n.d.
Health Planning	n.d.	n.d.	n.d.	n.d.
Health Services	n.d.	n.d.	n.d.	n.d.
Human Resources	n.d.	n.d.	n.d.	n.d.
Management Services	n.d.	n.d.	n.d.	n.d.
Provincial Revenue	n.d.	n.d.	n.d.	n.d.
Public Safety and Solicitor General	n.d.	n.d.	n.d.	n.d.
Skills Development and Labour	n.d.	n.d.	n.d.	n.d.
Sustainable Resource Management	n.d.	n.d.	n.d.	n.d.
Transportation	n.d.	n.d.	n.d.	n.d.
Water, Land and Air Protection	n.d.	n.d.	n.d.	n.d.
Legislation	n.d.	n.d.	n.d.	n.d.
Office of the Premier	n.d.	n.d.	n.d.	n.d.
Offices of the Legislature	n.d.	n.d.	n.d.	n.d.

In British Columbia, the number of IT employees in each department was not available. The choice was made based on the most frequently chosen departments in other province. For example, the Health and Education departments were chosen in most provinces, thus were chosen for British Columbia.

11. Yukon

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Infrastructure-Information & Communications Technology	47	36	36	44,44%
Education	826	9	45	55,56%
Environment	152	9	54	66,67%
Energy, Mines & Resources	80	4	58	71,60%
Health and Social Services	898	4	62	76,54%
Justice	207	4	66	81,48%
Yukon Workers' Compensation, Health & Safety Board	71	4	70	86,42%
Infrastructure-Other	660	3	73	90,12%
Community Services	136	2	75	92,59%
Finance	53	2	77	95,06%
Business, Tourism & Culture	94	1	78	96,30%
Public Service Commission (HRIS)	55	1	79	97,53%
Yukon Housing Corporation	46	1	80	98,77%
Yukon Liquor Corporation	59	1	81	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

12. Northwestern Territories

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Education, Culture and Employment	178	21	21	21,65%
Executive	250	20	41	42,27%
Health and Social Services	167	18	59	60,82%
Resources, Wildlife and Economic Development	465	10	69	71,13%
Justice	425	8	77	79,38%
Public Works and Services	218	7	84	86,60%
Transportation	355	5	89	91,75%
NWT Housing Corporation	102	4	93	95,88%
Municipal and Community Affairs	125	2	95	97,94%
Finance	46	1	96	98,97%
Legislative Assembly	44	1	97	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

13. Nunavut

Departments	Total number of employees	Total number of CS employees	Total number of CS employees (cumulative)	% cumulative
Public Works	247	36	36	49,32%
Health and Social Services	927	11	47	64,38%
Finance and Administration	161	10	57	78,08%
Education	462	5	62	84,93%
Justice	344	4	66	90,41%
Legislative Assembly	78	3	69	94,52%
Community Government and Transportation	168	1	70	95,89%
Executive and Intergovernmental Affairs	93	1	71	97,26%
Human Resources	80	1	72	98,63%
Sustainable Development	178	1	73	100,00%
Culture, Language, Elders and Youth	46	0	73	100,00%

Only departments in bold are covered in this survey; they account for 90% of IT employees of the provincial government.

Appendix 3: Distribution of the population by strata

RÉGION	NUMBER OF EMPLOYEES	NAICS				
		3340	5100	5200	5400	5415
		POP	POP	POP	POP	POP
NEWFOUNDLAND AND LABRADOR	6-25 empl.	5	62	160	169	15
	26-50 empl.	1	6	88	24	2
	More then 50 empl.	1	13	9	20	4
PRINCE EDWARD ISLAND	6-25 empl.	0	14	73	67	11
	26-50 empl.	0	3	21	8	1
	More then 50 empl.	0	5	4	4	2
NOVA SCOTIA	6-25 empl.	8	122	365	409	55
	26-50 empl.	2	25	177	60	13
	More then 50 empl.	8	37	34	60	17
NEW BRUNSWICK	6-25 empl.	4	64	354	259	46
	26-50 empl.	1	18	108	34	12
	More then 50 empl.	4	20	23	17	13
QUÉBEC (except Montréal and Gatineau)	6-25 empl.	39	324	1185	909	154
	26-50 empl.	5	57	376	133	22
	More then 50 empl.	31	46	149	88	29
ONTARIO (except Toronto and Ottawa)	6-25 empl.	96	500	2238	2200	331
	26-50 empl.	28	130	1239	262	45
	More then 50 empl.	58	125	184	205	48
MANITOBA	6-25 empl.	9	131	692	465	63
	26-50 empl.	6	27	124	50	19
	More then 50 empl.	9	36	67	60	18
SASKATCHEWAN	6-25 empl.	11	102	605	442	49
	26-50 empl.	1	19	122	53	9
	More then 50 empl.	5	38	54	38	9
ALBERTA (except Calgary and Edmonton)	6-25 empl.	8	154	522	607	29
	26-50 empl.	1	25	85	61	1
	More then 50 empl.	0	15	21	35	0
BRITISH COLUMBIA (except Vancouver and Victoria)	6-25 empl.	10	191	766	806	46
	26-50 empl.	3	46	147	75	5
	More then 50 empl.	4	26	68	32	8
TERRITOIRES	6-25 empl.	0	28	49	80	6
	26-50 empl.	0	5	7	9	1
	More then 50 empl.	0	5	2	5	0

MONTREAL	6-25 empl.	82	565	1399	1802	519
	26-50 empl.	27	161	453	282	123
	More then 50 empl.	87	207	224	335	144
GATINEAU	6-25 empl.	1	17	51	59	28
	26-50 empl.	0	7	18	8	3
	More then 50 empl.	1	6	7	3	7
OTTAWA	6-25 empl.	29	124	276	701	317
	26-50 empl.	17	36	176	109	52
	More then 50 empl.	48	53	37	139	98
TORONTO	6-25 empl.	197	941	2208	3864	1505
	26-50 empl.	66	279	1283	667	247
	More then 50 empl.	116	357	675	746	249
CALGARY	6-25 empl.	37	137	581	1694	301
	26-50 empl.	14	47	136	259	44
	More then 50 empl.	13	55	90	246	43
EDMONTON	6-25 empl.	25	114	552	888	200
	26-50 empl.	3	35	136	136	25
	More then 50 empl.	5	40	63	115	21
VANCOUVER	6-25 empl.	56	395	1254	1825	356
	26-50 empl.	18	97	278	225	53
	More then 50 empl.	38	134	180	251	84
VICTORIA	6-25 empl.	5	39	173	266	74
	26-50 empl.	3	15	24	31	7
	More then 50 empl.	5	15	36	19	8
TOTAL		1251	6295	20428	22416	5591

Appendix 4 : Distribution of the sample in each strata

RÉGION	NUMBER OF EMPLOYEES	SCIAN				
		3340	5100	5200	5400	5415
		ECH	ECH	ECH	ECH	ECH
NEWFOUNDLAND AND LABRADOR	6-25 empl.	5	57	159	166	15
	26-50 empl.	1	5	84	23	2
	More then 50 empl.	1	11	8	19	3
PRINCE EDWARD ISLAND	6-25 empl.	0	14	72	66	11
	26-50 empl.	0	3	21	8	1
	More then 50 empl.	0	3	3	4	2
NOVA SCOTIA	6-25 empl.	8	117	357	405	55
	26-50 empl.	2	23	164	59	13
	More then 50 empl.	7	30	23	58	14
NEW BRUNSWICK	6-25 empl.	3	60	344	258	45
	26-50 empl.	1	14	103	33	12
	More then 50 empl.	3	15	16	14	12
QUÉBEC (except Montréal and Gatineau)	6-25 empl.	39	322	371	501	154
	26-50 empl.	5	55	310	130	22
	More then 50 empl.	29	41	120	87	28
ONTARIO (except Toronto and Ottawa)	6-25 empl.	95	496	425	445	331
	26-50 empl.	28	127	364	261	45
	More then 50 empl.	55	120	166	199	46
MANITOBA	6-25 empl.	8	125	347	385	61
	26-50 empl.	6	25	121	50	18
	More then 50 empl.	8	28	56	56	17
SASKATCHEWAN	6-25 empl.	11	100	372	390	49
	26-50 empl.	1	18	119	51	9
	More then 50 empl.	4	32	34	36	9
ALBERTA (except Calgary and Edmonton)	6-25 empl.	8	148	333	390	29
	26-50 empl.	1	25	81	61	1
	More then 50 empl.	0	12	17	35	0
BRITISH COLUMBIA (except Vancouver and Victoria)	6-25 empl.	9	188	358	406	46
	26-50 empl.	3	45	142	74	5
	More then 50 empl.	4	24	57	31	8
TERRITOIRES	6-25 empl.	0	28	49	80	6
	26-50 empl.	0	5	7	9	1
	More then 50 empl.	0	5	2	5	0

MONTREAL	6-25 empl.	81	482	358	486	517
	26-50 empl.	27	158	351	278	122
	More then 50 empl.	82	182	186	319	137
GATINEAU	6-25 empl.	1	17	50	59	28
	26-50 empl.	0	7	18	8	3
	More then 50 empl.	1	6	7	3	7
OTTAWA	6-25 empl.	29	123	275	442	317
	26-50 empl.	17	35	174	109	52
	More then 50 empl.	46	44	32	138	98
TORONTO	6-25 empl.	196	471	415	450	481
	26-50 empl.	65	279	358	495	247
	More then 50 empl.	112	334	453	599	244
CALGARY	6-25 empl.	35	131	336	392	301
	26-50 empl.	14	47	132	255	43
	More then 50 empl.	9	42	74	233	41
EDMONTON	6-25 empl.	25	112	353	401	199
	26-50 empl.	3	35	129	136	24
	More then 50 empl.	5	32	48	110	20
VANCOUVER	6-25 empl.	55	391	381	423	356
	26-50 empl.	18	90	268	224	53
	More then 50 empl.	33	124	143	240	82
VICTORIA	6-25 empl.	5	38	171	266	73
	26-50 empl.	3	15	24	31	7
	More then 50 empl.	5	13	28	18	8
TOTAL		1212	5529	9969	10910	4530

Appendix 5: Distribution of the population and the sample of the first stage for the public sector by strata

Governments	Take-all/ Take-some	Number of divisions (N _h)	Number of sample divisions (n _h)
Federal, Ottawa/Gatineau only	Take all	393	393
	Take some	880	109
Federal, except Ottawa-Gatineau	Take all	150	150
	Take some	430	96
Newfoundland and Labrador	Take all	58	58
	Take some	89	52
Prince Edward Island	Take all	22	22
	Take some	36	28
Nova Scotia	Take all	67	67
	Take some	134	65
New Brunswick	Take all	61	61
	Take some	67	44
Quebec	Take all	197	197
	Take some	521	100
Ontario	Take all	144	144
	Take some	216	79
Manitoba	Take all	111	111
	Take some	263	84
Saskatchewan	Take all	101	101
	Take some	144	67
Alberta	Take all	135	135
	Take some	220	80
British Columbia	Take all	95	95
	Take some	132	64
Territories	Take all	56	56
	Take some	124	62
TOTAL		4846	2520

Appendix 6a : Distribution of locations of the private sector by the number of occupations present

There are 3977 responding locations that has employees other then contract workers or volunteers

Nb occupations	Nb locations	%	Cumul %
1	1244	31,3	31,3
2	712	17,9	49,2
3	488	12,3	61,5
4	368	9,3	70,8
5	300	7,5	78,3
6	201	5,1	83,4
7	160	4,0	87,4
8	115	2,9	90,3
9	86	2,2	92,5
10	54	1,4	93,9
11	64	1,6	95,5
12	32	0,8	96,3
13	17	0,4	96,7
14	29	0,7	97,4
15	12	0,3	97,7
16	34	0,9	98,6
17	8	0,2	98,8
18	7	0,2	99,0
19	8	0,2	99,2
20	6	0,2	99,4
21	6	0,2	99,6
22	3	0,1	99,7
23	5	0,1	99,8
24	7	0,2	100
25	11	0,3	100

Appendix 6b: Distribution of location in the public sector by the number of occupations present

There are 589 responding divisions that has employees other then contract workers or volunteers

Nb occupations	Nblocations	%	Cumul %
1	143	24,3	24,3
2	110	18,7	43,0
3	64	10,9	53,9
4	45	7,6	61,5
5	40	6,8	68,3
6	58	9,8	78,1
7	31	5,3	83,4
8	25	4,2	87,6
9	12	2,0	89,6
10	17	2,9	92,5
11	4	0,7	93,2
12	15	2,5	95,7
13	8	1,3	97,0
14	7	1,2	98,2
15	4	0,7	98,9
16	3	0,5	99,4
17	1	0,2	99,6
18	1	0,2	99,8
19	0	0,0	99,8
20	0	0,0	99,8
21	0	0,0	99,8
22	1	0,2	100
23	0	0,0	100
24	0	0,0	100
25	0	0,0	100

Appendix 7: Merged Strata

Strata AB_E2_5200 and AB_E3_5200 merged to form the stratum AB_E2_5200.

Strata BC_E1_3340, BC_E2_3340 and BC_E3_3340 merged to form the stratum BC_E1_3340.

Strata ED_E2_3340 and ED_E3_3340 merged to form the stratum ED_E2_3340.

Strata GA_E2_5100 and GA_E3_5100 merged to form the stratum GA_E2_5100.

Strata GA_E2_5400 and GA_E3_5400 merged to form the stratum GA_E2_5400.

Strata GA_E1_5415 and GA_E2_5415 merged to form the stratum GA_E1_5415.

Strata MB_E1_3340, MB_E2_3340 and MB_E3_3340 merged to form the stratum MB_E1_3340.

Strata NB_E1_3340, NB_E2_3340 and NB_E3_3340 merged to form the stratum NB_E1_3340.

Strata NF_E1_5100 and NF_E2_5100 merged to form the stratum NF_E1_5100.

Strata NF_E2_5200 and NF_E3_5200 merged to form the stratum NF_E2_5200.

Strata NF_E2_5415 and NF_E3_5415 merged to form the stratum NF_E2_5415.

Strata PE_E1_5100, PE_E2_5100 and PE_E3_5100 merged to form the stratum PE_E1_5100.

Strata PE_E2_5200 and PE_E3_5200 merged to form the stratum PE_E2_5200.

Strata PE_E1_5400, PE_E2_5400 and PE_E3_5400 merged to form the stratum PE_E1_5400.

Strata SK_E1_3340 and SK_E2_3340 merged to form the stratum SK_E1_3340.

Strata TE_E1_5100, TE_E1_5200, TE_E1_5400, TE_E1_5415, TE_E2_5100, TE_E2_5200, TE_E2_5400, TE_E2_4515, TE_E3_5100, TE_E3_5200 and TE_E3_5400 merged to form the stratum TE_E1_5100.

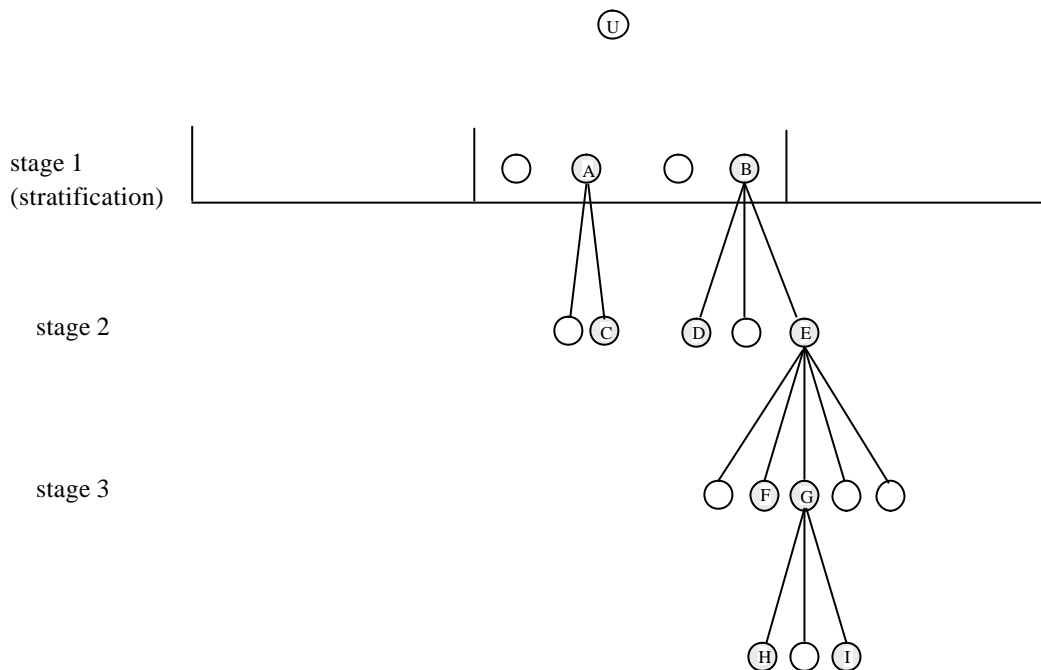
Strata VI_E1_3340 and VI_E2_3340 merged to form the stratum VI_E1_3340.

Strata VI_E2_5200 and VI_E3_5200 merged to form the stratum VI_E2_5200.

Strata VI_E2_5415 and VI_E3_5415 merged to form the stratum VI_E2_5415.

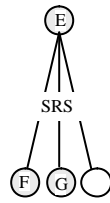
Appendix 8 : Iterative calculation of variance for the third stage

This iterative approach to the calculation of variance is due to Rao. For any multi-stage design involving selection without replacement at each stage, the estimated variance at the population level U can be obtained recursively. The formula can be adapted if any stage involves sampling with replacement. The example below assumes simple random sampling at every stage.



The formula for the estimated variance at the population level U can be obtained by recursion starting from the bottom units. To each sample unit i , we associate an estimated variance \hat{V}_i and an estimated total \hat{t}_i . Then we recursively compute these for the cluster containing the sample unit.

To do the recursion, we only need to consider each cluster and its subunits. Let us look at cluster G and its units H and I. We compute two quantities for cluster G: the estimated variance at G due to subsampling and the estimated total for G. Since units H and I are at the lowest level with no further subsampling, we have $\hat{V}_H = 0$, $\hat{V}_I = 0$. Furthermore, the estimated totals at this level are simply the actual values. Thus, $\hat{t}_H = y_H$ and $\hat{t}_I = y_I$. Now, we compute the estimated total and variance for cluster G as follows.



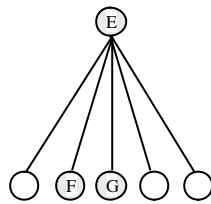
$$\begin{aligned}\hat{V}_G &= v_{SRS}(\hat{t}_H, \hat{t}_I) + \frac{\hat{V}_H}{\mathbf{p}_{H|G}} + \frac{\hat{V}_I}{\mathbf{p}_{I|G}} \\ &= v_{SRS}(y_H, y_I) + \frac{0}{2/3} + \frac{0}{2/3} \\ &= v_{SRS}(y_H, y_I)\end{aligned}$$

$$\begin{aligned}\hat{t}_G &= \frac{\hat{t}_H}{\mathbf{p}_{H|G}} + \frac{\hat{t}_I}{\mathbf{p}_{I|G}} \\ &= \frac{y_H}{2/3} + \frac{y_I}{2/3}\end{aligned}$$

The conditional inclusion probabilities for $\mathbf{p}_{H|G}$ and $\mathbf{p}_{I|G}$ under simple random sampling are simply $\mathbf{p}_{H|G} = 2/3$ and $\mathbf{p}_{I|G} = 2/3$. Also, $v_{SRS}(y_H, y_I)$ is the usual variance formula for SRSWOR based on the sample unit values y_H and y_I . In other words,

$$v_{SRS}(y_H, y_I) = \frac{1}{(3-1)} \{ (y_H - \bar{y}_G)^2 + (y_I - \bar{y}_G)^2 \} \text{ where } \bar{y}_G = (y_H + y_I) / 2$$

Since there is no further subsampling of unit F, we define $\hat{V}_F = 0$ and $\hat{t}_F = y_F$. Now that we have an estimated variance and total for all of the subunits of cluster E, we can apply the formula again to obtain \hat{V}_E and \hat{t}_E . Again, we assume simple random sampling without replacement.

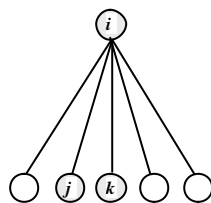


$$\begin{aligned}\hat{V}_E &= v_{SRS}(\hat{t}_F, \hat{t}_G) + \frac{\hat{V}_F}{\mathbf{p}_{F|E}} + \frac{\hat{V}_G}{\mathbf{p}_{G|E}} \\ &= v_{SRS}(y_F, \hat{t}_G) + \frac{0}{2/5} + \frac{\hat{V}_G}{2/5}\end{aligned}$$

$$\begin{aligned}\hat{t}_E &= \frac{\hat{t}_F}{\mathbf{p}_{F|E}} + \frac{\hat{t}_G}{\mathbf{p}_{G|E}} \\ &= \frac{y_F}{2/5} + \frac{\hat{t}_G}{2/5}\end{aligned}$$

We then continue until we obtain the estimated variance at the population level. We can view this as the estimated variance for a "fictional" unit U at the top of the diagram. This unit corresponds to the entire population.

Formula for the recursion at each stage of subsampling



$$\hat{V}_i = v_{SRS}(\hat{t}_j, \hat{t}_k, \dots) + \frac{\hat{V}_j}{\mathbf{p}_{j|i}} + \frac{\hat{V}_k}{\mathbf{p}_{k|i}} + \dots$$

$$\hat{t}_i = \frac{\hat{t}_j}{\mathbf{p}_{j|i}} + \frac{\hat{t}_k}{\mathbf{p}_{k|i}} + \dots$$

Note the use of conditional probabilities in the formulas. The idea is to produce an estimate of the total for each unit. The above formula assume simple random sampling without replacement but the more general without replacement formula with single and joint inclusion probabilities (\mathbf{p}_{jk}) can be used instead of $v_{SRS}(\hat{t}_j, \hat{t}_k, \dots)$. For any ultimate sampling unit k (at the bottom of the selection tree), remember to define $\hat{V}_k = 0$ and $\hat{t}_k = y_k$.

