

A QUALITY APPROACH TO BUSINESS SURVEYS

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ABSTRACT

Over the last few years, Statistics Canada has initiated a project that will ultimately affect all major economic surveys. One of the long term objectives is to be able to present an integrated product for our users. The surveys are being unified to use the same sampling frame, an integrated sampling and estimation strategy as well as common collection and processing systems. As part of the initiative, efforts are being made to gather sufficient meta data to enable us to evaluate the quality of all processes as well as make some judgements about the quality of the final data. As well, Statistics Canada has started a Data Quality Survey, collecting information from existing business surveys about their methodology, from frame to estimation.

KEY WORDS: Data quality; Evaluation; Business surveys.

RÉSUMÉ

Au cours des dernières années, Statistiques Canada a lancé un projet qui affectera éventuellement toutes les enquêtes économiques majeures. Un des objectifs à long terme est de pouvoir présenter un produit intégré à nos utilisateurs. Les enquêtes sont unifiées pour utiliser la même base de sondage, une stratégie intégrée d'échantillonnage et d'estimation ainsi qu'un système de collecte et de traitement commun. Faisant partie de l'initiative, des efforts sont fournis pour recueillir des méta-données suffisantes pour nous permettre d'évaluer la qualité de toutes les procédures aussi bien que d'évaluer la qualité finale des données. De plus, Statistiques Canada a initié une Enquête sur la qualité des données, recueillant l'information d'enquêtes existantes au sujet de leur méthodologie, à partir de la base de sondage jusqu'à l'estimation.

MOTS CLÉS : Qualité des données; évaluation; enquêtes auprès des entreprises.

1. INTRODUCTION

The Project to Improve Provincial Economic Statistics (PIPES) is one of the largest and most important initiatives at Statistics Canada (Royce, 1998). It arose out of discussions in 1996 on sales tax harmonization between the Governments of Canada and several of the provinces. In three of the ten provinces, a common sales tax with a single collection authority was adopted, reducing the administrative burden on business. A formula to allocate the pooled revenues among the participating governments was determined and Statistics Canada was asked to provide detailed provincial economic data. In order to do so, Statistics Canada would need to substantially improve the

quality of its statistics on provincial and territorial economies. By the end of 2000, Statistics Canada programs will be restructured and expanded to provide detailed and reliable economic accounts for the provinces and territories (Statistics Canada, 1998a).

Approximately 200 separate business surveys are conducted regularly to gather data on different industries and commodities. Most of the annual surveys will be integrated into a single master survey program called the Unified Enterprise Survey (UES). The new integrated approach focuses on enterprises: it will ensure that financial data collected from the enterprise's head office will be consistent with production and sales data received from its different

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establishments. The UES will collect more industry and commodity detail at the provincial level and avoid overlap between different survey questionnaires.

The UES is being designed to incorporate quality improvements in four areas: (i) consistency of concepts and survey methods used across industries, (ii) coherence of the data collected at different levels of the business organization, (iii) coverage of industries and (iv) depth of information in content detail and domains detail. All of these objectives, but especially consistency, are easier to achieve with an integrated approach.

Presently, Statistics Canada encourages the consistent use of concepts, methods and procedures among the different surveys, through a number of mechanisms. These include the standard conceptual frameworks (such as the System of National Accounts (SNA)), standard classification systems (North American Industrial Classification System (NAICS)), a common business register, corporate policies related to survey-taking procedures and common staff pools for methodology, operations and systems development.

The objective of this paper is to present a general discussion of quality, with an emphasis on quality at Statistics Canada. Our quality framework, both administrative and conceptual is described. Then three aspects of quality that relate closely to the UES are described. These are the Data Quality Survey, the quality evaluation of the Unified Enterprise Survey, and the experimental Composite Quality Indicator. Finally, some future directions are outlined.

2. AN OVERALL VIEW OF QUALITY

A statistical program is of high quality if its products are relevant, accurate, timely, accessible, interpretable, and consistent: that is, its products are "fit for use". The elements of quality are overlapping and interrelated. Achieving a level of quality requires balancing the elements of quality. An action taken to address or modify one element of quality affects others. The decisions and actions that achieve a level and a balance of quality are based on knowledge, experience, reviews, feedback, consultation, and inevitably on judgement.

- *Relevance* is measured by the degree that statistical program meets the needs of users.
- *Accuracy* is measured by the closeness that an estimate is to the unknown true value that it

represents. Closeness itself can be only estimated—if it were known an estimate could be adjusted to perfection.

- *Timeliness* is measured by the usefulness of statistics through time. Usually statistics become less useful as the event they describe fades into history.
- *Accessibility* is measured by the ease by which users can obtain statistical data—the media of release, the visibility of the release, and the cost to users.
- *Interpretability* is measured by the ease by which the users are able to understand and properly use statistical data. The adequacy of concepts and definitions, the information on methods, data quality and data limitations, and the supplementary information on data highlights and data analysis largely determine interpretability.
- *Consistency* is measured by the degree that statistical data is logically connected and complete within and among statistical programs.

There are two major aspects to a statistical program: the process and the product. The survey *process* creates the statistical *product*. The two are closely and inexorably intertwined and in a periodic survey (such as an annual or monthly survey) information about the quality of each helps to improve the quality of the other. For example, if there is a problem with the quality of the frame, which is part of the survey process, there is a definite impact on the quality of the estimates, which form the statistical product. In general, when the processes involved in a survey are evaluated, much information is provided that describes the quality of the product.

There is no single measure of quality nor is there an effective and proven statistical model that brings together all of the characteristics of quality into a single indicator. For this reason quality is often described and quantified by each of the major elements of quality. Sometimes a quantitative analysis is appropriate and possible. For example, measure of sampling error is the obvious choice. Other measures can often be calculated, such as response rates, edit failure rates and imputation rates. However, for other situations, a qualitative analysis is the only possible approach. This type of analysis includes activities such as an evaluation about the appropriateness of the wording of concepts and definitions used in survey questionnaires, interviewer feedback about the collection process, and the results of subject matter comparative analyses.

3. QUALITY AT STATISTICS CANADA

This section describes three initiatives within Statistics Canada that are central to the development of a statistical program of high quality. They form the framework for quality, by providing guidelines and policy directions to survey managers.

Quality Guidelines (Statistics Canada, 1998b) provides a comprehensive framework for survey managers to follow in developing a high quality statistical program. The guidelines provide a context for quality by explaining fitness for use; by describing the steps of a survey and the characteristics of a high quality process; and by explaining the managerial context for quality - the organization and infrastructure within Statistics Canada that provides leadership and guidance for quality.

Data users need an understanding of the quality of the statistical product. The Policy on Informing Users of Data Quality and Methodology (Statistics Canada, 1996) provides survey managers with a detailed and comprehensive list of the information that should be provided to users. It also lists the minimum requirements of the policy to ensure users are provided with a basic understanding of the quality of the data they use.

The Quality Assurance Framework (Statistics Canada, 1977) documents the processes in place to manage quality. The framework concentrates on relevance, design and execution (accuracy, timeliness, accessibility, and interpretability), and the environment (the corporate initiatives and processes that encourages a concern for quality within Statistics Canada).

The Auditor General of Canada's annual report (1999) on the federal public service states that 'Statistics Canada is committed to producing statistics of high quality. It has put in place a wide range of systems and practices to build quality into its statistical programs ... and to encourage a concern for quality throughout the organization'. The Auditor General also remarked that although Statistics Canada has a commendable framework in place, it needs to monitor that the guidelines and policies are being implemented. One of Statistics Canada's objectives is to make continuous improvements to our statistical programs. Thus in general we do two things: evaluate the quality of the survey process and provide statements of data quality to users.

4. THE UNIFIED ENTERPRISE SURVEY AND QUALITY

4.1. Data Quality Survey

The purpose of the Data Quality Survey (DQS) is to monitor and measure the quality of business surveys at Statistics Canada. In the past, individual survey areas had their own Data Quality programs. The DQS is the first systematic attempt at monitoring the quality of business surveys. The DQS has changed in form since its inception in 1996: it is itself an example of continuing quality improvement.

In the first year of the DQS, for reference year 1995, surveys managers completed a DQS questionnaire. Many questions were asked about all aspects of the survey process, including questions about questionnaire testing, the survey frame, sampling, editing, imputation, estimation and analysis. Often personal interviews were needed with survey managers to complete the questionnaire and there was felt to be a significant response burden imposed on survey managers. Some analysis of the data was done, however, the questionnaire had many open questions and did not lend itself readily to data analysis.

In the second year of the DQS, for reference year 1996, a Microsoft Access Database System was used to help reduce response burden and focus the questions. Survey managers were already familiar with the basic concepts of the DQS, and the access database meant the managers were not required to complete the questionnaire all at once. Nonetheless, significant support was required by many survey managers to complete the DQS questionnaire. The data collected from this survey provides a benchmark for the quality of STC economic surveys, for comparison as they improve over time, especially as they integrate to the Unified Enterprise Survey.

The development of the Integrated Meta Data Base (IMDB) at Statistics Canada will soon provide a means of collecting DQS data as part of a wider set of meta data. Using the IMDB further lessens response burden and avoids duplication in data collection. The IMDB is not yet complete. For meta data related to data quality and methodology, a basic version should be ready for early 2000 with the full implementation following shortly thereafter. What form the DQS will take for reference year 1997 and beyond is still undecided.

4.2. Quality Evaluation of the UES

The Quality Evaluation of the UES closely follows the Policy on Informing Users of Data Quality and Methodology. The document is technical, comprehensive and written for data users external to Statistics Canada. The evaluation describes each step of the UES, including the rationale and qualitative evaluation of each step of the UES process. Tables showing quantitative analysis are presented where appropriate. Much of the input material for the report originates from the staff associated with the processes of the UES. The report emphasizes evaluating quality by the elements of fitness for use. It concludes with suggestions for future quality improvements to the UES.

As data are released for each component survey of the UES, a Data Quality Statement is prepared. It provides sufficient information to satisfy the Policy on Informing Users of Data Quality and Methodology and to give users some basic information about the product being disseminated.

4.3. An Experimental Composite Quality Indicator

The estimates that Statistics Canada disseminates are often accompanied by a wide-ranging set of statements that describe their quality. The guidelines for these statements are given in the Policy on Informing Users of Data Quality and Methodology. These statements provide indications and guidance for users so that they can derive their own conclusions about quality. It is difficult for users to compare the quality of several estimates, by industry and by time, if there is not a summary measure of quality for each estimate. There is a need to bring together these statements into a single measure of quality. Statistics Canada has developed an experimental Composite Data Quality Indicator for estimates from the Unified Enterprise Survey that achieves this objective. The indicator is an overall rating of the quality of the data being disseminated, taking into account the methods and the survey operations.

Thus far the measure concentrates on the accuracy component of fitness for use. There are two major types of error that affect the accuracy of statistics from a survey. Sampling error is the error introduced by sampling and measuring part of a population rather than all of it. Non-sampling errors are the errors

introduced by using data from respondents in the sample that are erroneous in some way. There are many types of non-sampling errors such as non-response, measurement error and data capture errors. Traditionally much of the measure of accuracy has depended upon the measure of sampling error, due to the difficulty or measuring non-sampling errors.

The composite quality indicator is based on four main phases of a survey: the concepts and definitions of the survey, the sampling and estimation design, data collection and processing, and analysis and validation of the estimates. Within each phase there are several sub phases. For example, data collection and processing includes the quality of the questionnaire, the outcome of data collection and capture, and the extent and impact of edit and imputation. The objective of the indicator is to evaluate the impact of the survey processes on the final quality of the estimates. Guidelines for evaluation are needed. An overall rating is derived for each of the four categories and then they are combined into one overall rating for the statistical product.

One must be careful to avoid evaluating the survey processes, as that is not the goal. Suppose, for example, in a particular survey that the method of imputing for missing data was of high quality, yet there was an extremely high non-response rate. And suppose that in another survey, the method of imputation was considered to be of poor quality, yet there was an extremely high response rate. Which survey has produced the better quality estimates? The answer is not clear. One survey had a high rate of non-response and needed a lot of imputation for missing data (and it was high quality imputation) and the other had a high rate of response and needed little imputation for missing data (but it was poor quality imputation). The example shows that evaluating quality requires a balancing of the *impact* of many processes on the final quality of the statistical product.

The Composite Quality Indicator seems to be most useful when comparing the indicators generated from a times series of a periodic survey or when comparing different surveys with the same reference period. It seems less useful as a stand-alone indicator, with no reference to other indicators. Diagram 1 shows the experimental Composite Quality Rating as derived for one of the surveys from the 1997 UES.

Diagram 1: Experimental Composite Quality Rating

Overall Rating	+	Excellent industry co-operation, a small sample size enabled detailed micro-analysis.		
		Overall	Element	
Framework		++		
	Concepts & Definitions		++	
Sampling & Estimation Method		+		
	Frame		0	Effective, demanded considerable resources, high out-of-scope rate.
	Sample Design		++	Generally good.
	Estimation Design		+	Generally effective; some difficulties due to the necessity of using weights for take-all businesses.
	Sampling error (CVs)		0	
Collection & processing		+		
	Questionnaire		+	Very effective but too complex for small businesses.
	Capture & Collection		-	Non-response and no contact was high.
	Edit & Imputation		++	Identified problems, used tax data of the actual business to assist imputation.
Analysis & Validation		0		
	Data analysis		0	Consistent with a census of taxation and administrative data, but there is no time series of data for analysis nor a model to further validate the estimates.
Explanation of codes:				
	Excellent	++		
	Good	+		
	Acceptable	0		
	Use with Caution	-		
	Unreliable	--		

5. FUTURE DIRECTIONS

The future directions of quality in the UES will emphasize our commitment to make quality a major focus of the work of survey managers.

The Data Quality Survey at Statistics Canada is undergoing major changes with the advent of the Integrated Meta Data Base. The possibility of limiting the Data Quality Survey to a supplementary

questionnaire in addition to the information provided to the IMDB is being examined.

Work is continuing for the evaluation of the Unified Enterprise Survey. Feedback has been provided to survey managers, based on the 1997 reference year. Changes are being incorporated into some processes to ensure that a more complete evaluation will be possible for reference year 1998. Within the UES, processes are being put in place to monitor

compliance with the Policy on Informing Users of Data Quality and Methodology.

Further developmental work will take place for the Composite Quality Indicator. Activities have begun to identify 'best practices', based in part on the Statistics Canada Quality Guidelines, for different survey processes. This will help establish a rating for each component, as is necessary for the Composite Quality Indicator.

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