

Annex 1: Quality Assurance Framework at Statistics Canada

I. Introduction

1. Quality is Statistics Canada's hallmark. If its information becomes suspect, the credibility of the Agency is called into question and its reputation as an independent, objective source of trustworthy information is undermined. Thus, quality management plays a central role. It is an important component of corporate management and an integral part of the management of every program. It is not a separate function, but, like financial management, an aspect of the management of the Agency that has to be addressed across all programs.
2. Managing quality comprises a wide variety of mechanisms and processes acting at various levels throughout the Agency's programs and across its organization. The effectiveness of this framework does not depend upon a single mechanism or process but on the collective effect of, and synergy between, many interdependent measures. These build on the professional interests and motivation of the staff. They reinforce each other as means to serve client needs. They emphasize the Agency's objective professionalism and concern for data quality.
3. Underlying are eight guiding principles (further described in the Quality Guidelines):
 - I. Quality is relative, not an absolute
 - II. Quality is multidimensional
 - III. Every employee has a role to play in assuring quality
 - IV. Balancing of the dimensions of quality is best achieved through a project team approach
 - V. Quality must be built in at each phase of the process
 - VI. Quality assurance measures must be adapted to the specific program
 - VII. Users must be informed of data quality
 - VIII. Quality must be at the forefront of all activities
4. Key factors in quality management are the knowledge, experience and motivation of staff. Staff must not only be technically expert but also be aware of quality issues and able to develop and implement procedures to meet quality objectives. Thus, particular emphasis is placed on staff recruitment and development, including entry level recruitment and development programs for major occupational groups, mentoring, career stream plans for major groups, a training policy and framework, the Statistics Canada Training Institute offering specialized courses, certificate programs, a corporate assignment program, development programs for managers, and an awards and recognition program.
5. The six dimensions of quality that Statistics Canada has promulgated for many years can be characterized as *static* in the sense that they tend to change relatively slowly and are always a consideration in managing quality. They are described in Section 2. Certain aspects of quality are more *dynamic*, being intimately linked to the external environment within which the Agency

operates and subject to quick changes as the environment evolves. Such elements are given special attention as detailed in Section 3.

II. Static Elements of Quality

A. *Relevance*

6. The relevance of statistical information is the degree to which it meets the needs of users. It can be viewed at two levels: relevance of the overall statistical program (*global relevance*), and relevance of each survey. The Agency's challenge is to weigh and balance the (possibly conflicting) needs of current and potential users in designing the statistical program and the individual surveys given the resources available. Management of relevance means determining the information that the Agency as a whole, and each individual survey, will produce and deciding the resources to be allocated to each survey program. Also, since needs evolve over time, survey programs must be continuously monitored through user and stakeholder feedback, program review, and data analysis, and appropriate adjustments be made.

7. The principal feedback mechanisms include the National Statistics Council, professional advisory committees in major subject areas, bilateral arrangements with key senior federal departments and agencies, policy and program discussions with Deputy Ministers, the Federal-Provincial Consultative Council on Statistical Policy and its subsidiary committees, liaison with business associations, market research and monitoring of product sales and requests, discussions with potential users, other NSOs and international organizations.

8. Data analysis is a valuable tool in assessment of relevance. Identifying questions that the data products cannot answer pinpoints gaps and weaknesses in the outputs. The use of analytic frameworks such as the System of National Accounts to integrate and reconcile data coming from different sources is an important element. An active internal analysis program is supported through fellowship programs, joint analytic work with external authors, subject oriented data review and reconciliation committees and research data centres.

9. Given information on user needs and program weaknesses, the long-term planning process provides the framework for deciding what changes will be made to the Agency's program from one year to the next. However, there are constraints as 90% of the Agency's budget is devoted to non-discretionary ongoing surveys providing basic information and/or meeting the legislative and regulatory needs specified in some two dozen Acts of Parliament. Thus, the Agency's responses to newly emerging information needs must be found by efficiencies within non-discretionary surveys, by redirection of resources from discretionary surveys, and/or by persuading users (particularly federal government clients) to finance additions.

B. *Accuracy*

10. The accuracy of statistical information is the degree to which the information correctly describes the phenomena it was designed to measure. It is usually characterized in terms of error in statistical estimates and is traditionally decomposed into bias (systematic error) and variance

(random error) components. It is also described in terms of the major potential sources of error. Management of accuracy requires particular attention during *design*, *implementation*, and *assessment* stages of a survey.

11. As regards *design*, measures taken to promote accuracy include:

- establishing a project management environment with participation of staff members specializing in subject-matter, methodology, operations and systems;
- specialized resource and support centres for certain functions, in particular, questionnaire design and testing, seasonal adjustment, and data analysis;
- centralized headquarters operations staff, and a regional network of field staff for conducting collection and processing;
- internal cost recovery, to reflect real costs in making design decisions; and
- peer and institutional design reviews.

12. The Agency's Quality Guidelines (2003) detail the policies, standards and best practices to be taken into account. They cover concepts and definitions, questionnaire design, survey frames and use of the business register, sampling and estimation, securing response and dealing with nonresponse, seasonal adjustment, dissemination and evaluation.

13. Mechanisms for monitoring *implementation* are built into survey processes at the design stage. Two types of information are required, first, to monitor and correct, in real time, any problems arising during survey implementation, second, to assess whether the design was implemented as planned, whether some aspects were problematic, and what lessons were learned from the operational standpoint.

14. *Assessment* of accuracy is also an important consideration at the design stage since much of the information required must be recorded whilst the survey is taking place. As accuracy is multidimensional, choices have to be made regarding the most important indicators for each individual survey. Also, as each survey produces thousands of different estimates, either a generic method of indicating the accuracy of large numbers of estimates is used, or the indicators are confined to certain key estimates.

15. As many design issues are highly technical, independent review is vital. Options include:

- referral of technical issues to internal advisory committees;
- review of practices of other NSOs and exchanges of experiences with them;
- participation in working groups of international organizations;
- presentation of technical issues and proposed solutions at professional meetings.

16. Whilst described in the context of accuracy, the measures outlined in the above paragraphs also help enhance other aspects of quality, especially timeliness and coherence.

C. *Timeliness*

17. Timeliness of information refers to the length of time between the reference point (or end of the reference period) to which the information relates and its availability to users. Timeliness

targets are derived from relevance considerations, in particular the period for which the information remains useful for its main purposes. This varies with the rate of change of the phenomena being measured, with the frequency of measurement, and with the immediacy of user response to the latest data.

18. Timeliness is a design decision, often involving trade-offs with accuracy and cost. Thus, improved timeliness is not an unconditional objective. Rather, timeliness is an important characteristic that is monitored over time to provide a warning of deterioration. Furthermore, timeliness expectations are likely to heighten as users become accustomed to immediacy in all forms of service delivery, thanks to the pervasive impact of technology.

19. Mechanisms for managing timeliness include announcing release dates well in advance, issuing preliminary estimates, and making best use of modern technology.

D. Accessibility

20. Accessibility of information refers to the ease with which users can learn of its existence, locate it, and import it into their own working environment. It includes the suitability of the form or medium through which the information can be accessed and its cost.

21. Corporate-wide dissemination policies and delivery systems determine most aspects of accessibility. Policies include Informing Users of Data Quality and Methodology, and Review of Information Products. The dissemination strategy is to make information of broad interest available free of charge through several media (including the press, internet, research data centres and libraries) while charging for products and services that go beyond satisfying general public demand for basic information. The primary dissemination vehicles are:

- The Daily, which is the Agency's official release bulletin and first line of communication with the media and the public, providing a comprehensive, one-stop overview of new information available;
- the Statistics Canada database (CANSIM) as the repository of all publicly available data;
- the Statistics Canada website as the primary entry point; and
- an extensive program of publications and analytical reports for specific client groups.

22. The Government's depository libraries program ensures that all products are available to libraries across the country. The information needs of the analytical community receive special attention as they often require access to individual data records. Given that the Statistics Act prevents the Agency from making individual records available in any form that might identify individuals, the following options are open:

- production of public-use microdata files, screened to protect confidentiality;
- provision of a custom retrieval service through which external analysts can submit special requests for retrievals from an internal confidential micro-data base;
- contracting with an external analyst sworn in under the Act;
- sharing of micro-data under certain provisions of the Act.

E. Interpretability

23. Statistical information that users cannot understand - or can easily misunderstand - has no value and may be a liability. The interpretability of statistical information reflects the availability of the supplementary information, referred to as *metadata*, necessary to interpret and utilize the information appropriately. This includes the underlying concepts, variables and classifications used, the data collection and processing methods, and indications or measures of the accuracy of the statistical information. The methodology descriptions also serve as surrogate accuracy indicators, enabling the user to assess whether the methods used were scientific, objective and carefully implemented.

24. Statistics Canada's Policy on Informing Users of Data Quality and Methodology provides guidelines for provision of quality and methodology metadata. Particular effort is required to ensure that the metadata are comprehensible, not obscured by internal jargon and up-to-date.

25. Further aid to users is provided by the commentaries accompanying information releases. They focus on the primary messages that the new release contains and increase the probability that the first level of interpretation by the media to the public will be clear and correct. Conversely, the Agency publicly answers or refutes serious misinterpretation of its data.

F. Coherence

26. The coherence of statistical information reflects the degree to which it can be successfully brought together with other statistical information within a broad analytic framework. Coherence of statistical data includes coherence between different variables pertaining to the same point in time, coherence between the same variables for different points in time, and international coherence. Coherence does not necessarily imply full numerical consistency.

27. Three complementary approaches are used for managing coherence. The first is the development and use of standard frameworks, concepts, variables and classifications. The aim is to ensure that the measurement targets are consistent across programs, that terminology is consistent, and that the quantities being estimated have known relationships to each other. International comparability is addressed by adopting international standards where they exist.

28. The second approach is to ensure that the measurement processes do not introduce inconsistency between data sources when the quantities being measured are defined in a consistent way. The development and use of common frames, methodologies and systems for data collection and processing contribute to this aim. Examples include use of standard question modules when the same variables are being collected in different surveys.

29. The third approach involves analysis of the data themselves and comparisons/ integration of data from different sources and/or over time. The aim is to recognize and explain situations where inconsistencies exceed levels expected as a result of random errors. Conceptual frameworks covering particular subject-matter areas, such as the national accounts, play an important role by providing a basis for recognizing incoherence.

III. Dynamic Aspects of Quality

A. *Non-Response*

30. One of the biggest challenges in maintaining quality at current levels is declining response rates, particularly in social surveys, resulting from changes in social attitudes and technology. Modern Canadian lifestyles make it increasingly difficult to contact families at home. Through caller display and call screening, Canadians can avoid a deluge of telephone solicitations, including calls from Statistics Canada. More households use only cell or Internet phones, which are more vulnerable to eavesdropping than traditional landlines. In some neighbourhoods, Canadians feel less secure and are less willing to open doors to strangers, including Statistics Canada interviewers. Increasing levels of Internet penetration bring opportunities for gains in efficiency and effectiveness through Internet based data collection. However, this requires investment by the Agency, and, where this option has not yet been put in place, businesses and households may decline to respond by other means.

31. Statistics Canada pursues cooperative arrangements with data suppliers through its respondent relations program, response burden management program, engagement with the small business community and small business ombudsman, electronic reporting initiatives and recognition of respondents in publications. Particular attention is paid to respondent complaints and to ensuring that questionnaires are tested to warrant minimal intrusion on privacy and to respect public sensitivities.

32. In the longer term, decreasing response rates and increasing costs of traditional data collection methods will require development of more cost-effective follow-up and improved methods for reducing non-response bias at the estimation stage. New collection modes and increasing availability of operational metadata (*paradata*) are enabling more efficient and effective methods for dealing with non-response. Likewise, the Agency can take advantage of increasing availability of administrative data to create more complete frames with better contact information, to help impute data in the case of partial non-response or incomplete data, and to adjust for non-response bias errors at aggregate level.

B. *Coverage*

33. Coverage is determined by the quality of survey frames. Over the past 25 years the Agency has been slowly but steadily replacing area frames by list frames as more administrative data become available. It no longer uses area frames for its agricultural surveys and even the Labour Force Survey is increasingly based on addresses from the Address Register rather than from a traditional field listing. However there are some emerging issues with which to deal.

34. First, the Agency is more dependent on administrative data and thus vulnerable to changes in, or cancellation of, the corresponding administrative programs. Thus, good relations are vital to ensure the Agency's needs are considered. Second, when administrative agencies do not pay the same attention to classification of units as the Agency would like, intervention is required. Third, businesses are constantly forming and disappearing, merging and divesting, entering and

exiting industries, and adding and dropping products and services. There is often a time lag in detecting these changes from administrative data. Thus the Agency must be prepared to supplement administrative data by investing in its own maintenance mechanisms.

C. Sampling

35. Over time a survey design deteriorates in the sense that the data used to stratify and select units become out of date and the sample becomes less efficient. Furthermore, demand for data on specific subpopulations may emerge that the sample was not designed to support. Thus, ongoing surveys require periodic redesign. For example, the Labour Force Survey sample is redesigned after every decennial census. Redesigns of business surveys are more frequent, to keep up with changes in the business universe.

36. Sample redesign is an opportunity to introduce new techniques, for example, multiple frames and adaptive sampling and to spread respondent burden more evenly. The challenge is how to fund these redesigns, which often include a parallel run of the old and new samples in order to ensure that the redesign itself does not introduce breaks in the statistical series. Since survey quality deteriorates slowly, it is difficult to convince funding agencies to finance redesigns, thus Statistics Canada funds most from its own budget.

IV. Recent Quality Assurance Developments

37. Having a static quality assurance framework is not sufficient. The framework must adapt to changing circumstances. The following paragraphs summarise some recent efforts.

A. Implementation of Ongoing Quality Review Program

38. In response to three critical errors in data released in 2005 and 2006, Statistics Canada undertook a review of quality assurance practices in nine key programs. The objectives of the review were twofold: first, to identify any specific weaknesses, and the factors behind them; and second, to identify best practices that should be promoted to other programs. Amongst the key findings (published in *The Daily* in 2007) the review concluded that human resource issues dominated all other risk factors. In particular, the need for a strong research and analysis capacity separate from production was identified as key in ensuring quality.

39. The review has become an ongoing annual program, starting in the fall with identification of programs that would benefit most from a review. Such programs are either more at risk than others (and have issues to address) or have recently undergone a significant change to successfully address such risks (and have good practices to share). The actual review is in the spring. Reports are written during the summer and finalized early in the fall so that they are available in time for the annual planning cycle and the allocation of corporate resources.

B. Quality Assurance Learning Exercise

40. The main objectives of the QA Learning Exercise were: to bring project teams together to discuss quality assurance practices in their programs; to identify areas where programs are exposed to significant quality risks; to provide a tool for managing risks; and to identify corporate learning and quality issues. The exercise focused on management of accuracy during the implementation and execution phases of the statistical cycle. Thus the target population comprised all staff involved in management or supervision of production operations. In total, the exercise brought together over 800 employees from 80 statistical programs, in groups ranging from 3-30, to discuss and answer some 100 questions on quality assurance practices. It has since been extended to the methodology, informatics and collection operations areas that provide services to statistical programs.

C. Analysis of Corrections in the Daily

41. To get a better understanding of published errors and their causes, the characteristics of all corrections made to The Daily are documented and analysed. From January 2008, the analysis also includes corrections to texts made less than 24 hours before release. The aim is to determine the effectiveness of the checks in detecting errors prior to release.

42. The results show that most of the corrections made for accuracy reasons are very small and do not materially affect the usability of the data. Also texts with a correction prior to release are much more likely to be corrected for accuracy after release. In other words, errors detected just prior to release are a “leading indicator” that something else in the text may be inaccurate.

43. As a result of this exercise and related quality initiatives, Statistics Canada has not recently experienced a correction of the same order of importance as those in 2005 and 2006. In addition, the percentage of texts that need to be corrected after their release for accuracy reasons has decreased from 4% in mid-2007 to 1% in 2009.

V. Priority Areas for Coming Years

A. Adapting Quality Training

44. In a rapidly changing environment a quality training program is vital to sharing of best practices and a culture of excellence. Quality training programs and tools are being adapted to staff at all levels, roles and work experience, including employees in regional offices. There are training courses at three levels - quality awareness, quality practices and specialized courses – and these are being integrated into a framework that covers and standardizes the presentation of risk management, project management, documentation and quality assurance.

45. The Agency's Quality Guidelines are currently being revised and the fifth edition containing more up-to-date best practices and a new section on seasonal adjustment will be released in the fall of 2009.

B. Building and Maintaining a Quality Culture

46. A quality culture depends upon setting clear expectations for every employee, providing the tools and training needed to meet those expectations, and assessing and providing feedback on performance against those expectations. Managers are responsible for reinforcing the message that quality is an integral part of everyone's job. The Agency is considering how to build quality expectations more explicitly into employees' annual performance objectives and learning plans whilst assuring employees that they can raise quality issues without fear.

47. In addition to training courses, quality procedures are being broadened to include walkthroughs of actual survey processes, case studies on quality issues and initiatives such as the Agency's alumni program whereby retired staff work in the office on a part time basis and contribute to the passing on of good quality practices.

C. Strengthening Project Management and Documentation Practices

48. Project management and documentation have emerged as elements needing reinforcement, particularly as crucial decisions involving tradeoffs between the various quality dimensions, costs and response burden often take place within a project team environment. Thus, as well as improving its quality assurance training, the Agency plans to revisit its project management training program. Issues to be addressed include the lack of uniformity in the application of project management methods, the absence of an effective mechanism for sharing best project management practices, project team roles and responsibilities, and documentation.

49. While the Agency has well developed policies and guidelines regarding the information that must be provided to data users, the documentation of survey processes is less well prescribed. Furthermore, as resources become increasingly scarce, there is a risk that documentation will suffer, and the current exodus of experienced personnel through retirement means good documentation is more critical than ever.

D. Developing a Broader View of a Quality Assurance Framework

50. Notwithstanding recent developments the current quality assurance framework leaves something to be desired. A fundamental question that is not well answered is *how the Agency should reallocate its resources in order to address emerging relevance and quality gaps*. The quality assurance framework tends to focus on individual programs and needs to be extended to provide more guidance at corporate level. In his 2009 paper, Sheikh discusses the three interdependent factors to be taken into account in resource reallocation: the extent of the use of the data (relevance), the quality of the data (accuracy, timeliness, accessibility, etc), and the data production costs relative to the benefits to citizens and policy makers. In making trade-offs between these factors, the Agency needs better quantitative measures of the performance of the statistical program as a whole and more effective change governance mechanisms.

51. As regards quality measurement, the concept of total survey error and efforts to estimate it are relevant, as is development of the Eurostat quality barometer. Whilst research to find a small number of quality indicator proceeds, the Agency will continue to address issues such as:

- how the existing attributes of quality are best quantified/ measured, even if subjectively;
- how the various measures should be weighted, even if subjectively, to arrive at a meaningful, reduced set of composite quality measures;
- how individual and composite measures of quality should be used in making comparisons between program options; and
- what the appropriate governance mechanisms are.