Quality assessment of multi-source statistical processes

Giovanna Brancato[1], Antonia Boggia[2], Andrea Bruni[3]

[1] *Istat, Rome, Italy; brancato@istat.it*
[2] *Istat, Rome, Italy; boggia@istat.it*
[3] *Istat, Rome, Italy; anbruni@istat.it*

Abstract
Quality assessment is a key activity in a National Statistical Institute. Istat has a long standing experience on quality assessment, which is one of the pillars of its quality policy. Istat quality assessment strategy is based on auditing and self-assessment procedures, in line with the approach described in the DatQam handbook. The assessment programme is supported by Quality Guidelines, auditing and self-assessment questionnaires, other documentation useful for the assessment, such as product and process quality reports, and final assessment reports defining improvement actions and identifying best practices. Up to now, the procedure and the tools have been developed for survey or census based statistics, and partially explored for statistical processes using administrative data.
The on-going Istat modernisation process has conveyed to a new paradigm in statistical production, with a prominent role played by the extensive use of administrative sources. The new scenario calls for a fine-tuning of the assessment procedures and tools in order to properly assess quality and allow for continuous quality improvement of statistical products and processes using administrative data.
As a consequence, tailored quality guidelines, stating the principles and methodologies to be followed, have been drafted. They are published on Istat website, in Italian. Currently, the suitable assessment instruments in the multi-source context are being studied and developed.
Aim of this paper is to report on the approach, the difficulties and the solutions that are being adopted for the quality assessment of statistical processes based entirely or partially on administrative data. The focus will be on the design of the assessment questionnaires, and how they are developed in order to gain evidence on input, process and output quality as well as on the sources of errors.

Keywords: quality assessment, auditing questionnaire, multi-source statistics.

1. Introduction

The assessment of the usability and quality of source data and the application of fit-for-purpose tools to enhance quality assurance are among the objectives of Eurostat Vision2020 key area "Strive for Quality", activities that also have a positive impact for maintaining and increasing users' trust in Official Statistics. Worldwide, the statistical production is moving from direct surveys to administrative and multi-source statistics. This context led to the development of methods and tools for extending Istat assessment programme, currently applied to direct surveys, to statistical processes using administrative data.

The paper is structured as it follows. Section 2 briefly reviews the current Istat quality assessment programme. Section 3 presents the quality model underlying the approach used to enhance the assessment programme to statistics produced from administrative sources and illustrates the supporting tools: the reference quality guidelines and the assessment questionnaire. In Section 4 some conclusions are drawn and future steps are outlined.

2. Istat quality assessment programme

Istat policy for systematic quality assessment, defined in accordance to the European framework for quality, includes direct and indirect quality assessment (Signore *et al.*, 2012).

The direct assessment of quality is aimed to evaluate statistical processes and products to verify their compliance to the principles stated in Istat Quality Guidelines. It is developed through the audit and self-assessment procedures with the purpose of improving the quality of statistical processes, by identifying the weaknesses of the process and the improvement actions to be implemented to overcome the critical points identified. In addition, the evaluation activity is also oriented at detecting the best practices of the evaluated processes, in order to promote their dissemination within the Institute. An audit and self-assessment questionnaire is used to verify the degree of compliance of the statistical processes with the principles listed in the Quality Guidelines. In auditing a team of auditors interviews the survey manager, while in self-assessment the survey manager fills in a self-administered questionnaire. Metadata and Standard Quality Indicators, stored in SIDI-SIQual, are used as objective facts to support the assessment. SIDI-SIQual is the quality documentation

information system documenting all Istat statistical processes (Brancato *et al.*, 2004). Both evaluation procedures end up with a report which summarises the main findings of the evaluation and includes a list of improvement actions that are considered necessary in order to overcome the identified weaknesses. A Quality Committee coordinates all the assessment activities and promotes quality improvements. In particular, it analyses the final reports from the audit and self-assessment procedures and presents the results to Istat top management for further decisions.

The indirect assessment of the quality of statistical processes relies on the systematic production of quality analyses based on the standard quality indicators stored in SIDI-SIQual. The analysis of quality indicators provides information on the quality of Istat statistical processes, in particular on the actual levels of quality reached and on the changes over time. Moreover, this analysis supports the decision process for quality improvement and allows an evaluation of some quality dimensions at Institute level (Brancato *et al.*, 2006).

3. The extension of the assessment programme to processes using administrative data

When assessing quality on processes using administrative data, the type of use plays a relevant role. Following the literature (Unece, 2015) and the current practice, the main uses can be broadly grouped in the following: a) direct tabulation, i.e. when one or more administrative datasets (or statistical registers created by using administrative sources) are used to derive directly statistics, by computing totals, averages or other statistics; b) substitution for direct collection, i.e. when some subpopulations or some variables are partially or totally obtained from administrative data; c) support to direct statistical surveys, including the use of frames for sample design and estimation, auxiliary information in the editing and imputation procedures, additional information for studies on nonresponse, comparison sources for the validation phase; d) data fusion (integrating multiple sources data representing the same object to produce synthetic data that is more informative than original).

The focus of this paper is in the above cases with the exception of situation c), in which the use of administrative sources is mainly oriented to improve quality, e.g. by allowing more

efficient survey designs, or providing a benchmark for quality control, as in the validation step.

In the following, the methodological framework adopted, and the tools, guidelines and assessment questionnaire, will be described, with a higher emphasis on the second. The audit and self-assessment procedure, i.e. the yearly programme stating the rules for identifying the processes to involve, the training of process managers and auditing teams, and all the other steps of the procedure, as well as the structure of the final assessment template do not require any change, being completely generalizable to the case of processes using administrative data.

3.1. The reference quality framework

The adopted reference quality framework identifies the following quality elements: *i)* the usability, before any specific statistical purpose; *ii)* the input quality, i.e. the quality of the administrative dataset centrally acquired; *iii)* the input output oriented quality, i.e. the quality of the dataset when used in a given statistical production process; *iv)* the errors arising from the use of administrative sources during the production process, named through-put quality; *v)* the output quality intended as the quality of the estimates derived using administrative data. Istat as a whole has many activities aimed at managing usability (D'Angiolini *et al.*, 2014) and input quality (Di Bella and Ambroselli, 2014) which are not the focus of this paper.

Input output oriented quality will be measurable once that the datasets (Daas and Ossen, 2011), or part of them, to be used in the given statistical process, are gathered, and before they are integrated in the process.

For the through-put quality a model based on the Generic Statistic Business Process Model (GSBPM), the Generic Statistic Information Model (GSIM), and on the two-phase life cycle of integrated statistics microdata from a quality prospective (Zhang, 2012) has been defined (Fig.1). Then the sources of errors are related to the process activities as defined in GSBPM. For each process activity (namely the identification of users' needs, the check of data availability, …) the potential errors derive from mismatches between successive steps

(Groves, *et al.* 2004), with the additional complexity that errors may propagate from one step to another and from units to variables.

Figure 1. Main sub-processes, information object and potential errors for units and variables

Main processes and sub-processes (GSBPM)	**Information Objects – GSIM (units)**	**Potential Errors (units)**		**Information Objects – GSIM (variables)**	**Potential Errors (variables)**
1. Specify needs 1.1. Identify needs 1.4. Identify concepts 1.5. Check data availability 2. Design	Statistical target population ↓ Accessible AD(s) / SR(s)	Conceptual deviations	Coverage errors	Target concepts / measure ↓ Administrative variables	Specification / Validity errors (conceptual instability)
4.Acquisition* 4.2. Set up 4.3. Run 4.4. Finalise	Accessible AD(s) / SR(s) ↓ Accessed AD(s) / SR(s)	Selection errors (missing, duplicates, delays)		Administrative variables ↓ Administrative instance variable	Missing values errors Measurement error
5. Process 5.1. Integrate data 5.5. Derive new units and variables 5.9. Align time references ** 5.4. Edit and impute 5.8. Finalise data files	Accessed AD(s) / SR(s) ↓ Statistical analysis population	Linkage errors Model assumption errors (or unit identification errors)		Administrative instance variable ↓ Validated microdata	Processing errors: Inter-source coherence errors Missing values errors Measurement errors Classification errors Model assumption errors Intra-source coherence errors
5.7. Calculate aggregates				Validated microdata ↓ Statistical output	Model specification error

* Collect is intended here in a wide sense, i.e. including acquisition from administrative data providers
** This sub-process is not explicitly included in GSBPM.

As for output quality, Eurostat approach for the quality of statistics (Agafiţei et al, 2015; Eurostat, 2011) was considered. The validity of the quality dimensions in the context of the use of administrative sources is analysed and the impact of this use on the quality measurement, evaluated.

3.2. The reference Quality Guidelines

In a quality assessment programme, the compliance is evaluated towards given standards. In our approach, the standard is provided by Quality Guidelines, stating the principles to be fulfilled and the methods that can be applied in order to address the principles. In 2015, with the joint efforts of many Istat experts, targeted quality guidelines for statistical processes using administrative data were released (Brancato *et al.* 2015). They follow a similar structure of the Quality Guidelines for direct surveys (Signore *et al.*, 2012) being organised into two parts: I. Process Quality and II. Output quality. In process quality, the principles follows the steps identified in Figure 1. Differently from the guidelines for direct surveys, which did not explain thoroughly the statistical methods, these last guidelines describe the methodologies in a more detailed way, since it was considered necessary to consolidate the knowledge on the matter.

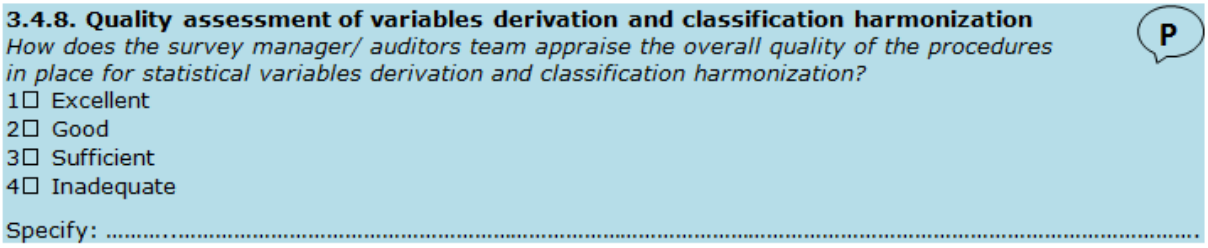
3.3. The assessment questionnaire

The above mentioned quality guidelines for statistical processes using administrative sources have led to the development of a tailored instrument aiming for a systematic and standardised quality assessment of specific statistical processes, namely the ones using exclusively administrative sources. Therefore, a new assessment questionnaire has been designed to keep up the stable and consolidated Istat two-fold procedure for direct assessment of the quality.

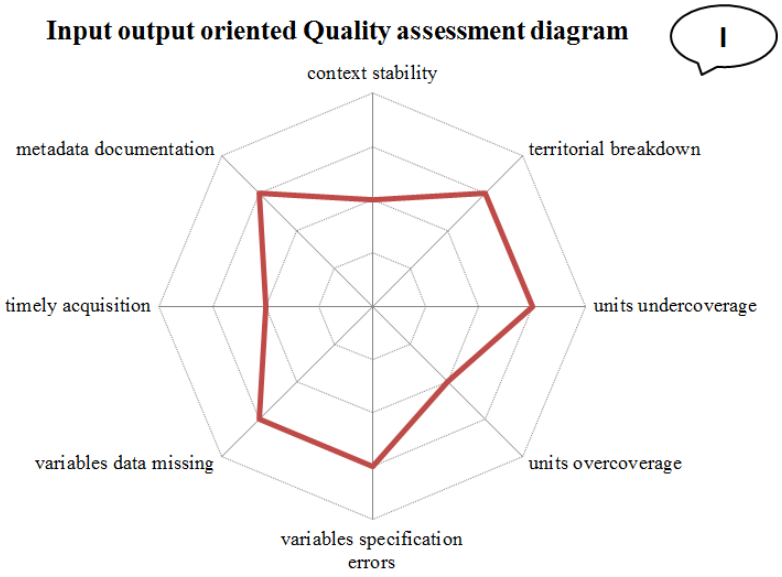
With regard to the questionnaire structure, Section 1 deals with the number of archives managed in the statistical process and the terms of their acquisition from administrative data providers. Then, section 2 is motivated by the need to investigate thoroughly the input quality of administrative data sources involved in the specific process. It is worth mentioning the inclusion of questions about coverage mismatch with respect to the target population, the timeliness of administrative records, the availability of reliable metadata, the extent and magnitude of errors in the units and the variables, the stability through time in every aspect (legislation, file structure, variables contained, concepts, etc.). Section 3 is structured in a process-oriented way, following the Quality Guidelines, that is to say those sub-processes of the GSBPM relevant in the considered uses of the administrative data and listed in Figure 1.

For each sub-process a set of questions has been developed aimed at understanding the methods used, their methodological soundness, the activities adopted in the process for preventing, monitoring and evaluating the errors arising in every step. Section 4 examines the estimates' quality with respect to the generally well known European Statistical System quality dimensions relevance, accuracy, timeliness, accessibility and clarity, comparability and coherence, and the impact that the use of administrative data has on them. Finally, Section 5 contains a limited number of questions relating to further management and organisational items, i.e. data recovery, internal staff satisfaction, quality management and control mechanisms.

A main element of the questionnaire architecture is the DESAP-like assessment questions emphasis (Eurostat, 2003): strategic questions are highlighted in different colours depending on the quality item taken under examination, with symbols employed as graphic additives at the right side to catch the respondent attention.



The coloured background questions can be summarised to provide immediate graphical feedbacks by drawing four different assessment diagrams, covering the quality areas identified to profile view on quality (namely, the **I**nput output oriented quality, sources of **E**rror, through-**P**ut quality, **O**utput quality).



Given the auditing and self-assessment purpose, that require a thorough investigation of all aspects related to the production and its quality, it was chosen to have for each question, together with closed-ended questions, also boxes to allow for reporting additional remarks and to write down ideas and comments.

Before being finalised, the questionnaire was tested by administering it to one of the most important Istat processes using a variety of administrative sources, i.e. the construction of the register of active enterprises. The test that was carried out highlighted that the complexity of the administration of the questionnaire increases noticeably when several administrative sources are integrated. However, the questionnaire turned out to work properly even to such infrequent situations.

4. Conclusions and future steps

The paper illustrates the framework and tools for conducting auditing and self-assessment on processes using exclusively administrative sources.

In the 2016 annual audit and self-assessment programme, besides the direct surveys, two additional processes exclusively using administrative will be assessed with the new tools. The

questionnaire to be used when administrative data are combined to survey data that still requires the testing phase, is also under development. Tailored quality indicators to be documented in the SIDI-SIQual system are being identified, to support the whole procedure. Finally, the quality guidelines for processes using administrative sources are being translated into English and an update with minor adjustments is on the way.

5. References

Agafiţei M., Gras F., Kloek W., Reis F., Vâju S. (2015), Measuring output quality for multisource statistics in official statistics: Some directions, Statistical Journal of the IAOS, 31, pp. 203-211.

Brancato G., Barbalace F., Boggia A., Busetti C. (2014), Quality Guidelines for statistical processes using administrative data, European Conference on Quality in Official Statistics Q2014 Vienna 2-5 June 2014.

Brancato G., Carbini R., Pellegrini C., Signore M., Simeoni G. (2006), Assessing quality through the collection and analysis of standard quality indicators: the Istat experience, Proceedings of the European Conference on Quality in Survey Statistics (Q2006), Cardiff, UK, 24-26 April 2006.

Brancato G., Pellegrini C., Signore M., Simeoni G. (2004), Standardising, Evaluating and Documenting Quality: the implementation of Istat Information System for Survey Documentation – SIDI, European Conference on Quality and Methodology in Official Statistics Q2004 Mainz, Germany 24-26 May 2004.

Brancato *et al.* (2015), Linee guida per la qualità dei processi statistici che utilizzano dati amministrativi. A cura di G. Brancato. Versione 1.0, Luglio 2015 http://www.istat.it/it/files/2010/09/LineeGuida_v.1.0_Luglio_2015.pdf.

Daas P., Ossen S. (2011), Report on methods preferred for the quality indicators of administrative data sources, Blue – ETS Project, Deliverable 4.2.

D'Angiolini G., De Salvo P., Passacantilli A. (2014), Istat's new strategy and tools for enhancing statistical utilization of the available administrative databases. European Conference on Quality in Official Statistics (Q2014), 2-5 June 2014, Vienna, Austria.

Di Bella G., Ambroselli S. (2014), Towards a more efficient system of administrative data management and quality evaluation to support statistics production in Istat. European Conference on Quality in Official Statistics. Q2014. 2-5 June 2014, Vienna, Austria.

Eurostat (2003), The European self-assessment check list for survey managers (DESAP) http://ec.europa.eu/eurostat/documents/64157/4373903/07-Checklist-for-Survey-Managers_DESAP-EN.pdf/ec76e3a3-46b5-409e-a7c3-52305d05bd42.

Eurostat (2011), European Statistics Code of Practice http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-32-11-955/EN/KS-32-11-955-EN.PDF.

Groves R.M., Fowler F.J. jr., Couper M.P., Lepkowski J.M., Singer E., Tourangeau R. (2009), Survey methodology, J.Wiley & Sons 2nd edition, Chichester, U.K.

Signore M., Carbini R., D'Orazio M. (2012), Quality assessment in Istat: the combined use of standard quality indicator analysis and audit procedures. European Conference on Quality in Official Statistics, Q2012, 29 May – 1 June, 2012, Athens, Greece.

Signore M., Brancato G., Carbini R., D'Orazio M, Simeoni G. (2012), Quality Guidelines for statistical Processes. December 2012 http://www.istat.it/en/files/2011/11/QualityGuidelines_EngVers_1.11.pdf.

Unece (2015), Statistical Network MIAD - Methodologies for an Integrated Use of Administrative Data in the Statistical Process, Deliverable A.1. Usage of Administrative Data Sources for Statistical Purposes https://ec.europa.eu/eurostat/cros/sites/crosportal/files/Usage%20of%20Administrative%20Data%20Sources%20for%20Statistical%20Purposes.pdf.

Zhang Li-Chung (2012), Topics of statistical theory for register-based statistics and data integration, Statistica Neerlandica, Vol 66, 1, pp. 41-63.