



Discussion paper

Quality management of methodology and process development for official statistics

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Summary

Methodology and process development are cornerstones of official statistics and belong to the major factors that contribute to their quality. This is reflected in the European Statistics Code of Practice, which mentions that "Sound methodology underpins quality statistics" and "Appropriate statistical procedures, implemented from data collection to data validation, underpin quality statistics". However, methodology and processes are hard to explain to the average user, and so we must find other ways to ensure trust in statistical methodology and processes, and to convince users of the quality of official statistical methodology and processes. Important elements of such an approach are independence of the methodological and development units, transparency of methods and process designs, peer reviews, internal reviews and evaluations, and internal quality management.

In this paper we look in particular at quality management. We show how quality management of methodological and development units may be based on the Code of Practice. We show how the various elements work together, and how the whole of these elements may lead to certification of the units, for example by EFQM or ISO. In 2017 the department for process development and methodology at Statistics Netherlands was certified according to ISO 9001. As an example, we discuss the various steps that have been taken to achieve this certification. In particular we focus on

- the quality procedures for internal and external reports, recommendations and briefs;
- the quality assurance of statistical development projects in which methodologists and business analysts participate;
- the quality assurance of methodological courses taught to statisticians;
- the internal management of the department.

Keywords

quality management, official statistics, statistical methods, process development, certification, ISO 9001

1. Introduction¹

The production process of official statistics has increasingly become more and more complex, which makes it hard to form an opinion about its quality. In the last 50 years we have seen shifts from censuses to surveys to administrative data to big data. The concept and practice of censuses and administrative data are easy to understand: basically, it is just counting. But surveys use complex methods for sampling, weighing and correcting for nonresponse; and these methods are based on a whole separate science of survey methodology. Also, methods have become increasingly complex over time. And with big data we are possibly going even further in modeling the relations between variables and between data sets (Struijs et al, 2014; Braaksma and Zeelenberg, 2015; Zeelenberg, 2016).

All this has made it difficult for external users to judge themselves the quality of statistical information; cf. Kuurstra and Zeelenberg (2016). Statistical organizations have therefore sought other ways to convince users of the quality of their products. In the last 20 years, this has led to the establishment of quality management within NSIs, based on codes of practice and expressed in for example communication about quality, guidelines, sharing of best practices among NSIs, certification, peer reviews and other external reviews. Quality management has not been limited to statistical outputs only but includes process quality and transparency about methods and processes as well as communication and corroboration of process quality.

In this paper we will look more specifically at what this means for methodological and process development of official statistics. In section 2 we show how a general quality framework for process development and methodology may be derived from the European Statistics Code of Practice. In section 3 we describe how the Department for Process Development and Methodology has been certified for ISO 9001. Section 4 gives a summary and some conclusions.

2. Quality aspects of methodological and process development

Most NSIs work within a quality framework embodied in a code of practice, for example the *European Statistics Code of Practice* (ESS, 2017) or the *UN Generic National Quality Assurance Framework* (UN, 2012); see also ABS (2009), Census Bureau (2013) and Statistics Canada (2017) for country-specific quality frameworks.

¹ This paper has been presented at the European Conference on Quality in Official Statistics (Q2018) Krakow, 26-28 June 2018 (www.q2018.pl)
We thank Douwe Kuurstra (Statistics Netherlands) for reviewing our paper.

Here we will focus on European NSIs, which work within the European Statistics Code of Practice (CoP). Many of the principles and indicators of the CoP are relevant for methodological and process development. In general, both process principles and output principles are relevant for methodological and process development; and some institutional principles, for example disclosure control, may also be relevant. How far this relevancy goes, depends of course on the internal organization of an NSI, in particular on whether development is more or less centralized. However, because of the complex professional nature of development work, the development unit will always be responsible for at least the quality of its own work. In a setting where development is shared between the statistical division and the development division, the following principles and aspects of the CoP are particularly relevant for development work:²

- Principle 6 (*Impartiality and Objectivity*), in particular
 - Indicators 6.1 and 6.2 which require an “objective basis” for statistics, and that “Choices of ... statistical methods ... are based on statistical considerations.”
 - Indicator 6.4, which requires that “Information on data sources, methods and procedures used is publicly available.”
- Principle 7 (*Sound Methodology*), in particular
 - Indicators 7.1 and 7.2, which require adherence to international guidelines, standards and good practices, and in particular a methodological framework as well as a methodological organizational structure;
 - Indicator 7.7, which requires co-operation with the scientific community as well as external evaluation of methods.
- Principle 8 (*Appropriate Statistical Procedures*), in particular
 - Indicator 8.2, which requires testing of questionnaires;
 - Indicator 8.3, which requires periodical reviews of statistical processes;
 - Indicator 8.5, which requires procedures for revisions.
- Principle 10 (*Cost Effectiveness*), in particular
 - Indicator 10.4, which requires “... standardised solutions that increase effectiveness and efficiency.”
- Principle 12 (*Accuracy and Reliability*), in particular
 - Indicator 12.2: “Sampling errors and non-sampling errors are measured and systematically documented.”
- Principle 14 (*Coherence and Comparability*), in particular
 - Indicator 14.1, which requires internal coherence and consistency;
 - Indicator 14.4, which requires comparison and reconciliation of statistics from different sources and of different periodicity.
- Principle 15 (*Accessibility and Clarity*), in particular
 - Indicator 15.6: “Users are kept informed about the methodology of statistical processes ...”

² See also the *Quality Assurance Framework of the European Statistical System* (ESS, 2015a), which details many of the principles and indicators of the CoP.

Together these principles, indicators and requirements set a framework for the methodological and development units within an NSI. A summary might be:

- Statistical methods are scientifically based.
- Statistical methods and process designs are documented and published.
- Statistical procedures and processes are based on guidelines and are regularly reviewed.
- Statistical methods, procedures and processes are geared towards cost effectiveness and efficiency and use standardized solutions.

3. ISO 9001 certification of process development and methodology at Statistics Netherlands

3.1 Quality management at Statistics Netherlands

Quality management at Statistics Netherlands (CBS) is based on the European Statistics Code of Practice (CoP), and the general quality policies have been laid down in the Statistics Netherlands Quality Declaration (CBS, 2017), which is structured according to the CoP. More detailed policies are described in the Statistics Netherlands quality assurance framework (CBS, 2009, 2014).

The 2015 CoP Peer Review (ESS, 2015b) concluded that these “form a solid basis for the quality assurance of processes,” but recommended that “Statistics Netherlands should ... consider also, in the context of external communication, the adoption of recognized industry standard quality assurance/certification systems.” This has led to the decision to certify the Statistics Netherlands statistical processes according to ISO 9001 (ISO, 2015). ISO 9001 has been chosen because it fits in with the rather goal-oriented and practical culture within Statistics Netherlands and also because of preferences within top management. It was also felt that at all management levels, existing practices correspond already more or less to the PDCA (Plan-Do-Check-Act) cycle that ISO 9001 proposes as well as that many elements of ISO 9001 are already present in the Statistics Netherlands quality framework.

3.2 ISO 9001 certification at Statistics Netherlands

The ISO 9001 certification program was started in 2016 and is expected to run until 2019.

The ISO 9001 program operates at three levels:³

1. the top level for Statistics Netherlands as a whole
2. the division level, for each of the 5 divisions
3. the departmental level, for each of the around 50 departments

Each of the ISO 9001 requirements has been allocated to one of the levels. For example, HR (recruitment, performance reviews, etc.) and planning & control are uniformly organized across Statistics Netherlands and have therefore been allocated to the top-level. Statistical processes may differ in for example sampling, editing and integration aspects, are carried by teams within departments, and so have been allocated to the departmental level. At each level, the appropriate steps for ISO 9001 certification, such as descriptions of processes and procedures, have been undertaken. In other words, each level has its own quality management system (QMS) which details only the processes, procedures and actions that are actually carried out at that level and have not been allocated to another level. In terms of ISO 9001: the top-level QMS focuses on context, leadership, strategy, and policy; the divisional QMS's focus on policy and planning; and the departmental QMS's focus on planning and operation; and QMS's at all levels deal with evaluation. Of course, this is only a rough segmentation; for example, a department may have its own context, in particular it may have its own relations with external stakeholders.

ISO 9001 certification is carried out by an external organization, that relies on an external audit of the processes to be certified. The requirements are described in the ISO 9001 standard (ISO, 2015). Basically, ISO 9001 requires that processes are governed by a PDCA (Plan-Do-Check-Act) cycle; moreover, the organization must have a quality policy, a risk and opportunity policy, and an internal audit practice.

3.3 ISO 9001 certification of process development and methodology

The ISO 9001 certification program at Statistics Netherlands includes the processes that support statistics directly, and also the processes of the department for process development and methodology (BPM). This department carries out research in methodology, consultancy in process development (business architecture, process design, Lean Six Sigma⁴) and methodology, participates in statistical development projects, and teaches courses in process development and methodology. Similar to other units within Statistics Netherlands, it was felt that existing practices and activities of BPM, already correspond fairly well to a PDCA cycle. Also, management and staff are highly educated professionals, and the departmental culture is quality focused; and from the outset it was clear that there are no serious quality problems. So, the purpose of certification was mainly to make quality management more explicit and to increase confidence of internal and external clients in the quality of the output of the department.

For BPM, the certification procedure has consisted of 5 phases:

³ See Kuurstra and Zeelenberg (2016) for more details.

⁴ See section 3.7.

1. Documenting the work processes within the department: research, consultancy, participation in projects, Lean Six Sigma and training.
2. Documenting the quality procedures that are actually being followed.
3. Documenting the context specific for the department, such as relations with internal and external stakeholders.
4. Determining and documenting the quality objectives and the performance indicators for evaluation of the operation and control of the departmental processes.
5. Management review: Reviewing the indicators, risks and opportunities; determining actions based on the review results.

The first two phases, documenting the processes and the quality procedures and resulting in a so-called *process description*, took some time, because procedures were not always clear, and because there was some discussion about the products and processes of the department. These phases were carried out by a working group of staff members from each of the teams. For each of the processes, the process description describes purpose, customer relations, procedures and practices, quality management, and allocation of budget, capabilities and staff.

The last three phases were mainly carried out by the management of the department. The output of phase 3 has been a list of *stakeholders*:

- the development directors of the statistical divisions, who are the contacts for consultancy and projects;
- the chief information officer, who chairs the central portfolio board, which allocates budget for major development projects;
- the Board of Directors, who decide about topics and budget for the research program;
- universities, with whom BPM cooperates in research projects, e.g. through the 4 staff members who are also part-time professor of statistics;
- international organizations and other NSIs, with whom we also cooperate in research projects.

For each of these stakeholders, it was considered whether the relations needed to be improved, and whether any improvement actions were necessary.

The quality objectives and performance indicators have been firmly tied to the quality policy of Statistics Netherlands, which is based on the European Statistics Code of Practice (CoP), and they follow the structure and reasoning as in section 2; they are described in the quality policy of the department.

The *quality objectives* resulting from phase 4, are:

1. The statistical methods that are being developed, are published on the Statistics Netherlands website. The standard methods that are being used at Statistics Netherlands, are maintained by BPM and are published in the Methodological Series on the Statistics Netherlands website.
2. BPM participates in European methodological meetings and projects.
3. BPM supports the training of Statistics Netherlands staff through methodological courses.
4. BPM supports Statistics Netherlands in achieving efficiency through projects with Lean Six Sigma and Lean Operational Management.
5. BPM supports Statistics Netherlands in standardizing and optimizing statistical processes.

6. BPM operates in a cost-effective way.
7. BPM contributes to a better public understanding of the statistical methods used by Statistics Netherlands.

For each of these quality objectives, it was considered whether performance needed to improve, and whether some aspects, although satisfactory, needed to be monitored. In the latter category, there are also indicators for some goals chosen at the Statistics Netherlands level or the divisional level.

The *performance indicators* for 2018 relate to:

1. Financial results
2. Absence rate (sick leave)
3. Reporting frequency (sick leave)
4. Work satisfaction
5. Customer satisfaction
6. Allocation of staff to various research topics
7. Participation in statistical development projects
8. Introduction of customer satisfaction surveys follow-up care
9. Privacy and security of data used in the research program
10. Introduction of statistical and methodological audit program
11. Number of Lean Six Sigma projects

3.4 Management reviews

The performance indicators are regularly monitored by the management of the department, usually in quarterly management-review meetings. These meetings are structured according to the PDCA cycle, and so the discussion is always followed by a decision: is the performance satisfactory and are further actions needed? These meetings also discuss the status of other actions concerning stakeholders, customer satisfaction and risks and opportunities.

3.5 Time schedule and costs

For Statistics Netherlands as a whole, the ISO 9001 certification process will take about 7000 hours: 4000 hours by the statistical departments and 3000 hours by the central quality management department, which coordinates the process and organizes the external audits, and carries out internal audits. It should be noted that this is the first time the process has been carried out, and that a major part of the process consisted of overdue maintenance, such as updating of documentation and procedures, and are not strictly part of ISO 9001 certification as such.

It is expected that next rounds of recertification will take considerably less time, about 25 hours per statistical department, mainly for audits, i.e. 500 hours in total. Central coordination and internal auditing will cost about 1500 hours. In total about 2000 hours, less than 0.1 percent of total Statistics Netherlands capacity. Finally, there are also some financial costs associated with the external audit; these are charged to the budget of the central quality management department.

Preparations for the certification of the department for process development and methodology started in early 2017. The documentation phase took about 200 working hours over a period of 3 months; since this was the first time such a process description was created, it may be expected that maintenance of the document will take considerably less time. The process description has about 20 pages. In late summer, the remaining documents were created. The quality-policy document has about 5 pages and took about 40 hours to create. The stakeholders, performance indicators, and risks and opportunities, are maintained in spreadsheet tables, that also describe the actions to be taken and their status. The creation of these tables took about 40 hours. All in all, the preparations for the certification took about 300 hours. Again, it should be noted that a major part consisted of updating of documentation. The quarterly management-reviews take about 1 hour each. It is yet too early to say how much time will be taken by the actions themselves, although at present it is the impression that these management-reviews and these actions may be fitted in with normal management activities.

3.6 Audit and review

In the autumn of 2017 the quality management system of BPM was externally audited. The audit was carried out in two rounds: a general review of the QMS and an in-depth review of several projects. The general review took one half day and discussed the process description and the quality policy. The second round took one day and reviewed 5 projects carried out in recent years by the department. The auditor questioned the project leader and the department management about various ISO 9001 aspects, such as requirements, communication with customers, planning, quality control. All in all, the audit took about 50 hours, including preparation; besides, about 50 hours were spent on collecting and updating additional documentation.

Late 2017, the department was ISO 9001 certified.

3.7 Relation with Lean Six Sigma and Lean Operational Management

Apart from ISO 9001 for its quality control, Statistics Netherlands has also adopted Lean Six Sigma (LSS) and Lean Operational Management (LOM), which are used for improving and steering processes (Smekens and Zeelenberg, 2015). The department of process development and methodology is the internal expert center for LSS and LOM but is also introducing LOM into its daily operation. It is important to integrate ISO 9001 and LOM, and to include within LOM the ISO 9001 objectives and performance indicators.

4. Conclusion

Methodology and process development are cornerstones of official statistics and belong to the major factors that contribute to their quality. However, methodology and processes are hard to explain to the average user, and so we must find other ways to ensure trust in statistical methodology and processes, and to convince users of the quality of official statistical methodology and processes, such as independence of the methodological and development units, transparency of methods and process designs, peer reviews, reviews, and internal quality management. Certification of the methodological and process development activities within an NSI is then one way in which the confidence of external and internal clients in the quality of these activities may be increased.

The European Statistics Code of Practice (CoP) and the associated Quality Assurance Framework of the European Statistical System may serve as a quality framework not only for official statistics in general, but also for methodology and process development. In particular principles 7 and 8 of the CoP are relevant: “Sound methodology underpins quality statistics” and “Appropriate statistical procedures, implemented from data collection to data validation, underpin quality statistics.” At Statistics Netherlands, the department for process development and methodology was ISO 9001 certified in 2017. The burden of this certification procedure has been limited, about 300 working hours. Quality control as such was already in order, so that the main task was to make it visible, in the documentation, but in particular during the certification audit. Until the certification, quality control was rather implicit, which limits bureaucracy, but increases risks, whereas ISO 9001 requires that quality control is explicit and visible.

Clearly, the explicitness and visibility of quality control are advantages of the ISO 9001 approach. However, the ISO 9001 approach is managerial and administrative, and is less visible and distinctive for the staff, who usually have a more practical and concrete approach to quality. It is therefore important that management defines concrete aims of quality control, such as standards for client satisfaction, and actively promotes and communicates these aims.

Finally, as said in the introduction, external communication about quality is important, and ISO 9001 certification will have a role in this. The ISO 9001 certification for Statistics Netherlands and for its department for process development and methodology will of course have its place in the Statistics Netherlands Quality Declaration (CBS, 2017). The fact that Statistics Netherlands has been ISO 9001 certified will mostly appeal to major stakeholders such as the government and regulators. It will also be relevant for external clients for custom work, which is becoming more and more important for Statistics Netherlands (Zeelenberg, 2015).

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Explanation of symbols

Empty cell	Figure not applicable
.	Figure is unknown, insufficiently reliable or confidential
*	Provisional figure
**	Revised provisional figure
2017–2018	2017 to 2018 inclusive
2017/2018	Average for 2017 to 2018 inclusive
2017/'18	Crop year, financial year, school year, etc., beginning in 2017 and ending in 2018
2015/'16–2017/'18	Crop year, financial year, etc., 2015/'16 to 2017/'18 inclusive

Due to rounding, some totals may not correspond to the sum of the separate figures.

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