Quality Assessment and Improvement Methods in Statistics – What works?

Hans Viggo Sæbø, Statistics Norway
hvs@ssb.no

Abstract: Several methods for quality assessment and assurance in statistics have been developed in a European context. Data Quality Assessment Methods (DatQAM) were considered in a Eurostat handbook in 2007. These methods comprise quality reports and indicators, measurement of process variables, user surveys, self-assessments, audits, labelling and certification. The entry point for the paper is the development of systematic quality work in European statistics with regard to good practices such as those described in the DatQAM handbook. Assessment is one issue, following up recommendations and implementation of improvement actions another. This leads to a discussion on the effect of approaches and tools: Which work well, which have turned out to be more of a challenge, and why? Examples are mainly from Statistics Norway, but these are believed to be representative for several European statistical institutes.

1. Introduction

During the last decades, both international organisations and National Statistical Institutes (NSIs) have focused on the importance of quality work. A systematic approach to quality has been adopted in many statistical institutes. This has been based on some common principles of quality management. The work has been supported by international initiatives, in Europe in particular the Code of Practice (CoP) for the production and dissemination of statistics [1]. A second round of peer reviews assessing compliance with CoP has just started.

Several methods for quality assessment and assurance in statistics have been developed in a European context. Data quality assessment methods (DatQAM) were considered in a Eurostat handbook in 2007 [2]. These methods comprise quality indicators and reports, measurements of process variables, user surveys, self-assessments, audits, labelling and certification.

The entry point for the paper is the development of systematic quality work in European statistics with regard to quality frameworks and good practices, such as those described in the

DatQAM handbook. Assessment is one issue, following up recommendations and implementation of improvement actions another. This leads to a discussion on the effect of approaches and tools: Which work well, which have turned out to be more of a challenge, and why?

Examples are mainly from Statistics Norway, but these are believed to be representative for several European statistical institutes.

2. Quality frameworks

A quality framework provides a frame for the identification of quality challenges and actions for their resolution, and it is a prerequisite for systematic quality work. The framework should therefore be reflected upon before considering the use of tools for quality assurance.

A quality framework or management system consists basically of some definitions, principles and a model linking the principles together. General quality frameworks comprise Total Quality Management (TQM), Six Sigma, European Foundation for Quality Management (EFQM), Common Assessment Framework (CAF), Balanced Scorecard, ISO and Lean or Lean Six Sigma. These systems are to a large extent based on a common set of definitions (e.g. quality as "fit for use") and principles (such as user and process orientation, improvements based on measurements and participation by all), but they differ with respect to main focus and degree of formalisation. In EFQM and ISO emphasis is for example put on rating and certification, whereas Six Sigma focuses on quality control applying statistical methodology. Lean emphasises improved efficiency by the reduction of waste.
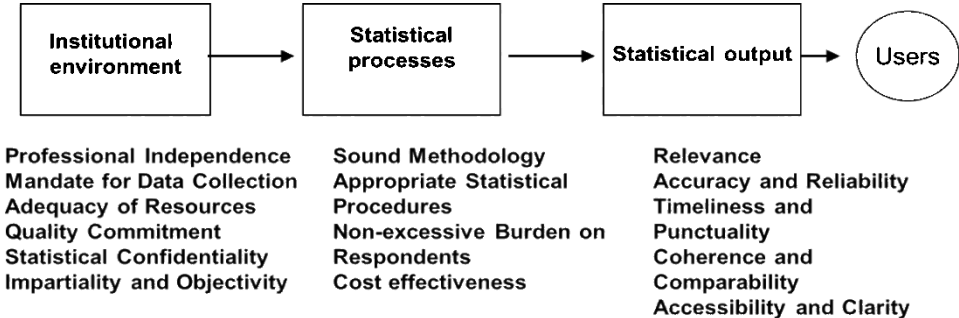
In some sense TQM that was developed in the last century is the mother of all general quality management systems. Concepts and principles developed here constitute a common content of all such systems developed later. However, the variety of systems may complicate comparability of quality work and a just description of strong and weak aspects of such work. Systems have developed, but also changed names over the years. In Norway no one talks about TQM nowadays, but many consultants promote Lean as if this is a completely new system. It is a built-in feature of their business to promote new initiatives, but for a statistical institution that needs continuity, is it important to keep values and principles and also their wording over time. It is crucial that earlier improvement work is recognised, and nothing is more demotivating for staff than being told that the real improvement will start now since earlier work has not succeeded. This is a challenge for management, since implementing

something new seems to prove decisive management. Deming's and TQM's principle constancy of purpose is just as valid today as when formulated more than 30 years ago [3]. This also points to the fact that quality work is a continuous task. User needs and possibilities (e.g. technology) change, and statistics and production processes must change accordingly.

Some National Statistical Institutes (NSIs) apply one or parts of several of the general quality systems. But there is a set of values and principles of official statistics, and hence the NSIs, which go beyond the principles of these systems. This, in particular, regards independence, impartiality and protection of data on individuals. Such requirements to official statistics were first formulated jointly in the ten UN principles of official statistics adopted in 1992 [4]. Later, such principles have been incorporated in quality frameworks for statistics.

In Europe, the CoP provides a common quality framework for statistics. It follows a TQM-like model from user needs for products to underlying processes and the institutional environment which is specific for statistical institutions (see figure 1). The indicators linked to the output represent an agreed definition of the components of quality in statistical products.

Figure 1. Code of Practice as a quality model

| Institutional environment | Statistical processes | Statistical output | Users |

Professional Independence
Mandate for Data Collection
Adequacy of Resources
Quality Commitment
Statistical Confidentiality
Impartiality and Objectivity

Sound Methodology
Appropriate Statistical Procedures
Non-excessive Burden on Respondents
Cost effectiveness

Relevance
Accuracy and Reliability
Timeliness and Punctuality
Coherence and Comparability
Accessibility and Clarity

Other frameworks developed in international statistical cooperation comprise the recently developed UN National Quality Assurance Framework (NQAF) [5] and the African Charter on Statistics [6], in addition to a number of national frameworks or Code of Practices, all taking the specific requirements to official statistics into account.

Work is underway to supplement the UN principles with more specific recommendations and description of good practices, turning it into a quality framework more comparable with the CoP and NQAF. In addition, both IMF and OECD have developed quality assurance framework, see [7] and [8].

It is natural that statistical institutions incorporate the specific requirements to official statistics in their quality framework. Extensive discussions on which quality management system is the best should be avoided. What is important is that an organisation has one and goes ahead with implementing it.

Different tools can be linked to the elements of the framework which provide the standards for assessing and reporting quality of statistics.

The tools and procedures to assure quality described in the Eurostat project on Data Quality Assessment Methods and Tools (DatQAM) [2] comprise:

> Quality reports and indicators
> Measurement of process variables
> User surveys
> Self-assessments and auditing
> Labelling and certification.

These tools can be applied to a various degree, but to a large extent they build on each other. Audits are for example normally built on self-assessments, and audits or some reviews are a prerequisite for labelling and certification.

Where relevant, tools can be linked to different stages in the production process of statistics, i.e. a business process model (for example quality indicators and process variables). Statistics Norway has developed a detailed process model based on the international General Statistical Business Process Model (GSBPM), see [9] and [10]. This is a basis for work on standardisation, and documentation is also linked to it.

Together with a quality framework such a business model and an organisation for coordinating quality work constitute a necessary infrastructure for systematic quality work in a statistical institution.

International and European initiatives have supported quality work in the NSIs. On the other hand national work on quality in statistics has influenced European requirements and recommendations, since these have been developed in cooperation with the European NSIs. CoP has been important for the development of systematic quality work in NSIs and constitutes a quality framework for Statistics Norway.

Considerations on different tools reviewed in the DatQAM report follow.

3. Quality reports and indicators

A quality report provides information on the main quality characteristics of a product for its users. Quality reports are normally based on quality indicators describing these characteristics. Quality reports are important for the producers and the management as well. However, the requirements of users and producers are different, but a standard structure is preferable. For European statistics, Eurostat has developed a guide and a handbook, see [11].

NSIs produce quality reports required by several international organisations and deliver them together with the data. Many NSIs also produce different types of standardised documentation including quality aspects for other and general users. Statistics Norway has a system where "About the statistics" is linked to every statistic on the web, all together about 400 different reports. These contain information on the background for each statistic, production, methodology and definition of concepts in addition to information on product quality such as relevance (use and users), accuracy, timeliness and comparability. Burg [12] discusses if these types of standard documentation really are quality reports, on the basis of the Austrian Standard Documentation system. The answer is and should be yes, given that the documentation includes the necessary quality aspects.

For an NSI standardised documentation like "About the statistics" going beyond the pure quality aspects are necessary for both users and producers. In Statistics Norway we use this information as a basis for our internal reviews described in section 7.

The level of detail in these reports is an issue. The extent and complexity of the reports tend to increase over time, and we should realise that the target group in practice is rather expert users. Producers will anyway need more comprehensive documentation linked to from the standard report. For a "normal" user there is a need for simplified information linked to or directly integrated in the text following the release of statistics.

Another issue that came up very clearly during our reviews is the need to update the standardised documentation consecutively. Most of "About the statistics" were not up to date, and there is no reason to believe that the situation is better for statistics not reviewed. That few if any of our users have complained about this may be a sign that this type of documentation is not much used, or is too comprehensive or complicated.

Quality indicators are used in the quality reports and in particular by management. In Statistics Norway some aggregated quality indicators are included in a set of performance indicators that are reported to the Ministry of Finance and publicised. This regards indicators on timeliness, punctuality, response burden and response rates (proxy for accuracy). Even if we stick to the definitions given in the Eurostat handbooks, there is some obscurity linked to these in practice. Measurement of timeliness is an example. For some statistics it is not obvious what should be the period or point of time linked to them (end or middle of period or time of data collection?). And how should the publication of preliminary figures be handled? When developing indicators that cover several statistics, weighting and aggregation is an issue. The indicators should therefore be used with some care. Also balancing between different quality aspects substantiates this. There is for example no need to obtain 100 per cent punctuality – that would be on the cost of timeliness. There is a similar balance between accuracy and timeliness.

Sometimes a quality indicator will show that something is wrong and that there is a need for action. An example can be the steadily decreasing response rates of some surveys. In general naming and shaming works, but not denouncing. In the case with response rates it is obvious that the general development of society with many opinion polls and difficulties to get hold of people (no phonebooks) is the main reason for the decrease, and new sources and ways of collecting data are called for. Management discussions on the development of performance and quality indicators must be constructive by considering and suggesting improvement possibilities.

4. Process variables

Statistical institutes have always measured some process variables. Examples are measurements of non-response of different types, interviewer performance, costs and use of time for different processes. A method for controlling and improving quality based on such measurements of repetive processes was introduced in the "classical" paper by Marker and Morganstein [13], based on Deming's statistical thinking about quality. The DatQAM report considered this and presents some examples of use of such variables, and Sæbø [14] adds a few more examples. These comprise techniques for mapping processes, supplemented by statistical control methodology monitoring variations in processes (with respect to for example time and errors). The idea is to study how a process described by key process variables varies. If the variability is satisfactory, control limits can be established and used to

identify later errors or improving the process by considering the effect of possible actions (checking the significance of these). If variability is too high, the process should be changed.

However, use of process variables other than resource inputs is still limited in official statistics, often confined to analysing response rates and managing interviewers. Our work with this kind of method has perhaps not been systematic enough, which is a paradox for statisticians familiar with analysing data. Editing and the effect of this is one area where this methodology should be suitable. This process normally counts for a relatively high share of resources used for the production of statistics.

5. User satisfaction surveys

A user satisfaction survey is a survey which aims at assessing the satisfaction or the perception of the users, normally as a basis for improvement actions (Eurostat's concepts and definitions database).

The DatQAM handbook [2] distinguishes between general surveys directed to diverse known users of products/services (for example all paying customers), image studies directed to unknown users and asking for their perception or confidence in statistics, and specific surveys directed towards target groups such as questionnaires added to printed publications or web questionnaires. Examples of a number of user surveys and recommendations are given. In addition, user satisfaction surveys can be categorised by general surveys covering the satisfaction with the quality of all statistics provided and surveys in specific statistical domains, as carried out on the Internet by Eurostat [15].

In the preparations for the current European peer reviews, Eurostat has surveyed the status of user surveys in European NSIs. It was found that most of them have implemented one kind of user satisfaction study or another, many of them covering both statistics in important fields, quality issues, trust, dissemination and overall evaluation, see [16].

There are several ways of ensuring systematic user feedback, for example by user councils and contact in connection with work on commission. In the quality reviews in Statistics Norway experiences with focus groups are good, revealing new insight in user perceptions and needs (see section 7). However, these reviews have revealed that user orientation often represents an improvement area for the different subject matter divisions.

User satisfaction studies have some limitations that one should be aware of. When evaluating the quality of statistics, users often emphasise timeliness and coherence (they want to see specific statistics in a broader context). Relevance is normally considered to be good. However, in surveys (or meetings such as focus groups) with known users or target groups using statistics, relevance will almost by definition get a high score. Those who do not find relevant statistics will normally not be included in such surveys. This should not lead to the conclusion that relevance is less important than other quality dimensions, and that it cannot be improved!

Another point is that satisfying the user needs is not always sufficient. Quality assurance and user satisfaction surveys normally answer the question if we do things right, to a less extent if we do the right things. Users do not always know what kind of statistics or solutions for presenting and disseminating them they really would like. Sometimes they should be positively surprised (a good example is Apple and Steve Jobs)! This means that producers of statistics should be pro-active, monitoring and quickly taking the development of society and technological possibilities into account.

The ongoing discussions on new data sources (including "big data") and new communication channels for statistics (such as Facebook and Twitter) could be mentioned in this context. New technology and data and new actors producing and spreading vast quantities of statistics represent both threats and opportunities for statistical institutions and official statistics.

There are a few examples of "paradigm shifts" in statistics in the past, the best is probably the development of the Internet. As one of the first NSIs Statistics Norway started to disseminate statistics on the Internet in February 1995, and this had great significance for our users' satisfaction and trust in the institutions in the years to come.

Timing is crucial regarding user satisfaction. To this end, Statistics Norway has not offered our users any "app" for retrieving statistics on mobile phones and tablets (there have been good reasons for putting priority on modernising the web service as such, also with APIs). A few years ago, this would have been an example of a positive surprise for our users. Now this is rather something they would expect, and since we do not have this it might harm confidence in the institution. However, Statistics Norway is present on social media (Facebook and Twitter which are important on mobile devices).

6. Self-assessments

Self-assessment is a review of an organisation's activities and results referenced against a model/framework, and carried out by those who are responsible for these activities. Several tools for self-assessment of statistics have been developed, in Europe in particular DESAP for survey managers [17], in addition to the self-assessments for statistical institutions conducted as preparations for peer reviews.

In Statistics Norway DESAP has been used to assess all our statistics in 2008 [18]. Improvement points comprised systems for more systematic user contacts, better knowledge of quality of administrative data owned by others, more automatic editing, and in general better documentation, including updating of "About the statistics". These measures were reviewed in 2010. There had been some progress, but there were still challenges linked to most of the areas mentioned. There might be a gap between theory and practice in this area – stand-alone self-assessments do not necessarily provide a correct picture, see [19]. However, a self-assessment based on a quality framework could be a good start to systematic quality work – to anchor the framework and quality thinking in the organisation and to identify weak points and improvement actions.

Self-assessments are normally used as a part of preparations for reviews and audits. This was the case prior to the European peer reviews in 2006 – 2008. Here CoP itself constituted the basis for the self-assessments. Together with the underlying Quality Assurance Framework (QAF) [20] CoP is used as a basis for the self-assessment preceding the current round of peer reviews, and all European NSIs and several other producers of European statistics have just filled in comprehensive questionnaires.

The UN NQAF has also been supplemented by a checklist that is suitable for and used for self-assessments in several countries in different parts of the world.

7. Reviews and audits

Statistics Norway started work with systematic internal quality reviews or audits of selected statistics in 2011([21] and [22]). The CoP and tools linked to this have guided the reviews. The reviewing system has been integrated with our internal control to form a system that covers all aspects of work in the institution. The reviewing process is illustrated in figure 2. It is performed very much like the European peer reviews, with the exception that specific statistics or subject matter areas are reviewed and not the institution as such.

In the period 2011 – 2013, 21 different statistics or clusters of statistics have been reviewed; at least one in each division producing statistics. Together they represent almost 30 percent of the working hours used for statistics production in Statistics Norway.

The reviews have been based on three elements: Self-assessments on the compliance with the principles and indicators in the Code of Practice and other documentation, process mapping using Lean techniques (Value Stream Mapping) and focus groups to evaluate user needs. A team of 4 persons has conducted the review. The team members have a background from quality management, statistics production, dissemination and survey methodology. One of the members is a methodologist. The team has been assisted by experts in conducting focus groups.

Statistics reviewed were selected in cooperation with the producers following proposals from the reviewing team, among others based on preferences from the National Accounts and experiences from earlier self-assessments using DESAP.

The reviews were "audit –like" even if they were carried out by an internal team. This implies focus on evidence. Findings are presented objectively in a report that is the sole responsibility of the team. The reports follow a standardised structure, also including a consideration of strengths and weaknesses. There is no ranking, but each report ends up with a set recommendations based on the findings. The division responsible for the relevant statistics reviewed can correct factual errors, but will make a separate action list on the basis of the recommendations. If they disagree with some of these they can express this here. Reports and action plans have been sent to the Director General and are followed up later. They are published on the Statistics Norway Intranet. The different steps in the reviews and experiences are described in more detail in [22].

The reviews have resulted in more than 170 proposals for improvements. Many of the improvement points concern several statistics, and there is reason to believe that they are valid generally in Statistics Norway.

The most important improvement points concern the need for:

> **Figure 2.** The reviewing process

- ➢ More focus on user needs and the relevance of statistics, in particular users want to see the statistics in a broader context.
- ➢ Better dissemination with more visualisation (graphs, maps, etc.).
- ➢ Improved documentation, in particular a need to update "About the statistics" which provides metadata for the users on www.ssb.no.
- ➢ Improved production processes.
- ➢ Increased understanding for and use of statistical methods, in particular in editing which requires relatively large resources.
- ➢ Increased knowledge of formalities (such as the basis for data collection).

Figure 2. The reviewing process
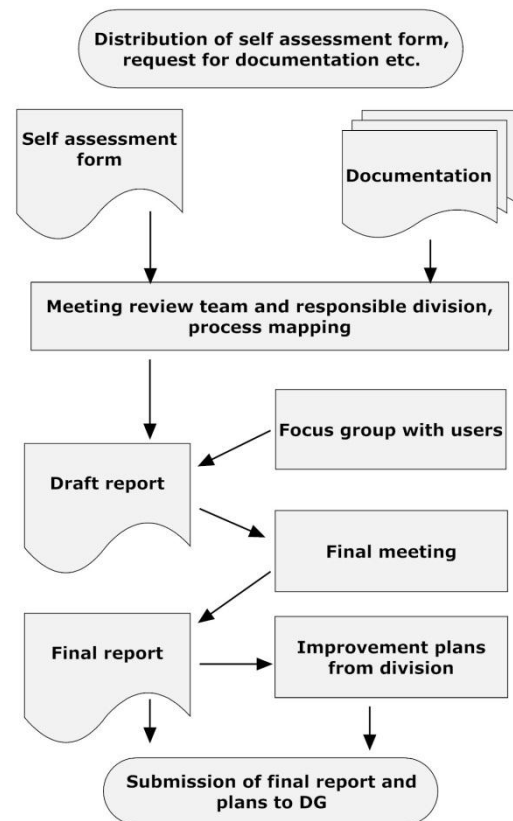
8. Following up improvement proposals

The European peer reviews have been and will be followed up by monitoring the resulting action plans. This is necessary and often provides support to internal improvement efforts.

Some of the improvements points from the internal reviews in Statistics Norway were the same as those revealed already in the DESAP self-assessments in 2008. This illustrates that self-assessments alone might not be that effective, but foremost that both assessments and reviews must be followed up. This is a responsibility for management on all levels, but monitoring can be performed centrally.

In Statistics Norway, the reviewing team gathers information on status for planned actions annually. This was done for the first time in 2013. By then about half of these actions from the reviews in 2011 and 2012 had been fulfilled, most of the remaining were fulfilled in 2014. Statistics Norway is currently carrying out a Lean programme, and there is a break in the reviews since these have to be adapted to this. However, they have given input to this program, and will also provide a basis for the European peer reviews in Statistics Norway.

Measures implemented are primarily linked to improved documentation and metadata, improved dissemination, evaluation and balancing of quality and efficiency in the production, international cooperation (on good practices), and better coordination and collaboration within Statistics Norway. Measures have been carried out to assure confidentiality. There are examples of transitions to use of common and standardised IT solutions.

Reasons for delayed improvement actions or actions that cannot be carried out, comprise dependencies on others (internally or externally, for example delayed implementation of standardised solutions or the development of our new web site), other external changes such as new Eurostat demands or the cycle/calendar of statistics that are not produced often. It is always possible to mention the lack of resources and priorities, but this has been done only on a few occasions. In general, these reviews have been considered to be useful, and that there are several general observations that can be useful also for improving areas not reviewed.

In line with its responsibility to follow up improvement proposals, management should ensure that identified best practices or "current best methodology" are not only documented, but known and taken aboard in the organization.

9. Labelling and certification

Labelling and certification are also considered in the DatQAM report. A discussion on labelling has been on the international agenda. As mentioned in section 5, developments in technology, data sources and user needs represent both a threat and opportunity for official statistics, and communicating the value of such statistics is important regardless of a labelling system.

It is normally agreed that official statistics shall serve the whole spectrum of society, and hence be easily available and be based on quality criteria such as those formulated in CoP, including professional independence and impartiality. Official statistics should be distinguished from analyses/research and pilot studies. Some of the criteria are absolute and measurable, but most of them are subject to judgements (for example balancing accuracy and timeliness). Definitive requirements could include the use of a release calendar, non-disclosure of information about individuals, use of statistical standards (internationally agreed definitions of units, variables and classifications ensuring coherence and comparability) and transparency by providing documentation on data sources, production processes, methods and

quality. Use of best practices in the production can then be judged. Being an active part of the international statistical society contributes to such use even if it does not give any guarantee.

Few NSIs have a system with labelling in the form of marking statistics and statistical tables, but examples from UK and Sweden are mentioned in the DatQAM report. In the UK there is a separate institution, the Statistical Authority, that is responsible for approving national statistics from ONS and other producers, following a system of quality reviews similar to the internal reviews in Statistics Norway, but much more comprehensive. In Sweden the production of statistics is even more decentralised, with 25 producers of official statistics. Here these institutions themselves decide which statistics that fulfil quality criteria and can be marked as official within the specific subject matter area under their mandate.

Labelling can be a tool for increasing trust in statistics if needed, improving quality and to avoid misuse (of statistics that are not approved/labelled). On the other hand it would require more bureaucracy, and there might be problems with how to apply labelling in practice (linked to tables, figures, databases and different technical solutions for dissemination). Eventually, will users really distinguish between labelled and non-labelled statistics? This will vary from country to country, and a general recommendation cannot be given.

The level of centralisation of the statistical system in a country is also a factor that may affect the need for labelling. Norway has a relatively centralised system, with Statistics Norway producing at least 85 per cent of such statistics. Even if we do not apply labelling, statistics presented on ssb.no with our logo are perceived as official. However, for other national producers of statistics it is more unclear what could be regarded as such statistics. The content of Norwegian official statistics will be clarified according to Statistics Norway's strategy.

Several of the considerations given on labelling of statistics also concern certification. Examples of certification efforts in NSIs comprise the Greek NSI Elstat who is in a process of certifying other national statistics producers according to CoP. Statistics Sweden has recently been certified according to ISO 20252 (quality standard for market, opinion and social research). Certification can be useful to improve trust and in a situation with competition for resources, but it has its costs. Statistics Norway has not considered certification. However, investing in assessments and reviews is a necessary prerequisite for both labelling and certification.

10. Concluding remarks

The basis for a systematic work on quality is a quality framework. In Europe, the Code of Practice together with general quality management principles represents a common quality framework. In addition to a quality framework a business process model and an organisation for coordinating quality work constitute a necessary infrastructure for a systematic quality work in a statistical institution.

Quality assurance by help of tools linked to such a framework should be implemented step by step, from the use of simple tools such as quality reporting and indicators. A self-assessment itself could represent a good starting point for a systematic work on quality. But reviews and audits really make a difference. Labelling or certification presupposes a thorough cost benefit analysis – the need for these activities will vary from country to country. However, clarifying and communicating the value of official statistics based on quality criteria is important.

Quality work is a continuous effort. User needs change over time, so do the environment for producing statistics including the technological possibilities. Constancy of purpose and management support on all levels are important. Too high ambitions in the short run could be counterproductive.

Actions to improve quality can be defined as separate quality projects, but it is just as important to ensure that quality thinking and aspects are integrated in all activities. This sounds evident, but in practice there is always a danger that quality work will be looked upon as a separate task.

Quality assurance by monitoring, reviewing and formulation of improvement actions are not enough – following up the implementation of planned actions is crucial. The existence of best practices is not enough either – they need to be known throughout the organisation and followed.

Finally one should bear in mind that quality assurance should not only apply to doing things right. Doing the right things is just as important, and some resources should be invested to ensure this.

References

[1] Eurostat (2011): *European Statistics Code of Practices.* Available from
http://epp.eurostat.ec.europa.eu/portal/page/portal/quality/code_of_practice

[2] Eurostat (2007): *Handbook on Data Quality - Assessment Methods and Tools (DatQAM).*
Available from http://epp.eurostat.ec.europa.eu/portal/page/portal/quality/quality_reporting

[3] Deming. W.E. (1982): *Out of the crisis*. Cambridge, Mass.: MIT Center for Advanced Engineering Study

[4] UN principles. Available from http://unstats.un.org/unsd/dnss/gp/fundprinciples.aspx

[5] NQAF. Available from http://unstats.un.org/unsd/dnss/QualityNQAF/nqaf.aspx

[6] African Charter on Statistics.
http://www.au.int/en/sites/default/files/AFRICAN_CHARTER_ON_STATISTICS.pdf

[7] IMF Data Quality Assessment Framework (DQAF). Available from
http://dsbb.imf.org/Pages/DQRS/DQAF.aspx

[8] OECD Quality Framework for OECD Statistical Activities. Available from
http://www.oecd.org/std/qualityframeworkforoecdstatisticalactivities.htm

[9] GSBPM (Generic Statistical Business Process Model). Available from
http://www1.unece.org/stat/platform/display/metis/The+Generic+Statistical+Business+Process+Model

[10] Statistics Norway (2008): *Statistics Norway's Business Process Model*.
http://www.ssb.no/english/subjects/00/90/doc_200817_en/doc_200817_en.pdf

[11] Eurostat (2014): *ESS Handbook for Quality reports*. Available from
http://epp.eurostat.ec.europa.eu/portal/page/portal/quality/quality_reporting

[12] Burg, T. (2010): *Are the Standard Documentations really Quality Reports?* Paper presented at Q2010,
Helsinki May 2010. http://q2010.stat.fi/media//presentations/session-9/burg_helsinki_paper.pdf

[13] Morganstein, D. and Marker, D. A. (1997): *Continuous Quality Improvement in Statistical
Agencies.* In Lyberg L, Biemer P, Collins M, De Leeuw E, Dippo C, Schwarz N, and Trewin D (eds.*), Survey
Measurement and Process Quality*, New York: Wiley, pp. 475-500.

[14] Sæbø, H. V. (2007): *Measurement of process variables within the framework of quality assessment.* Paper
for the ISI Conference 2007, Lisboa, 22-29 August 2007

[15] Baigorri, A. and Junker, C. (2010): *Internet based User Satisfaction Surveys.* Paper presented at Q2010,
Helsinki May 2010. Available from
http://q2010.stat.fi/media//presentations/session-11/

[16] Eurostat (2013): *User-satisfaction survey.* Item 3.4 in 5th meeting in the Task Force to Develop the
Methodology of the Reviews, Brussels, 4 June 2013.

[17] Eurostat (2003): *Checklist for Survey Managers (DESAP).* Available from
http://epp.eurostat.ec.europa.eu/portal/page/portal/quality/quality_reporting

[18] Næs, P. (2009): *Quality self-assessment in Statistics Norway.* Documents 2009/14, Statistics Norway.
http://www.ssb.no/english/subjects/00/90/doc_200914_en/doc_200914_en.pdf

[19] Sæbø, H. V. (2006): *Systematic Quality Work in official Statistics - Theory and Practice.* Paper for the
European Conference on Quality in Survey Statistics, Cardiff, 24-26 April 2006

[20] Eurostat (2012): *Draft Quality Assurance Framework*.
http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/QAF_2012/EN/QAF_2012-EN.PDF

[21] Sæbø, H. V., Byfuglien, J., Haraldsen, G. and Næs, P. (2012): *From the European Statistics Code of Practice to review of Norwegian statistics*. Paper presented at Q2012, Athens May 2012
 http://www.q2012.gr/articlefiles/sessions/2.4_Saebo-Naes_Code%20of%20practice-paper.pdf

[22] Sæbø, H. V. and Byfuglien, J. (2013): *Quality reviews in Statistics Norway – Setup and experiences.* Paper presented at Nordic Statisticians' Meeting, Bergen August 2013
http://www.ssb.no/omssb/tjenester-og-verktoy/kurs-og-seminarer/nordisk-statistikermote-vedlegg/_attachment/130427?_ts=1402e6500d0