

Quality Issues at Statistics Norway

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Statistics Norway has like other National Statistical Institutes (NSIs) worked with quality for many years, but we have now started a systematic approach, inspired by the TQM principles and the work on this in several NSIs. The article considers some quality issues that have been given special attention at Statistics Norway during the last few years, in addition to summing up the status so far and plans for our systematic quality work. Areas where we do things differently from most other NSIs are focused on. The following issues are discussed: our user orientation, aspects of documentation, the significance of having a relatively large research department inside Statistics Norway and our work on overall performance indicators for reporting and follow-up. So far we have not worked much on process quality, which is an important aspect of the systematic approach. The area of the Consumer Price Index (CPI) is an exception, and the quality work on the CPI is presented at the end of the article.

Key words: Systematic quality work; documentation; performance indicators; CPI.

1. Introduction

Statistics Norway has like other National Statistical Institutes (NSIs) been working on quality issues for many years. The traditional focus has been on the final quality of our products, for example on avoiding errors in tables and publications and on improving the accuracy of estimates expressed as sampling errors if applicable. However, in recent years our quality concept has been getting gradually more comprehensive. In particular, relevance and accessibility for users have been given a clearer focus. Recently, Statistics Norway has started systematic quality work encompassing all products and processes.

The article considers some quality issues that have been given special attention at Statistics Norway during the past few years, together with areas where we, to some extent, do things differently from most other NSIs.

A decade ago, our main products were publications that were designed to satisfy in particular the needs of users within planning and research. But during the last ten years we have gradually changed our dissemination policy towards meeting the needs of a broader public, as well as targeting more specialised users. This change has been facilitated by the development of new technology, in particular the Internet. Today all official Norwegian statistics are disseminated for free via the Internet, and it is an objective to reach the general public directly or via different public media. For this purpose we have actively recruited journalists to work within Statistics Norway. User orientation and dissemination is one of the quality issues considered in this article.

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Our work on documentation includes a systematic description of statistics on our website. Several aspects of quality linked to each statistic are described here. This system is briefly presented.

Statistics Norway is one of the few statistical institutes that have a relatively large research department. Hence, we will focus on the importance of our own research activity for maintaining and improving the quality of statistics.

The management of quality issues should be closely linked to the overall system for management and reporting. There is an increasing focus on indicators for measuring overall performance both for internal reporting and follow-up, as well as for external reporting. Such indicators are aggregated quality indicators. Some experiences with performance indicators at Statistics Norway are reported.

The article sums up the status of our systematic quality work. There is a need for continuous improvements in user satisfaction, product quality, and work efficiency, due to international requirements, cuts in governmental grants, and increased market funding and competition. The work is based on a broad quality concept with user needs as the point of departure for defining and evaluating the quality of products and processes. It should be noted that quality indicators can refer to different levels, ranging from characteristics of a single number (for example its accuracy) on the most detailed level up to performance indicators covering the NSI or even a statistical system like the European on the most aggregated level.

So far we have little experience in studying processes and their quality, which is an important aspect of the systematic quality approach. The area of the Consumer Price Index (CPI) is an exception. The quality work on the CPI is briefly described at the end of the article.

2. User Orientation

2.1. Recent developments and status

The process of changing our dissemination policy to reach a broader group of users started about ten years ago. We harmonised all our publications based on a new profile, and started to publish new statistics in “Statistics weekly” in addition to our traditional publication series. Our first journalist was recruited to edit this weekly publication, where emphasis was put on presenting statistics in a more user-friendly way seen from a non-expert point of view. Of course this led to some internal conflicts between popularisation and a more “pure” statistical way of presentation. But there is no doubt that Statistics Norway gained a reputation of being more up-to-date and that our statistics reached a broader public than before, also because the media spread more of our statistics. This development was boosted by the development of the Internet. Statistics Norway was one of the first NSIs with a web service when we started in February 1995. The Internet (www.ssb.no) is today our main channel for dissemination of statistics. Several new sets of statistics are released daily (“Statistics daily” has replaced “Statistics weekly”). Headings and introductions are written by journalists in cooperation with the responsible statisticians. All new publications are also released on our web site and can be downloaded from the Internet. New statistics are released according to a prerelease calendar. Statistics Norway’s web service is free of charge.

We have just opened a service where users can select statistics directly from our statistics databank on the Internet. It is believed that this in particular will benefit professional users. The aim is that all official statistics shall be available in this databank at the same time as they are released.

The number of hits on our Internet service is now about 3 million per month. The number has increased by about 50 per cent annually. Main statistical news and some other services from our web site are also available on mobile telephone.

2.2. Measuring and considering user needs

A major issue when discussing quality and dissemination is how to measure and take into account user needs. Users have different needs that might be in contradiction with one another. For statistics or analyses covered by a large governmental grant there is a need for extensive user contacts and also user studies and surveys to ensure that our priorities are in accordance with the user needs. It is often believed that the degree of customer satisfaction is measured automatically when the demand for statistics is decided in a free market. Today NSIs are partly financed by the market. Statistics Norway gets about 25 per cent of its income from projects paid for directly by the customers. However, often these customers are public institutions that demand statistics on behalf of other public bodies such as the municipalities or the general public. Hence, even when statistics are financed in the market there is a need for more information about the users and customers than just who is buying what.

On the other hand, customer views cannot always be taken into account. The contradictory nature of different user or customer needs is one thing; another is the need to ensure consistent and coherent statistics that can be compared over time and regions. It can for instance be observed that many users tend to give priority to timeliness, whereas it might be difficult for them to appreciate aspects related to international comparability or evaluate the reliability of the figures. This makes it necessary for an NSI to follow its own agenda to some extent. In fact, a main reason to have one national statistical institution with a considerable degree of governmental funding, and a statistical act giving it an exclusive right to collect statistical data by law, is to ensure the implementation and maintenance of one coherent statistical system following international definitions and standards.

We have done some work to balance different user needs at Statistics Norway. As mentioned before, there is no doubt that the general public knows more about our statistics now than some years ago, and frequent contacts with expert users and our market activities make us sure that we know something about their needs. There is no statistical council for users of statistics in Norway. However, representatives of major users such as the ministries and the research community are on the Board of Statistics Norway. But the most important organised and regular contacts with users are taken care of by advisory committees that provide valuable guidance for our work. There are about 30 such committees covering most areas of statistics. In addition there are (more or less) regular meetings with major users such as ministries.

However, the private sector and in particular the industrial sector has not been satisfactorily represented among our advisers, and comparisons with other countries also indicate

a potential for increased use of our statistics in this sector. We have therefore taken steps to improve our services offered to the industrial sector. Businesses are important data suppliers as well, and it is important that they see the usefulness of providing data that give input for the production of statistics. One successful example that can be mentioned is a recent project where businesses after having submitted data on their energy use, get feedback with their own figures compared with key (average) figures for their industry. Feedback to data providers, including statistics, is an important issue in connection with the development of electronic data collection (also through the Internet). Statistics Norway works on such data collection projects both in the public (municipalities) and the private sector. The industrial sector will in general require quite detailed statistics, for benchmarking and market analyses. These needs have to be balanced against protection of privacy and maintaining data quality.

The assumption of increased availability and use of statistics in general through the Internet is supported by evidence from different sources. Examples are statistics on the number of quotations in major newspapers and other media, statistics on telephone calls and E-mails to our library and information service, as well as web statistics. However, we have not systematically carried out user surveys, and we do not have satisfactory customer databases. Hence, our knowledge about our customers could be improved.

What we have done is to participate in a general national survey measuring public confidence in different institutions, both in the public and the private sector. This survey, carried out by a private survey institute, shows that Statistics Norway is one of the institutions with the highest score. In total about 80 per cent of people that express their views have great or very great confidence in our statistics. We have also carried out a small study among the customers who have paid for statistics or other work at Statistics Norway. These customers are in general satisfied as well. What they are least satisfied with is the timeliness of statistics. However, these surveys only give some indications, and a more systematic approach to user needs, including user surveys, will be considered within the framework of our systematic quality work described in Section 6.

Dissemination is a major issue in the new strategic plan of Statistics Norway, Strategy 2002. The strategic plan is based on quality principles, taking user needs as the point of departure. In contrast to our former strategic plan from 1997, uses and users of statistics and dissemination issues are considered before the production of statistics.

3. Documentation

Documentation is an important element of quality management. A lot of work has been done on documentation at Statistics Norway during recent years, including documentation of data, systems and completed statistics. Nevertheless we still have a long way to go to have satisfactory documentation of all our data. However, one recent major achievement has been a systematic description of statistics on our web service. The documentation follows a set-up that is common in several countries including Sweden and Denmark. At Statistics Norway this documentation is linked to all statistics included in our release calendar on the Internet (about 300 sets of statistics). The items to be documented are listed in Box 1.

Descriptions vary in coverage, level of detail, and length. In some cases items are not

Box 1. About the statistics

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Administrative information <ol style="list-style-type: none"> 1.1. Name 1.2. Subject group 1.3. Frequency 1.4. Regional level 1.5. Responsible division 1.6. Authority 1.7. EU regulation (if relevant) 2. Background and purpose <ol style="list-style-type: none"> 2.1. Purpose and history 2.2. Users and applications 3. Statistics production <ol style="list-style-type: none"> 3.1. Population 3.2. Data sources 3.3. Sampling 3.4. Collection of data 3.5. Response burden 3.6. Control and revision 3.7. Analysis | <ol style="list-style-type: none"> 4. Concepts, variables and classifications <ol style="list-style-type: none"> 4.1. Definition of the main concepts 4.2. Definition of the main variables 4.3. Standard classifications 5. Sources of error and uncertainty <ol style="list-style-type: none"> 5.1. Collection and processing errors 5.2. Sampling errors 5.3. Nonsampling errors 6. Comparability and coherence <ol style="list-style-type: none"> 6.1. Spatial comparability and comparability over time 6.2. Coherence 7. Availability <ol style="list-style-type: none"> 7.1. Internet address 7.2. Language (Version of Norwegian, English) 7.3. Publications 7.4. Storing and use of basic material 7.5. Other documentation |
|--|---|

filled in because they are not relevant (such as sampling errors in a census or in register statistics), but also because we do not know for example the uncertainty (but it is useful to know that we do not know). Descriptions vary from a couple of pages for some statistics to 20 pages or more for other statistics. One issue is if this documentation is what the users want or need. It is believed that it is most useful for expert users, while it might be too technical for the media and the general public. There is a need for a harmonisation of the forms and also for a general quality assurance regarding the descriptions. This will be carried out as a quality project. At the same time we will consider simplifying the descriptions, possibly on the top level, and have a more detailed description for expert users linked to this level, in addition to other and more comprehensive documentation such as methodological and technical reports, statistical standards and classifications. The possibility of differentiating between user groups by linking several levels of information is one of the most striking features of the web.

4. Analytical Frameworks and the Quality of Statistics

It is often argued that the main users of statistics include the national statistical institutes themselves. This should especially be the case at Statistics Norway, which has a long tradition of integrating statistics production with research and model building, based on national accounts. This improves user orientation in general since many users require analytical results. Furthermore, several aspects of quality can only be evaluated when the figures are analysed within a systematic framework. Analytical frameworks such as

the national accounts and economic and socio-demographic models are considered essential to ensure quality related to the following aspects:

- Relevance
- Accuracy
- Comparability and coherence

The point can be illustrated by the following situation when we have – as is the case at Statistics Norway – an econometric macro model closely integrated with national accounts, i.e., by using historical time series from the national accounts the parameters of the model are estimated. Over time we will observe residuals between the results of model estimates and the observations, and we will acquire knowledge about the structure of residuals. The residuals can follow different patterns:

- 1) The dispersion of the residuals looks plausible according to previous experience.
- 2) The residuals appear to develop according to a trend.
- 3) The residuals are systematically positive or negative.

In Situations 2) and 3) we will have to consider whether there is a new situation not caught by the model, for instance missing variables, or if there is something wrong with the data. The model will be of great use to understand relationships and detect possibly erroneous or missing data.

The following is an example. The base year for an index was changed without the knowledge of those responsible for quarterly national accounts. When the new index figures were put into the model, this led to a considerable price effect that at first glance was considered to be due to random fluctuations (“noise”). However, when more data were put into the model, the disturbances became so important that a more detailed review of the base data had to be made – and the national accounts were corrected (Situation 3). This case also underlines the importance of documentation, since the problem might have been avoided if the index had been accompanied by proper metadata.

In general, cooperation and common frameworks and tools are important for quality assurance in an institution. The quarterly national accounts model was for example developed in close cooperation between experts on econometric models and national accounts. It was developed on the basis of a framework shared with previous econometric models. There is shared expertise when it comes to the model tools and a good possibility of ensuring high quality of updating and maintenance of the quarterly accounts model – as well as other models.

On the other hand, internal users of statistics such as our researchers provide support but that does not guarantee quality assurance. The Research Department and analytical activities at Statistics Norway do not cover all areas where we produce statistics, and there is always a potential for improving cooperation and increasing the use of analytical work in the whole organisation. Breaking down barriers between departments and activities is also an issue in our systematic quality approach.

5. Performance Indicators and Quality

As mentioned above, quality issues related to statistics can be studied on different levels, and the importance of different quality dimensions can vary according to level. Relevance

and accuracy may for instance have most meaning for specific figures, for data series or for a survey, whereas coherence, cost efficiency and independence/neutrality may have more meaning at the institutional level.

Performance indicators are based on a systematic measurement of the performance of different parts of the organisation with monitoring of resource usage and volume and quality of output. Ideally, performance indicators should be able to monitor quality aspects both at a detailed level and at an institutional level. Performance indicators for national statistical institutes have been discussed by Fellegi and Brackstone (1999), Franchet (1999), and de Vries (1999).

Statistics Norway has for the last 40 years been working on systems for a fairly detailed registration of resource usage linked to different operations and subject areas. Over the last few years there has been an increased focus on measuring a broader range of indicators telling more about efficiency, including response burden and product and process quality – production time, response rates etc.

At the moment it is possible to produce the following performance indicators on the basis of our planning system:

- Timeliness or production period (period between reference date and release date)
- Punctuality (if actual release time is in accordance with announced release)
- Response rate
- Response burden (estimation of number of hours spent by respondents)
- Resources used (hours/costs) per product

In order to assess efficiency it is necessary to get some estimates for the total production – and how this activity is developing. This appears to be a difficult task for an institution producing not only ‘‘numbers’’ but also ‘‘information.’’ However, there are some proxies that might be utilised to assess output, such as:

- Number of releases of statistics according to the release calendar
- Published titles
- Electronic products (diskettes, CD-ROMs)
- Data (cells) in dissemination databases (regional, time series)
- Published articles in national and international scientific magazines
- ‘‘Pages’’/‘‘megabytes’’ available on the web

Parts of the information mentioned have been utilised and proved valuable in the annual reporting from Statistics Norway, for instance tables of output, timeliness for monthly, quarterly and annual statistics, punctuality, response rates, response burden, and resource usage. The following tables show recent examples of these indicators.

Table 1. Number of releases of statistics

	1997	1998	1999	2000	2001
Releases	642	754	740	761	817

Table 2. Number of publications produced

Publications	1997	1998	1999	2000	2001
Total number	268	286	316	275	274
Official statistics (NOS)	76	61	64	48	66
Analytical publications	77	84	97	95	107
Other publications	115	141	155	132	101

Tables 1 and 2 are examples of traditional measures of output: the total number of releases and of publications. However, these measures are rather crude and do not give a fully relevant description of the total output increasingly in the form of downloads/print-outs from the web sites.

Table 3. Timeliness. Duration from reference date to publishing (average number of weeks)

	1999	2000	2001	
			Target	Result
Monthly statistics	3.8	4.1	3.8	3.9
Quarterly statistics	8.9	8.4	8.9	9.1
Annual statistics	48.5	47.5	43.4	45.1

Timeliness or actuality is an important indicator in relation to quality and overall performance. This overview is based on a mapping of most of the regular statistical production processes. The production time for annual statistics is partly influenced by the different numbers of statistics included and some arbitrary delays in release from one year to the next.

Table 4. Punctuality. Deviation in relation to preannounced date. Per cent

	1997	1998	1999	2000	2001
All deviations	14	10	13	15	13
Too early	6	2	4	2	3
Too late	8	8	9	13	10

This table is based on a processing of the release calendar. It should be observed that it is not always good to be too early in relation to the planned release date. It might confuse users, and in some cases give rise to a suspicion that we are not independent. It could also indicate that planning is too cautious.

Table 5. Response rates. Per cent

	1998	1999	2000	2001
Mandatory surveys				
– wage statistics	84	95	96	97
– other statistics	92	91	95	94
Voluntary surveys	69	73	72	72

Response rate is an important indicator to assess accuracy for survey-based statistics. The summary above is based on figures for each survey.

Table 6. *Response burden. Person-labour years*

	1997	1998	1999	2000	2001
Total	200	196	189	164	165
Businesses/ industries	110	113	120	97	90
Other respondents	90	83	69	67	75

Response burden has been given increasing attention, and there is a long-term objective to reduce this burden, by using new and efficient technology. The figures above are based on an assessment of the time usage for each form in the surveys, multiplied by the number of respondents. In general the response burden for purely statistical surveys alone is rather limited, compared to the total response burden incurred by all types of administrative forms and commercial market research.

Table 7. *Resource use (hours) by type of activity. Per cent*

Type of activity	1999	2000	2001
Total	100	100	100
Production of statistics:	62	62	63
– Ongoing production of statistics	53	54	54
– Development projects	7	8	9
Research and analysis	10	10	9
Management, administration and planning	9	9	9
Internal support functions	20	19	19

Absences from work (about 15 per cent including holidays) are excluded from the table.

This table shows that about 63 per cent of the total resources used within Statistics Norway are allocated directly to the production of statistics, while around 9 per cent are related to research activities.

It should be underlined that even if we may have been developing fairly concrete performance indicators, there is still much more work to be done to get more and better information on overall performance. This includes reliable data on the volume of output and on user satisfaction and other quality indicators mentioned in this article.

So far, little effort has been made to systematically compare performance indicators for Statistics Norway with those of other statistical agencies or comparable organisations. However, work has been going on for several years to present and discuss some indicators for comparisons at a Nordic level. Some of the indicators discussed in this connection have been:

- Total expenditures and employment broken down by main activity categories
- IT – solutions and technological change
- Organisational adaptations.

Efforts to make comparisons on a thematic level have proven difficult due to problems in identifying comparable products.

Based on the efforts at the Nordic level and also efforts to collect cost estimates at the European level, some of the issues to be addressed in order to make progress on comparisons of the statistical production systems in different countries appear to be:

- How is it possible to measure outputs of the statistical production systems in a comparable way?
- How is it possible to give a comparable structural description of the statistical production system, including both the national statistical institute and its partners?
- How is it possible to specify the different cost elements in the production of statistics – taking different accounting practices and organisational models into account?
- How is it possible to distinguish comparable products and routines/processes for which more concrete performance indicators can be developed?

However, systematic comparisons of national statistical systems should still be pursued, as already performed or planned by some national statistical institutes as well as Eurostat at the European level. To facilitate such studies, it would be helpful if national statistical systems utilised a common nomenclature of statistical activities and processes. This harmonisation would also benefit users when trying to find and retrieve statistical information.

The relevance of comparisons tends to increase with the level of detail. For specific processes comparisons with other NSIs (in particular the Nordic ones) have made major contributions to the development at Statistics Norway. This concerns for example comparable surveys, systematic documentation as described in Section 3, Internet dissemination from databases, and electronic data collection. On this level the work on performance indicators is coinciding with work on establishing good process indicators considered in the next section. Work on comparing and benchmarking specific processes is increasingly important.

6. Systematic Quality Work

Statistics Norway has credibility in the Norwegian society. There are strong requirements for quality of official statistics, including requirements from international agencies such as Eurostat and the International Monetary Fund. The use of statistics for policy formulations and decisions also increases the demand for high-quality statistics, and makes the results of erroneous or delayed statistics more visible. At the same time the governmental budgets are cut, and the extent of market funding for projects achieved in competition with others is increasing. Quality work is important to ensure our position and improve our products, in order to satisfy existing and new users and requirements. It is also the key to improving efficiency and enabling the organisation to face new challenges. This is the background for embarking on a systematic quality approach.

Our systematic quality work is based on the principles of TQM (Total Quality Management) and on experiences from other NSIs, in particular from Statistics Sweden (see Lyberg 2000 and Lee and Shone 2000). User needs are, as mentioned before the starting-point for our approach. In short we can say that all indicators expressing something (important) that affects user satisfaction are quality indicators. Hence, the issue of

selecting quality indicators is to translate user needs into requirements for products and underlying processes.

The dimensions of product quality for statistics are often described according to Eurostat's criteria (Eurostat 1998):

- Relevance and completeness
- Accuracy
- Timeliness and punctuality
- Comparability and coherence
- Accessibility and clarity

Cost constraints are important, and costs always have to be considered in connection with quality indicators. Statistics must also be objective, and personal integrity must be protected. The response burden is also a quality indicator since it contributes to the costs of statistics for society.

Good product quality is necessary to satisfy user needs, but improving process quality is a precondition for better product quality at an acceptable cost (Box 2). An example of the relationship between product and process quality is the link between the *accuracy* which is an indicator of product quality, and the *response rate* which affects the accuracy and is an indicator linked to the survey process (process variable).

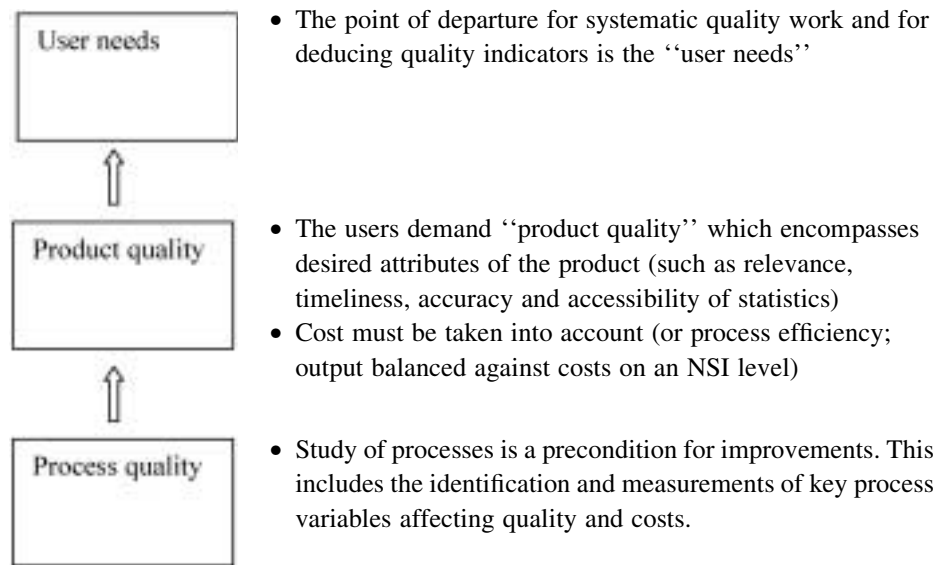
Our systematic approach started in 2001 and encompasses all activities and all employees of Statistics Norway. Commitment from all levels of management is a precondition for success. To ensure this, several seminars and training schemes for our managers have been carried out. All directors or department heads and all division and office heads (in total about 50) have been given two days of training. During 2001 we educated 18 quality pilots who participate in improvement projects as facilitators to ensure that quality principles are followed.

In developing our systematic quality work we have been assisted by Westat, an American statistical and consulting organisation that has assisted several NSIs including Statistics Sweden on TQM (see Morganstein and Marker 1997). Westat has carried out the training of both the managers and the quality pilots in Statistics Norway. Another 20 quality pilots were educated in 2002.

Improvement projects vary by area, but the first of these projects with quality pilots were relatively limited in scope and time. Examples of quality improvement projects are:

- Accuracy and quality control limits for the Consumer Price Index
- The documentation process in the Survey of Living Conditions
- Editing in the Sample Survey of Agriculture and Forestry
- The process of recruitment and appointment

The pilots are usually not doing normal project work. Their role is to participate in project meetings and teach the team members about quality principles and give advice ensuring that these principles are followed. For quality improvement projects techniques for mapping the processes involved are important, and pilots are trained in such techniques and in identifying and measuring critical process parameters. Asking questions like: Who are the users? What do you do? How and why? is part of their role. Normally, the pilot comes from another area or division in the organisation than the project manager.

Box 2. Definition of total quality at Statistics Norway

In total about 30 projects were started with quality pilots during the first year of systematic quality work at Statistics Norway. Experience so far varies, but is mainly good. It seems that it has been easier for the pilots to work in projects aiming at improving existing routines than in development projects, even though there are some good results also for projects in the latter category. Particularly positive experiences are reported from discussing user needs, from involving all relevant parties in the projects and from discussing improvements based on process diagrams. Statistical methods and analysis have not been much used in these projects until recently, partly because of lack of measured process variables. This underlines the importance of defining and measuring process indicators for future improvement projects.

Existing activities are included in, or when necessary adapted to, the systematic approach. This includes the activities described in this article regarding user orientation and dissemination, documentation and performance indicators. Other relevant activities comprise major development projects on coordination and electronic data collection, restructuring of our survey division, elaboration of the new strategy mentioned in Section 2, management and other human resources development. Comparisons with other NSIs with similar processes are central (Best practices or CBM – Current Best Methods).

There is normally a positive correlation between user satisfaction and employee satisfaction. Hence, surveys that measure employee satisfaction are part of the systematic quality work as well. A staff perception survey was carried out at Statistics Norway in 2002.

7. Case Study: The Consumer Price Index

The Consumer Price Index (CPI) is one of the most important and widely used macroeconomic indicators. To ensure and document its quality is crucial, and a programme

designed to develop and establish a formal system for quality assurance has been initiated. The work includes analysing the quality of the CPI as a product as well as studying the underlying monthly production process. The quality system is to further ensure adequate control for less frequent processes such as the annual update of the basket of goods and services and the sample of outlets. Similar efforts have taken place in other countries, for example in the U.K. (Fenwick 1997). Earlier work in Norway has been documented in Johannessen (1999).

Activities and results of the quality work on the CPI so far include:

1. User requirements have been identified
2. Processes and production cycles have been mapped and the subprocesses have been better documented
3. Problems during the production cycle as well as possible causes have been identified
4. The use of electronic data based on bar codes has been expanded
5. Improved routines for the analysis and dissemination phase have been introduced

Remaining activities include:

1. To develop procedures for systematically analysing the variance in the all-item index and subindices
2. To develop differentiated reminding procedures depending on which industrial sector the missing outlet belongs to
3. To determine and measure key process variables affecting quality (for each subprocess in the monthly production cycle)
4. To complete the documentation
5. To develop and introduce a formal quality assurance system
6. To develop and introduce CBM (current best method) for certain processes, e.g., in order to reduce nonresponse

7.1. User needs

The main users of the CPI such as the Central Bank, the Ministry of Finance, trade unions and employer associations, the National Accounts Division and the Research Department of Statistics Norway, are members of an Advisory Committee for Price Statistics. Other users are the media, public administration, Eurostat, external research institutions, other economic analysts, and the general public. Timeliness, punctuality, accessibility, and clarity are some of the main product specifications requested by the main users. Accuracy is another important quality requirement of the CPI.

In Norway the CPI data refer to the middle of the reporting month (15th), and the results are released on the 10th of the next month (9th or 11th if the 10th falls on a weekend). It has been found that the CPI satisfies the timeliness requirement of most users. But it is an objective to improve the production process by ensuring that the workload is more evenly distributed over time (it tends to reach a peak just before publication date).

Some users often request subindices that are not available at present such as regional indices or indices for different demographic subgroups. Accuracy is the key quality indicator in relation to these needs. This means that an increased number of price observations

and the development of systematic measures of sampling and nonsampling errors are needed to develop new products or publish subindices that are not available today.

7.2. *The production cycle and quality control*

A great deal of effort has been put into mapping the monthly production cycle to identify the core processes and the interrelationships between different parts of the production cycle.

The production cycle can be split into three main processes:

- Data collection
- Data editing and validation
- Dissemination

Each of the main processes can be split into several subprocesses (see Box 3 which is an example of a process diagram for the editing process). New and better technology has made the production cycle of the CPI more efficient, and fewer people are involved today than a few years ago. Still, the production scheme is very tight and leaves no room for unexpected situations. In general, the different phases seem to be rather stable, although establishing measurements of the variation is necessary.

In order to develop procedures for systematically analysing the accuracy of the CPI, there is a need to select and study variables affecting this in different steps of the production cycle. When completed the quality system will monitor the production cycle through systematic checks of nonsampling errors that can arise in every step of the production.

7.3. *Data collection*

The price information is mainly collected by means of questionnaires. From some retail chains we receive data electronically based on scanned bar codes read at the cashier's desk. Rates of missing price observations, the number of out of stock items and inconsistent price observations are variables that can provide useful information on error sources like the questionnaire design, the reminding phase and the data entry.

Over the last few years the design of the questionnaires has been radically changed. Now every outlet in the sample receives a unique questionnaire where the prices of the two previous months are preprinted. The questionnaires also contain guidelines on how to handle different situations that outlets might face. When filling out the questionnaires, some outlets may for convenience just copy the previous month's prices instead of filling in the correct prices. The most obvious cases of this error are revealed in a manual check carried out when receiving the questionnaires. When a product or a service is removed from the market the outlets are instructed to find a replacement and mark it in the questionnaire. If they report a price of the replacement without marking it, the difference in price between the old product and the replacement will incorrectly be registered as a price change of the old product. The extent of this error is unknown. After undergoing manual checking the questionnaires are registered in an optical scanner. The scanner process is very reliable, and few errors occur here.

During the process mapping we found that the *nonresponse rate* is one of the most critical process variables. Nonresponse causes variation in the all-item index and

subindices and thus will have an effect on the accuracy of the CPI. One way to reduce the variance in the all-item CPI is to make more price observations of commodities with large expenditure weights and/or large variance in the prices collected. Today much effort is put into increasing the response rate from 90 to the 95 per cent which is the objective, but Statistics Norway does not systematically analyse how this response rate influences the variance in the all-item index.

The process mapping underlined the need to analyse the distribution of the nonresponse in a more systematic way. Such an analysis can help concentrate the efforts on reducing nonresponse to outlets having the largest effect on the CPI. Further analyses might show that even though the total response rate is somewhat lower than 95 per cent, the variance is within acceptable limits as long as the response rate among critical sectors/groups is within an acceptable limit. On this basis Statistics Norway will review the process of reminding and also differentiate the type of reminding depending on the industrial sector of the outlet.

Increasing the use of data based on bar code scanners is another way to improve the response rate of the CPI. Statistics Norway has started a project to identify outlets (especially retail chains) that can provide such data. So far around 50 per cent of the retail chains are delivering their price material electronically based on bar codes. Our aim is that all the retail chains in Norway shall provide such data.

7.4. *Data editing*

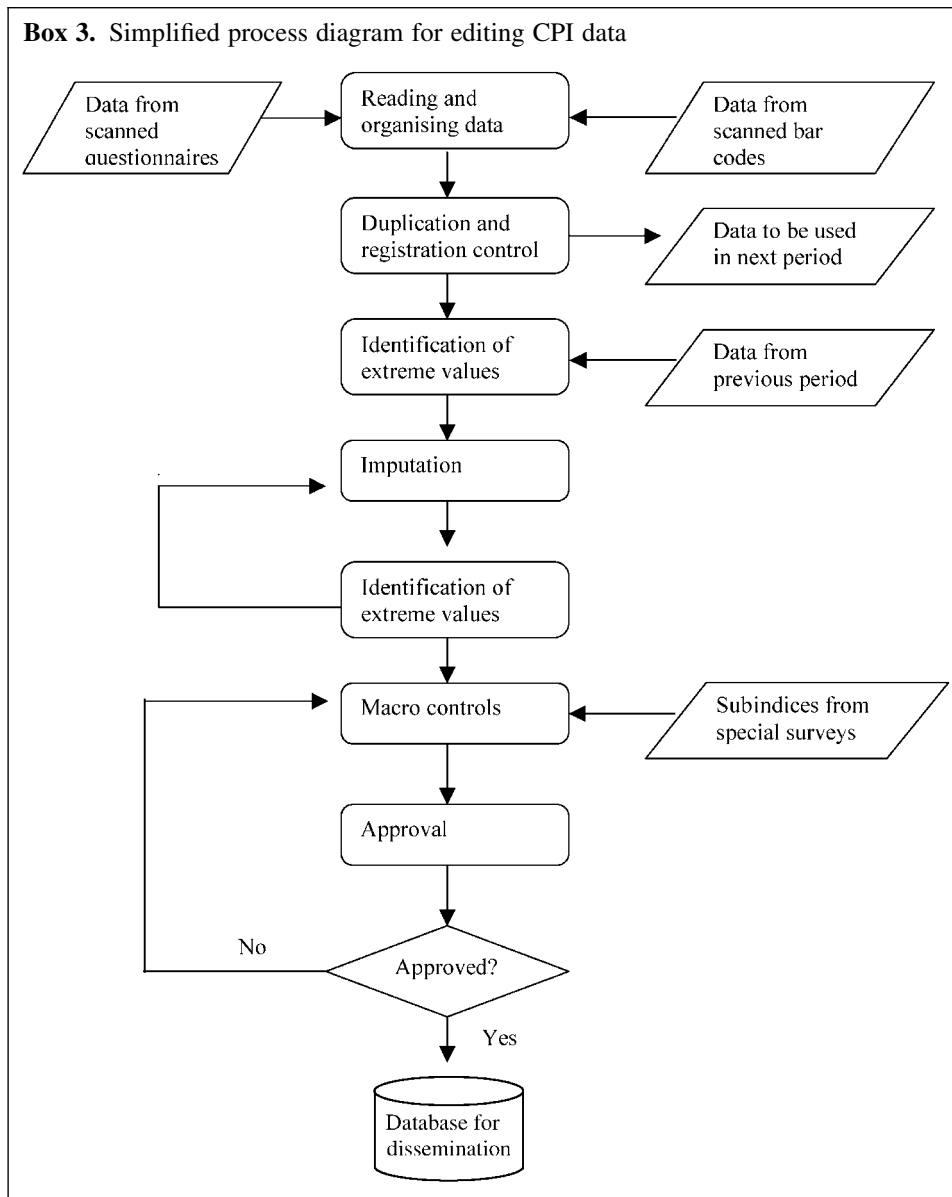
A few years ago a complete computerised system based on standard software (SAS and Oracle) for data consistency checks was introduced. The first checks are run to identify and avoid unexpected duplicate prices and other errors that might occur during the data entry phase. In the next step different validations are run to identify price movements that differ significantly from the average of an item. The price material is sorted by item and region, and further scrutinised. Subindices and item-indices are also checked against time-series published earlier and compared with other relevant statistics. Change rates in subindices and itemindices are given special attention when changes in fees and charges occur.

Before 1999 the editing was manual both on the micro and the macro level. The new system has improved the production process as fewer staff are involved in the editing and less time is spent. Less room for subjective editing is another benefit of the new system.

The sample of commodities is revised in August every year to ensure that it reflects the consumer patterns of the households. However, in calculating the CPI one regularly faces the problem that some of the commodities to be observed disappear permanently from the market and new ones appear between the regular revisions. To capture this, the number of imputed prices per commodity can be used as an indication as to whether the commodity is out of stock or not. As part of the quality work, the system also will be expanded so that calculation of bias in the CPI due to sampling rotation can be accomplished.

7.5. *Dissemination*

Some changes in the routines of writing and publishing the statistics daily (the press releases) have been made. After all the necessary validation checks, the staff involved attend a meeting preparing the press release. The aim of the meeting is to get a common understanding of the CPI figures and to distribute the writing tasks. Punctuality is a quality



indicator linked to the dissemination phase. In recent years the CPI has always been published exactly at 10.00 on the Internet. To ensure clarity, the press release has been redesigned. The press releases are also written and published in English.

The new routines have improved the writing of the press releases and reduced the time the management has to spend on approval.

7.6. Documentation

Large efforts have been put into documenting the production process of the CPI. When completed, the documentation can be separated into four levels:

1. The quality manual which defines the quality of the CPI and gives an overview of the quality system and organisational structure
2. Description of the procedures of the monthly production cycle, including a clarification of responsibilities
3. Work instructions that give precise details of how individual tasks should be carried out
4. Reference documents such as different kinds of handbooks.

The second and third levels are almost completed, although systematic quality checks for each procedure have to be established. Working out the formal quality manual and completing the quality assurance system remains to be done. Different reference documents exist, including a newly updated Technical Manual. The Technical Manual gives a description of how the price data are collected and aggregated into the CPI. This manual is mainly aimed at internal and expert external users.

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Received November 2001

Revised October 2002