A new model for quality management

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Explanation of symbols

.	= data not available
*	= provisional figure
**	= revised provisional figure
x	= publication prohibited (confidential figure)
–	= nil or less than half of unit concerned
–	= (between two figures) inclusive
0 (0,0)	= less than half of unit concerned
blank	= not applicable
2008–2009	= 2008 to 2009 inclusive
2008/2009	= average of 2008 up to and including 2009
2008/'09	= crop year, financial year, school year etc. beginning in 2008 and ending in 2009
2006/'07–2008/'09	= crop year, financial year, etc. 2006/'07 to 2008/'09 inclusive

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

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A new model for quality management

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Summary: This paper explains the OQM model developed by SN, and describes nine applications of the model. The applications vary from large-scale (TQM and process assurance) to small-scale. They demonstrate that the concept of quality areas is both powerful and flexible, and can be used in any domain.

Keywords: quality assurance framework, Total Quality Management, Code of Practice, quality area, object oriented quality management.

1. Introduction

In 2007 Statistics Netherlands (SN) started preparatory activities to select a quality management framework in order to improve compliance with principle 4 of the Code of Practice on quality commitment (Eurostat, 2005). We assessed several existing frameworks, e.g. ISO 9001, EFQM Excellence Model and the Balanced Scorecard, and concluded that these frameworks had some drawbacks (e.g. missing or less relevant requirements) but also some interesting elements.

We therefore decided to develop a model for quality frameworks inspired by the structure of existing frameworks, e.g. Dependence and Vulnerability analysis (A&K, 1998). We called it the Object Oriented Quality Management model (OQM model). It can be used to design *custom- made* frameworks and quality management systems as well as generic ones.

This paper starts by explaining the concepts used in the OQM model, firstly by determining the scope of what has to be managed in terms of *quality areas*, and secondly by asking the right questions about each quality area. The second part of the paper describes various applications of the OQM model at SN.

2. Determining the scope

In the OQM model, the scope of a framework or a management system is determined by so-called quality areas: combinations of an object and an associated characteristic. Auditors will be quite familiar with the concept of quality areas; they use them to delineate their assessments. Auditors are also participants in the field of quality management.

I shall first explain what objects and characteristics are, and then give examples of quality areas.

2.1 Objects

The metaphor that the OQM model uses is that an organisation and its environment can be seen as a set of inter-dependant objects. That is why the term *object oriented* is included in the name of the model.

Examples of *objects* are customers, statistical output, processes, staff, information systems, housing, etc. Every noun that can be prefixed by *the quality of* can be seen as an object.

For statisticians, statistical objects like businesses, persons, and households are quite familiar. In contrast with these objects, the objects in the OQM model should be characterised as *business objects.* Examples of these business object are shown in figure 1.

Figure 1: Examples of objects

2.2 Characteristics

All objects have characteristics. These characteristics are specific to the object. The object *statistical output*, for example, has different characteristics than the object *staff*.

The characteristics of the object *statistical output* are *relevance, accuracy, timeliness, punctuality, coherence, comparability, consistency, clarity, and accessibility* (figure 2). These are the characteristics mentioned in the Code of Practice (Eurostat, 2005).

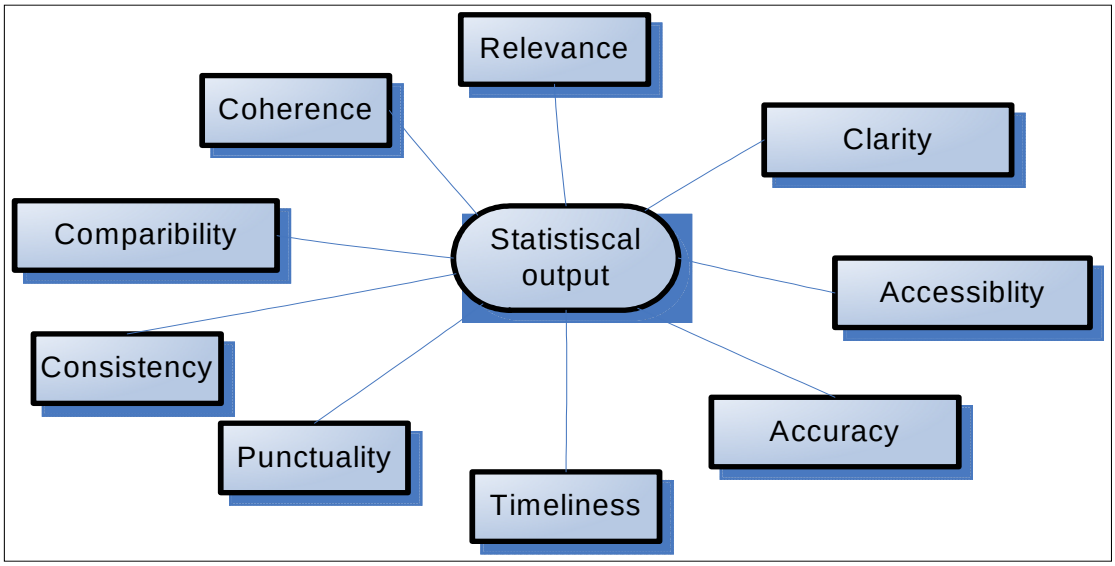

Figure 2: Main characteristics of the object statistical output

The object *staff* has other characteristics: e.g. c*ompetence*, *availability*, *integrity*, *satisfaction* and *mobility* (figure 3).

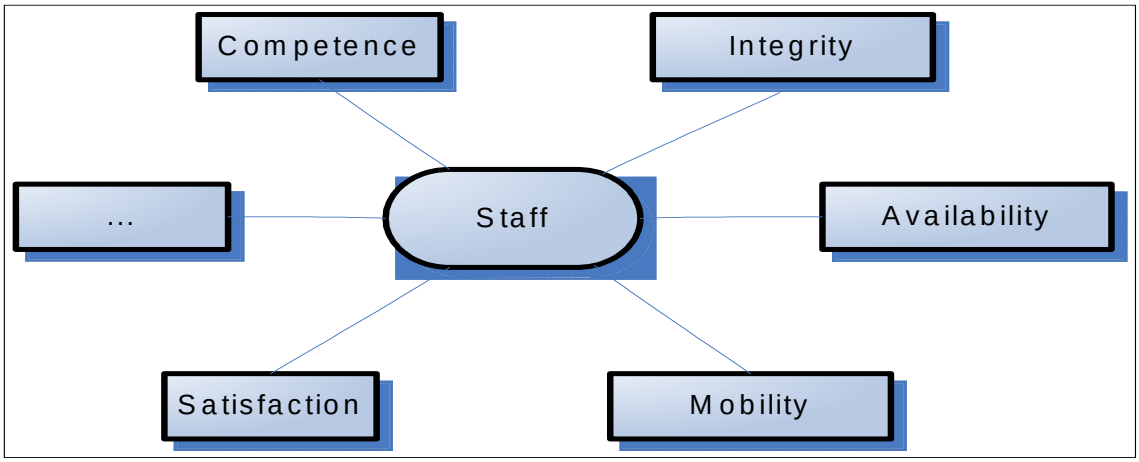

Figure 3 Examples of characteristics of the object staff

In the OQM model, quality is seen as an object's set of characteristics. This is a more value-free and a more generic definition than, for instance, *fit for use* or *compliant to specifications* used by others.

A characteristic of an object is either good or bad in the OQM-model. Annex A contains a list of possible characteristics.

2.3 Quality areas

A combination of an object and an associated characteristic is called a quality area. A quality area determines the scope of what has to be analysed, described, or managed.

Table 1: Some examples of quality areas (not exhaustive)

Quality Area	
Object	**Characteristic**
Cooperation	Effectiveness
Dataset	Completeness
Data centre	Continuity
Dissemination of statistical output	Timeliness
	Punctuality
Housing	Safety
Information systems	Availability
IT infrastructure	Capacity
Name of a variable	Clarity
Process	Efficiency
	Effectiveness
Staff	Competence
	Integrity
	Satisfaction
Statistical institute	Independence
Statistical output	Accuracy
	Comparability
	Consistency

Quality areas can cover all possible domains in an organisation and its environment. The organisation will easily recognise quality areas, as they are formulated in the language of the organisation. The concept of quality areas also enables them to focus on one surveyable area at a time. Moreover, quality areas can be used as building blocks for quality assurance frameworks and quality management systems.

3. Asking the right questions

The organisation can ask a number of standard questions about each quality area. However, the relevance of each question depends on the scope of the application of the OQM model.

Table 2: Standard questions for all quality areas

	Subject	Question
1	Definition	What is the definition of quality area X?
2	Knowledge	What is already known about quality area X within the organisation? What do relevant documents state about the quality area?
3	Responsibilities	How are responsibilities distributed? Who owns quality area X? What other roles can be distinguished?
4	Importance	How important is quality area X for realising organisational goals?
5	Relations	How is quality area X related to other quality areas? Is quality area X part of another quality area? Is quality area X dependent on another quality area?
6	Requirements	What are the requirements for quality area X? Quantitative? Qualitative? Standards, elements, principles, indicators (CoP) and recommendations can be regarded as requirements in the OQM model.
7	Problems	What problems exist with respect to quality area X? Or what problems are expected?
8	Causes	What are possible causes of problems with respect to quality area X? What are the threats or vulnerabilities?
9	Effects	What are the effects of problems with respect to quality area X for the organisation and its environment? What are the risks?
10	Opportunities	What opportunities does quality area X offer for the organisation?
11	History	What is the history of quality area X? What were the learning points and/or successes?
12	Tools	Which tools are available to manage quality area X?
13	Documentation	Which documentation or literature is available on quality area X?
14	Indicators	Which indicators are possible for quality area X? What are best practices?
15		Which indicators are already implemented or planned?
16		Which additional indicators should be implemented?
17	Measures	Which measures are possible to enhance or control quality area X? What are best practices?
18		Which measures are already implemented or planned?
19		Which additional or other measures should be implemented?
20	Control	Is the organisation in control of quality area X? Have all requirements been met? And is the residual risk acceptable?

The following sections explain which questions in table 2 are relevant for each application of the OQM model.

As risk analyses are integrated in the OQM model (questions 7, 8 and 9), no separate risk management model has to be developed.

The OQM model does not contain specific domain knowledge; it is an empty model and can therefore be applied to any domain (statistical and non-statistical).

4. Total quality management

An important application of the OQM model was the development and implementation of a total quality management (TQM) system for SN. This system was developed to comply with principle 4 of the Code of Practice on quality commitment (Eurostat, 2005) and principle 8 of the Quality declaration on systematic quality management (Eurostat, year unknown).

The first step in the development of the TQM system was the analysis of fifteen important documents (question 2). Examples of the documents studied are the Code of Practice, and the long-term work programme, annual work programme and quarterly reports of Statistics Netherlands. Questions included were: What quality areas do these documents mention? And what do they say about these quality areas? By including the Code of Practice it became part of the TQM system. The results of the first step were put in a database in order to make different selections and overviews.

More than 300 quality areas were identified as a result of this first step; this was dubbed the long-list. All quality areas in the long list were defined (question 1) and were mapped on the nine criteria of the EFQM Excellence Model (EFQM, 2003). The printed overview of all available information on the 300 quality areas covers more than 100 pages.

In the second step, ten representatives of the SN organisation were asked to award scores to each quality area, thus reflecting their importance (question 4). Related quality areas were clustered (question 5).

The most important quality areas were selected from the long-list on the basis of a number of criteria, including the score.

Next, a minimum of five quality areas were chosen for each EFQM criterion to assure an even distribution. Only the most important quality area in each cluster was selected. This resulted in a list of 60 quality areas: the short-list.

Within this set of 60 quality areas, a subset of 8 areas (level 4) had already been identified at an earlier stage. These 8 included all issues revealed in a previously conducted risk management project, for example: *consistency of short-term and long-term statistics on economic growth*, *storage capacity* and *staff competence.* The owner of each of these eight quality areas was asked to determine whether he was in

control of his areas (question 20) and, if not, which additional measures should be implemented (question 19).

In the third step, all 60 quality areas on the short-list were assigned to various owners (question 3). Typical owners of quality areas are division directors and department managers.

In 2010 all owners of the 60 quality areas will be asked a number of question regarding the quality areas they own. The questions relate to requirements (question 6), implemented measures (question 18), current or expected problems, and causes and effects of these problem (questions 7, 8 and 9), whether they are they in control (question 20), and any additional measures that need to be implemented (question 19). The additional measures will be integrated in the regular planning and control cycle of SN.

At the end of this exercise it will be possible to report to stakeholders to what degree SN is in control of the quality areas studied. This whole exercise will be repeated periodically, at least once every three years. During that three-year period, the system will be subject to change: new quality areas will be added and less relevant quality areas will be removed.

5. Process assurance

Some 300 statistical processes have been identified within SN. Process owners are required to maintain a *quality document* for each process. For critical processes, the quality document must be updated yearly, for non-critical every three years.

One part of the quality document is the *description of the process*. This delineates the process and clarifies what is part of this process and what is not.

Another part of the quality document is a *dependence analysis*. In this analysis, the requirements (question 6), the importance (question 4), an the standard measures (question 18) are determined for 16 quality areas Examples of the 16 quality areas are: *data confidentiality, soundness of methodology, quality (in general) of agreements with users* and *availability, integrity and accessibility of information systems.*

The above described system is a consequence of the Dutch Regulation for Information Security (VIR, 1994). It has been effective in SN since 2002, long before the OQM model was developed. Much of the OQM model is based on the concepts used in this system (A&K, 1998). In the OQM model, the approach has been expanded and made more generic.

6. Other applications of the OQM model

The OQM model can be used on a much smaller scale too. In this section we will give some examples of such small-scale applications.

6.1 Quality guide for statistical output

In 2009, a guide (Nederpelt, 2009c) was developed to collect the fragmented knowledge on the quality of statistical output. The OQM model was used to structure this guide. First, 19 quality areas were identified. Eleven of these are mentioned in the Code of Practice (Eurostat, 2005). Quality areas like *completeness and reproducibility of statistical output* were added.

Each chapter of the guide covers a single quality area. For each quality area, there is a section on definition (question 1), requirements (question 6), importance (question 4), causes and effects of problems (questions 8 and 9), possible indicators (question 14), and possible measures (17). Relations between quality areas, like the trade-off between accuracy and timeliness of statistical output (question 5) are described in an annex to the guide.

This guide is used for several purposes; for instance to design the quality of statistical output and quality reports, to make agreements with users, to control quality in the production process, to set standards, and to assess the quality of statistical output.

6.2 Workshop on quality

Within SN the Centre for Policy Related Statistics is responsible for compiling custom-made statistical products. In response to an article on the OQM-model in an internal SN newsletter, the Centre recently contacted the quality department for help because they wanted to "do something on quality".

Together with colleagues from the Centre, the quality department prepared a workshop to explain the OQM model in a nutshell. All twenty participants of the workshop were then asked to identify the relevant objects for their department together with the quality areas associated with these objects.

The six most important quality areas were identified (question 4), for instance *effectiveness of customer relations* and *clarity of reports for customers.*

Each quality area was elaborated further in one of six sub-groups, and the results were presented to the whole group. Subjects presented included definition (question 1), requirements (question 6), causes and effects of problems (questions 8 and 9), implemented measures (question 18), in control? (question 20), and additional measures to be implemented (question 19).

The workshop took 2.5 hours, and the results were used as a basis for a plan to implement the additional measures.

An article on the experiences of the group was published in SN's in-house magazine. One participant reported: *The OQM model is very intuitive. You don't have to be a whiz-kid to understand it. We spent only a short time on the theory and mainly interacted with each other*.

6.3 Standard for statistical processes

In 2009 Eurostat awarded a grant to SN to develop an (audit) standard for the quality of statistical output, agreements with users, and quality reports. This standard is currently under construction at SN.

The draft version of the standard covers over 50 quality areas. The original scope of the standard was expanded. The primary objects in the standards are: *statistical output, agreements,* and *quality reports,* but other objects were added later, like *documentation, metadata, knowledge, processes, staff, information systems* and *administrative burden*.

This standard is already being used for a new version of the audit standards and a self-assessment questionnaire. The self-assessment questionnaire will be used for all non-critical processes.

Subjects in the standard are requirements (question 6) but also effects of problems (question 9). When necessary, each requirement is explained. If a principle or indicator the Code of Practice (Eurostat, 2005) is applicable, then the Code of Practice is copied into the standard.

6.4 Research on quality of secondary data sources

By way of a literature study, the methodology department of SN has identified indicators for the quality of secondary data sources (Daas and Van Nederpelt, 2010). The OQM model was used to check whether this set of quality indicators was complete (question 14). Two objects were elaborated: the *data* and the *metadata of secondary data sources*. Within both objects, three sub-objects were additionally distinguished: *dataset, units* and *items*.

As a result of the application of the OQM model a total of 39 quality areas were identified (table 3). Furthermore, the indicators previously identified were regrouped and a new quality area was identified.

The conclusion of this work was that a combination of a top-down (OQM model) and bottom-up (literature study) approach proved very fruitful. The whole exercise and its results are described in a paper (Daas and Van Nederpelt, 2010) to be published soon on the SN website.

Table 3: Quality areas identified for secondary data sources

Characteristic	Domain	Sub-object	Characteristic	Domain	Sub-object
Authenticity	data	units			
			Clarity	metadata	dataset
			Clarity	metadata	units
			Clarity	metadata	items
Coherence	data	items			
			Comparability	metadata	dataset
			Comparability	metadata	units
			Comparability	metadata	items
Completeness	data	dataset	Completeness	metadata	dataset
Completeness	data	units	Completeness	metadata	units
Completeness	data	items	Completeness	metadata	items
			Confidentiality	metadata	dataset
Confidentiality	data	units			
Confidentiality	data	items			
			Correctness	metadata	dataset
Correctness	data	units	Correctness	metadata	units
Correctness	data	items	Correctness	metadata	items
Detailedness	data	items			
Selectivity	data	units			
Selectivity	data	items			
Stability	data	dataset	Stability	metadata	dataset
Stability	data	units	Stability	metadata	units
Stability	data	items	Stability	metadata	items
Timeliness	data	dataset	Timeliness	metadata	dataset
Timeliness	data	units	Timeliness	metadata	units
Timeliness	data	items	Timeliness	metadata	items
Uniqueness	data	units			
Uniqueness	data	items			

6.5 Comparison of the CoP with the framework of the ECB

The Sponsorship on Quality group is currently discussing whether or not the Code of Practice could be converted to the framework of the European Central Bank (ECB), and if so: how? For this discussion it was necessary to compare the two frameworks at a detailed level.

This comparison was done by mapping all elements in both frameworks into 110 quality areas. For each quality area it was determined whether or not it was covered by the Code of Practice. The same was done for the framework of the ECB. If a quality area was covered by the ECB and not by the Code of Practice, the ECB element was considered as a potential addition to the Code of Practice.

Although decision-making on this subject has still to take place, this exercise demonstrates that the concept of quality areas can be used for comparison and integration of frameworks.

6.6 Framework for a website on housing

An ad hoc framework was been developed for a website that is to be constructed with information on housing from SN and other parties. The project team identified 16 quality areas for the website, like *relevance of the statistical output* and *completeness of the metadata.* For each quality area one or more requirements (question 6) were formulated.

6.7 Framework for description of conceptual metadata

A framework has been developed for correct descriptions of conceptual metadata. This domain includes objects like *statistical object type, name of a data item (i.e. a variable), definition of a data item, owner's name,* etc. Typical characteristics are *correctness, completeness, clarity,* and *(un)ambiguity*. Requirements are specified (question 6) and explained where needed. Examples and counterexamples are also added to each requirement.

The added value of the OQM model for this framework is that it provides a good overview of the requirements for the user. It also enables the developers of the framework to check the completeness of the requirements better.

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ABOUT THE AUTHOR

Peter van Nederpelt (1951) has worked at Statistics Netherlands as an auditor and researcher since 2002. His background is in applied mathematics, business administration and auditing. Peter is member of the Working Group on Quality of Eurostat.

Annex A: List of possible characteristics (not exhaustive)

Ability
Acceptability
Acceptance
Access security
Accessibility
Accountability
Accuracy
Adaptability
Adaptively
Adequacy
Advisability
Ambiguity
Amount (of data)
Applicability
Appreciably
Appropriateness
Approximation
Attractiveness
Authenticity
Availability
Awareness
Balance
Beauty
Believability
Benevolence
Brightness
Capacity
Changeability
Clarity
Clearness
Coherence
Colour
Comparability
Compatibility
Competence
Competitiveness
Completeness
Complexity
Comprehensibility
Concentration power
Conciseness
Confidentiality
Consistency
Contestability
Continuity
Controllability
Convenience
Correctness
Costs
Coverage
Creativity
Credibility
Creditworthiness
Currency
Data freshness
Degree of detail
Degree of filling
Delivery reliability
Dependability
Dependence
Detailedness
Disputability
Diversity
Docility
Dynamics
Ease of manipulation
Ease of understanding
Ease of use
Effectiveness
Efficiency
Eligibility
Employability
Empowerment
Enforceability
Enthusiasm
Environment friendliness
Equivalence
Evenness
Exactness
Exclusivity
Existence
Expertise
Extensibility
Fairness
Familiarity
Faultlessness
Feasibility
Find ability
Flexibility

Format
Freedom from error
Friendliness
Functionality
Goodness
Growth
Health
Height
Helpfulness
Image
Impartiality
Importance
Incorrectness
Independence
Innovativeness
Integrity
Intensity
Interoperability
Interpretability
Inventiveness
Involvement
Legality
Legitimacy
Length
Level
Linkability
Loyalty
Maintainability
Market orientation
Measurability
Metadata compliance
Mobility
Mutation rate
Navigation
Necessity
Numerical consistency
Objectivity
Openness
Operability
Orientation
Over coverage
Passion
Perfection
Performance
Per iodization
Pertinence
Plausibility
Portability
Power
Precision
Predictability
Presence
Privacy
Productivity
Professionalism
Profitability
Proportionality
Provenance
Prudence
Punctuality
Purchasing power
Purity
Readability
Reasonableness
Recency
Record identifiably
Record matching ability
Redundancy
Reference time
Refinement
Relevance
Relevancy
Reliability
Repeatability
Replace ability
Representational consistency
Reproducibility
Reputation
Response
Responsibility
Responsiveness
Result orientation
Re-usability
Rightness
Robustness
Safety
Satisfaction
Scope
Secrecy
Security
Selectivity
Sensitivity
Severity
Shape
Size
Soundness
Speed

Stability
Stress resistance
Structure
Substitutability
Suitability
Sustainability
Tenacity
Thoroughness
Timeliness
Traceability
Transferability
Transparency
Trueness
Turnaround
Under coverage
Understand ability
Uniformity
Uniqueness
Usability
Usefulness
Validity
Value
Value-added
Verifiability
Visibility
Voluntariness
Vulnerability
Weight
Wholeness
Width
Willingness