

# Implementation of Eurostat Quality Declarations at Statistics Denmark with cost-effective use of standards

Mogens Grosen Nielsen, *Chief Adviser, Statistics Denmark*

Lars Thygesen, *Director, Statistics Denmark*

**Abstract:** As part of an EU-grant project Statistics Denmark is implementing a system to report SDMX reference metadata to Eurostat. The system is based on a generalized quality concept inventory, SIMS (Single Integrated Metadata Structure), developed by Eurostat. The system is part of a general documentation system where metadata on quality, concepts, variables and classifications are integrated. The development draws as much as possible on international standards like GSBPM, parts of GSIM, DDI, SDMX and others in order to ensure cost-effectiveness, and at the same time to benefit from and contribute to a common understanding and a "common language" internationally. The paper presents challenges related to a) overall vision and purpose b) how to fulfil external user needs c) integrating quality into business processes d) technical implementation. The paper contains a general discussion on how to ensure fulfilment of user needs with a cost-effective use of standards for processes and information (at Member State and Eurostat level) in order to reach the goals set up for the European Statistical System.

## 1. Introduction

One of the challenges for Statistics Denmark is how to implement cross-cutting solutions using common standards. The implementation of quality has mainly been performed by various "local" methods. It is difficult to allocate resources and to change processes (including some stove-pipe production) towards using common standards. According to an EU-grant agreed in the autumn of 2012, we had to come up with a metadata system, building on extensive use of standards. Today standards and standard-tools have given Statistics Denmark a cost-effective solution. Still, much remains to be done.

The paper is organized as follows. Chapter 2 "Introducing integrated metadata at Statistics Denmark" presents vision, solution and status on the on-going project. Chapter 3 "The road towards the right mix of standards at Statistics Denmark" gives an outline of our approach on combining and implementing standards on quality, business processes, etc. Chapter 4 focuses on challenges implementing quality

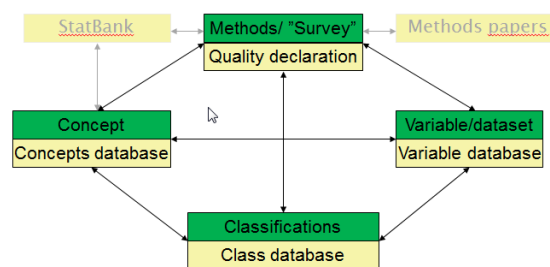
declarations at Statistics Denmark: a) handling user needs, b) strategic corporate level issues, c) integration of the quality dimension into business processes and d) introduction and implementation of standards. Each group of challenges is followed by a description of the responses from Statistics Denmark and a short description of suggestions for research and development. Chapter 5 completes with a discussion of how to handle the complex problem on implementing and benefiting from standards both at national and international level.

## 2. Introducing integrated metadata at Statistics Denmark

In a paper given at Q2012 in Athens and later published in the Journal of Statistics IAOS [1], Statistics Denmark discussed how to fulfil user needs, which is the ultimate goal for all statistical organizations. We advocated a Business Process Management approach integrating work on various disciplines: alignment of business processes with GSBPM, project management model, systems development model, metadata and quality-model. These ideas are being implemented in the on-going project.

The vision is to fulfil user needs by implementing an advanced “library catalogue system” enabling the user to get precise information about our products. Besides that, the cost-effectiveness in the short term was crucial, since we had very few resources for the project. In addition, we wanted a sustainable long-term cost-efficient solution.

To solve this problem the way forward was to rely on standards and standard software that would help us in the short run, and at the same time ensure long-term cost-effective solutions, building on the international development of standards. The figure below shows our overall idea on integrated metadata.

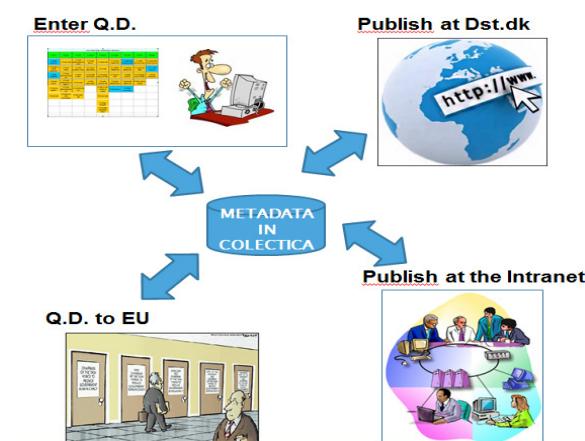


**Figure 1.** Integrated metadata

We wanted both in the short and long term to integrate the ideas above in the GSBPM model, including documentation on quality. The documentation includes description of content (e.g., methodology and

quality declarations), variables, classifications and concepts. In addition, we include documentation of processes, user-manuals and IT.

Figure 2 below shows the solution, using the Colectica software [2] as a DDI-standard tool extended with SDMX-standards.



**Figure 2.** The solution using Colectica as a common metadata repository.

Status on the project so far: a) System using Colectica, DDI and SDMX is in place b) It is possible to store all types of Quality Information by using the Single Integrated Metadata Structure (SIMS). From this structure we can create various kinds of dissemination and reports. c) Files to Eurostat complying with ESMS and ESQRS metadata structure definitions can be generated d) Guidelines and training course material prepared e) Over 100 surveys are created and subject-matter staff are working to transform from the old to the new standard-based quality declarations.

### 3. The road towards the right mix of standards at Statistics Denmark

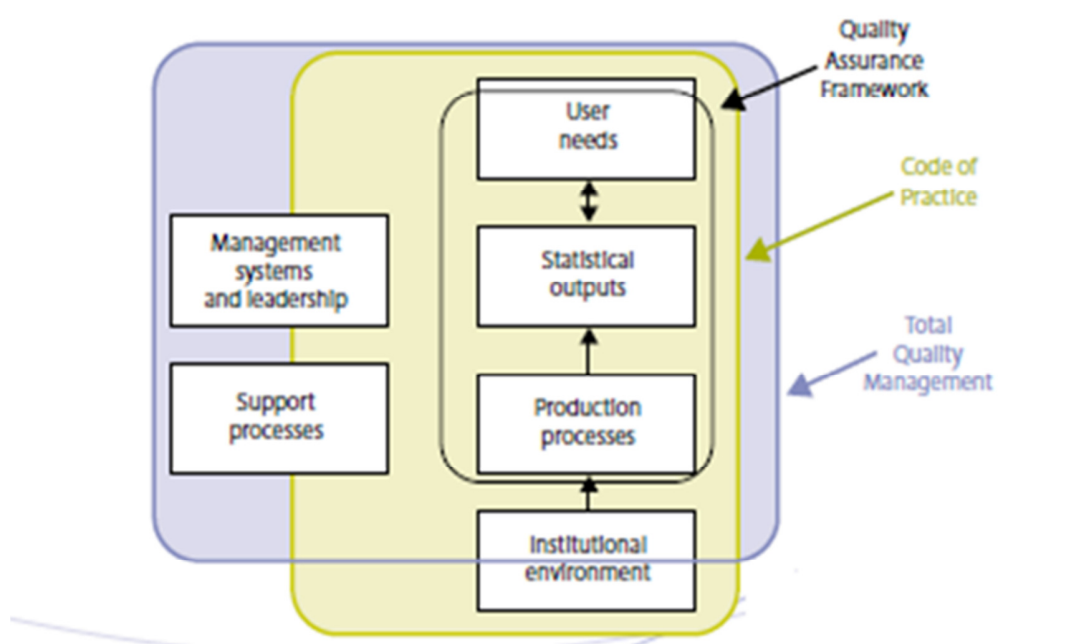
The title of this paper uses *cost-effective use of standards* and the abstract says *ensure cost-efficiency*. As you may know, we do not distinguish between effective and efficient in Danish, so some simple solution on terminology is needed. The Oxford definitions are as follows: *Efficient: (Of a system or machine) achieving maximum productivity with minimum wasted effort or expense. (Of a person) working in a well-organized and competent way. Effective: Successful in producing a desired or intended result.* A popular version of these definitions is: “Being effective is about doing the right things, while being efficient is about doing the things with the least waste of time and effort”.

Implementing standards in statistics covers both. We can introduce standards, get ISO certified, etc. in order to be effective and do things the right way. But being efficient requires the right mix of standards and most importantly decisions on how to gradually implement the standards. Thus, it is difficult to determine on general aspects surrounding cost-effectiveness. Something that is efficient for one organization will not be efficient for another organization.

Statistics Denmark is implementing Code of Practice (CoP) and Quality Assurance framework (QAF) developed by Eurostat. In these frameworks quality is defined as a relative concept where the products' characteristics are being defined in relation to users' needs. As with other products, statistical information has to be “fit for purpose”.

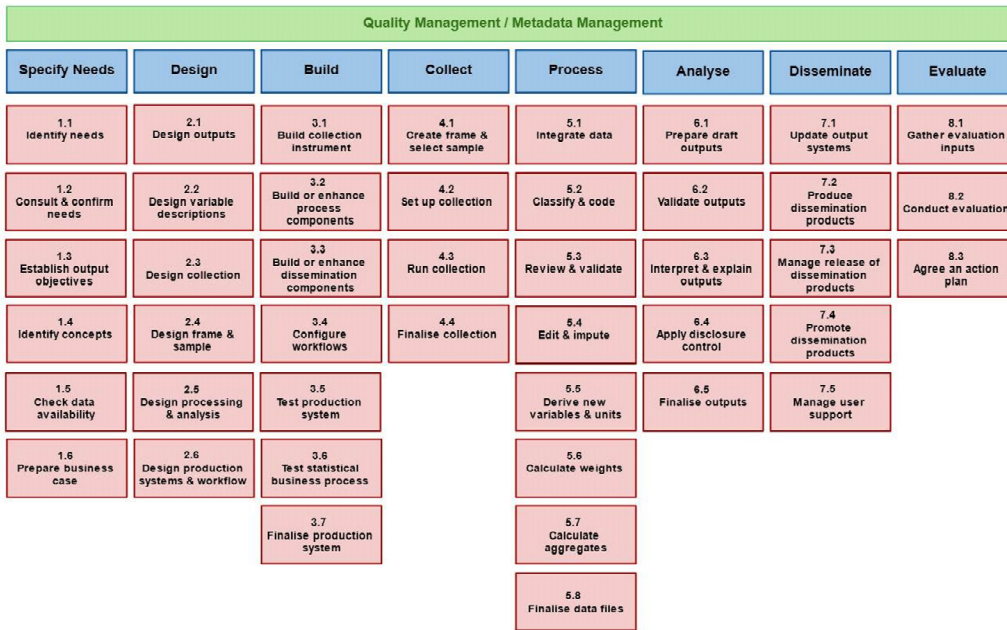
By introducing basic quality concepts from ISO 9000 we use this more precise definition of quality: *“the degree to which a set of inherent characteristics of processes and products fulfils requirements”* [3]. This definition leads us in the right direction regarding the use of standards. We can get help with characteristics of processes from the GSBPM, including how to locate quality and metadata processes. We can get help with characteristics of products using QAF and related development of metadata structures (SIMS) [4]. We can set up requirements on how to implement and measure processes and characteristics.

Quality management has a long history and many books are being published. Figure 3 below places the Quality Assurance Framework in a context of broader frameworks, including Code of Practice. [5]



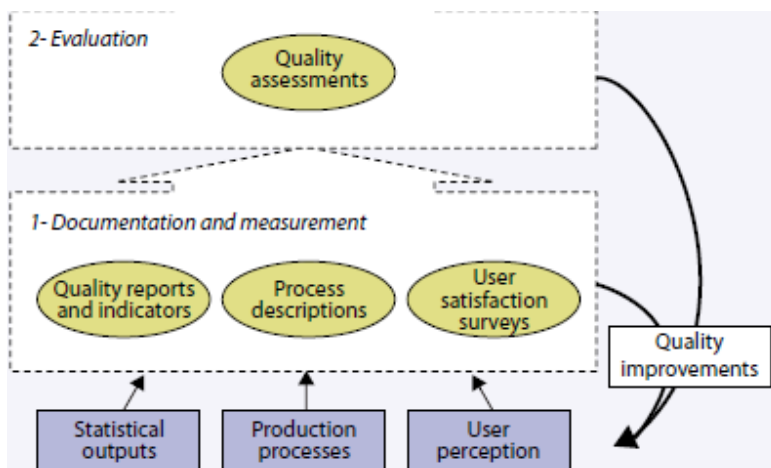
**Figure 3.** Quality Assurance Framework in context.

A Quality Management System including the production of metadata have to be seen in relation to the business processes in producing statistics, and for this purpose we naturally use GSBPM, as illustrated in figure 4 below.



**Figure 4.** GSBPM including quality and metadata management.

Quality Management is placed at the top of the model, but the GSBPM model only gives overall information on quality management processes using the “Plan Do Check Act” as described in the section about over-arching processes in the model. The handbooks on quality reporting from Eurostat suggests the following overall model on quality management [5]



**Figure 5.** Statistical products, processes and user-perception and documentation and processes related to quality assurance.

Based on the models mentioned above, *Principle 4. Commitment to quality* in QAF and *ISO 9001:2008 Quality Management System - requirements* Statistics Denmark has the following objectives for a Quality Management System:

1. Define requirements for the content of documentation to measure quality (descriptions of products, processes and user satisfaction)
2. Define production processes, including description of where and how to provide documentation for quality assurance
3. Involve users in the specification of requirements for documentation and for providing feedback
4. Establish organization to monitor, measure and analyze processes and products, and implement actions necessary to achieve planned results and continual improvement of these processes.

Ad. 1: Regarding the content of quality documentation (metadata), we follow the overall objectives in QAF. On products they follow the well-known structure: Relevance (principle 11), Accuracy and reliability (principle 12), Timeliness and punctuality (principle 13), Coherence and comparability (principle 14), Accessibility and clarity (principle 15). This overall structure is detailed in the SIMS standard classification of quality concepts. In addition, Eurostat has included some very overall requirement on quality-information about processes in SIMS. These requirements will be elaborated in the coming years.

Ad. 2: Regarding definition and description of production processes QAF has the following overall objectives: Sound methodology underpins quality statistics (Principle 7), Appropriate Statistical Procedures (Principle 8), Non-excessive Burden on Respondents (Principle 9), and Cost Effectiveness (Principle 10)

The table below gives details on the actual implementation at Statistics Denmark.

Overall objective	Implementation
1. Define requirements for the content of documentation to measure quality (descriptions of products, processes and	As mentioned above, Statistics Denmark uses SIMS as a standard quality concept classification for documentation of products

<p>user satisfaction)</p>	<p>and processes. This documentation is used internally, together with other documentation as input to quality assurance.</p>
<p>2. Define production processes, including description of where and how to provide documentation for quality assurance</p>	<p>Guidelines using GSBPM structure. Each GSBPM process will have the following guidelines included: description of the process, steps, input, output, resources and regulations / standards to be used in the process. Quality objectives on processes described in QAF principles 7, 8, 9 and 10 are reflected in the guidelines. In addition, the guidelines include information on how to provide quality documentation in relevant sub-processes.</p>
<p>3. Involve users in the specification of requirements for documentation and for providing feedback</p>	<p>Statistics Denmark has conducted focus-group surveys as part of the specification of requirements on content and dissemination of quality documentation (metadata)</p>
<p>4. Monitor, measure and analyze processes and products, and implement actions necessary to achieve planned results and continual improvement of these processes.</p>	<p>An organization has been set up to implement a simple quality management system following CoP and QAF</p>



## **4. Challenges, responses and ideas for the way forward**

### **4.1 Fulfilling user needs**

#### *4.1.1 Challenges*

1. One problem for the NSIs is that many user needs, which are often conflicting, have to be fulfilled. Some users want very detailed descriptions of e.g. accuracy, while others will not even read this information. As a concrete example on this, we have a challenge regarding the content of our product-descriptions reported to Eurostat. Eurostat has in some statistical domains set up detailed requirements and implemented those using the National Reference Metadata Editor. This solution makes it difficult to reuse the quality information for other users, including national users.
2. Historically, we have not taken fulfilment of the needs of end-users into consideration to a sufficient extent, when documenting our statistics.
3. A challenge regarding dissemination is the lack of a clear distinction between dissemination of statistics and dissemination of information about the statistics. In popular wording, there is a lack of awareness of building a modern library catalogue.

#### *4.1.2 Response*

Statistics Denmark has conducted focus-groups surveys with specific user communities, targeting how to disseminate and what should be the general content of our metadata. In order to disseminate quality information to experts as well as to non-experts we have added summary fields to the standard template for quality declarations, so that a good idea of the statistical product can be obtained from reading a one-page overview. But we still need feedback from users and based on this feedback we should be more focused on building the right “modern library catalogue system”. Regarding reporting to Eurostat the problem has been discussed at ESSC and other European meetings. The system built at Statistics Denmark follows decisions in these fora. In the short run, we will use the National Reference Metadata Editor for detailed reporting and Colectica for standardized reporting (e.g. ESMS)

Regarding the internal awareness on delivering easy-to-understand quality information, we have prepared manuals and courses leading the subject-matter statisticians in a direction having users in mind. The purpose is to increase the awareness of statisticians both on the form and content of the quality information.

Regarding the dissemination of quality information we strive for integration, where we focus on inserting as many links as possible from the quality information to statistical products. To ensure fulfilment of user needs we will set up mechanisms to have continuous feedback from users

#### *4.1.3 Suggestions for research and development*

There is a problem on how to get uniform descriptions across domains in order to fulfill user-needs. As an endeavor in this direction Statistics Denmark has undertaken a comparative analysis of six statistics, including both sample and non-sample surveys. This analysis confirmed that we have a challenge described under bullet 2 above. The description was not uniform; the description was based on mainly targeting internal needs and no other types of user needs. A work was carried out to make uniform descriptions across domains and the guidelines were adjusted based on a series of meetings with subject-matter statisticians and methodology staff. The result is harmonized and uniform description of quality for the six surveys. These quality declarations from these surveys will be used as “best-practice” when other subject-matter statisticians enter information on quality.

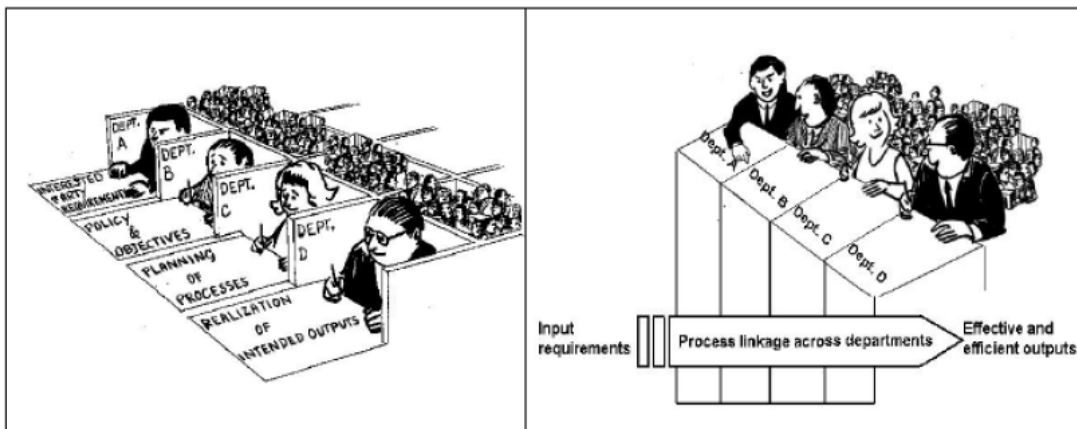
This problem is at the Eurostat level more complex, since many countries must deliver harmonized quality information. It requires that Eurostat must cooperate on common descriptions adhering to common standards. There should be research into how to build and disseminate information on the five quality dimensions. Descriptions should be uniform across domains and put into a language that is understandable for various users.

Regarding dissemination we must aim at building modern library catalogues, where the user can get easy information on content and information on where to find information-products. We should be as good as Amazon to direct our user towards the products they want.

## 4.2 Strategic corporate level issues and overall vision

### 4.2.1 Challenges

Many statistical organizations, both national and international, are influenced by historical bureaucratic ways of organising the work. This means there is clearly defined areas of competence and work-processes following clearly defined set of rules. Stove pipes are the result. The main problem is lack of awareness of linkages across dept processes in the organization.



**Figure 6.** From stove pipes to process integration

Some organizations put a lot of effort to move to a functional organization, following the GSBPM. A challenge regarding this approach is to avoid creating new GSBPM-stove pipes. This would happen if you have a too sharp division on labour between collection, processing, analysis and dissemination.

A challenge related to the GSBPM approach is to define who owns the processes. This first requires a common understanding of what a process is. In Eurostat a process covers the whole value chain for each statistic. In other settings the process means the sub-process in GSBPM. It is important to have a more precise definition and decisions on this before discussing ownership.

According to ISO and other quality frameworks the process owner is the function who is responsible for hiring and firing of staff on the process. Based on this we should have clear theoretical ideas about who owns the process and make this clear in the building of frameworks and creating organizational changes.

Besides the challenges above it is important to find out how to handle the integration suggested by Eurostat in Vision 2.0.

#### *4.2.2 Solution*

The solution on quality and metadata management at Statistics Denmark is an implementation strategy where we stepwise move towards integrated metadata, implementing the standards on product and process quality. A steering committee was set up and a group working on preparing the standards was made. A quality management system based on CoP and QAF is being prepared.

When we describe many different products it is absolutely essential to adhere to common standards. However, Eurostat has been introducing detailed reporting requirements that are different for different domains, which makes it difficult to use one common set of modular descriptions to fulfil different kinds of user-needs. We need to decide on common and precise requirements on how to report the quality of our products. The reporting standard should be put in SIMS and be structured according to the five product quality dimensions in QAF: Relevance, Accuracy and reliability, Timeliness and Punctuality, Coherence and Comparability, and Accessibility and clarity.

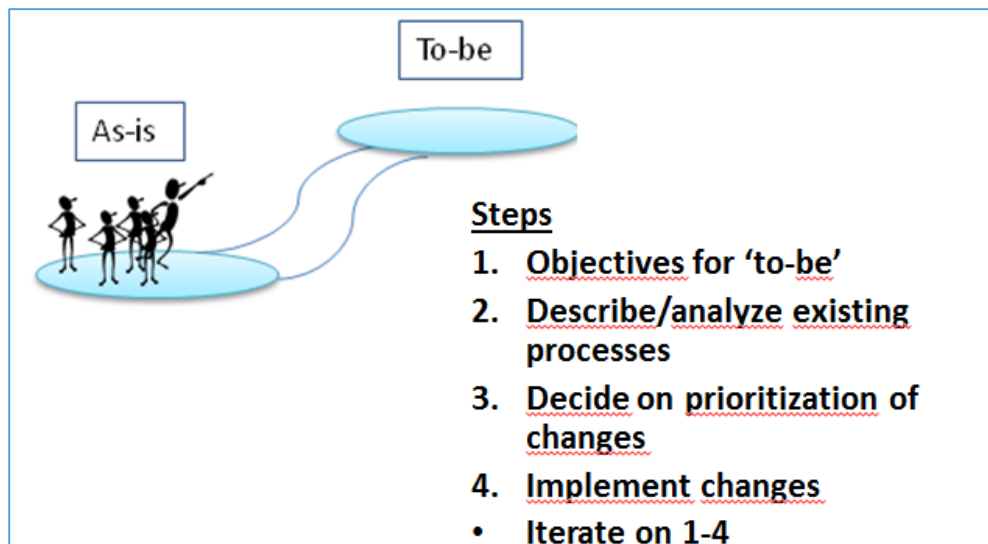
Implementing quality declarations in a stove-pipe like organization focusing on user needs and reaching the vision as described above requires a lot of change management. The solution implemented in Statistics Denmark made use of a heavy communication plan including newsletters and several meetings with management directors responsible for processes. An ongoing EU Peer Review Self-Assessment has helped create awareness on the problems.

#### *4.2.3 Suggestions for research and development*

It is suggested to carry out projects focusing on the idea that processes must be organized from start to finish in such a way that all processes add value for users. This includes handling the challenges on definition of processes and finding out who owns the processes.

This kind of projects must integrate the implementation of GSBPM, metadata and quality. A known methodology used for this is called Business Process Management (BPM). BPM is a process management method where business processes are managed, designed and continuously improved in order to increase business effectiveness and value creation. BPM provides a solid foundation to achieve a number of benefits, including methods on how to handle changes at the strategic level, effective and measurable processes, faster adaptability, increased customer focus, better links between business and IT, quality, etc. [6]. The methodology has in recent years been on the agenda in a number of private and public organizations.

A significant aspect of business process management relates to change processes. First of all there must be commitment from high-level management. In addition, BPM includes the idea of "as-is" and "to-be"-states. The short version of the ideas behind the as-is and to-be can be seen in the figure below.



**Figure 7. Progressing from “as-is” to “to-be”**

You start by examining and describing the existing processes (management, core and support processes) based on the goals you want to achieve. The targets may cover a wide range of areas: improved documentation and knowledge sharing, implementing quality framework, better use and management of metadata, better use of IT, including standardization and automation, improved organization, how to better meet user needs, improved methods, etc. The next step is to decide and prioritize the changes. This is followed by the implementation. Not all changes can be carried out at once. It is therefore important to reiterate the first four steps.

### **4.3. Integrating quality into business processes**

#### *4.3.1 Challenge*

A challenge at Statistics Denmark is that there is weak awareness on systematic quality work. This work is often seen as something made up by aliens. The quality declarations are often made after dissemination of the statistics, when you have time for this. There hasn't been sufficient awareness on

creating reports supporting the users. The challenge on integrating quality into the business processes is thus related to both the kind of quality information you must provide, and how to create and implement guidelines on how to carry the work in the GSBPM-phases.

#### *4.3.2 Response / Solution*

Regarding standards for the documentation of product and process quality, we see SIMS as the core, common standard. In order to connect this standard to production processes, we supplemented GSBPM with guidelines on how to prepare quality information, and in which processes. E.g. quality on user-needs must be reported in the needs-phase. Quality on accuracy (e.g. coverage) must be reported in the analysis phase.

#### *4.3.3 Suggestions for research and development*

As described earlier it is difficult to go from a stovepipe solution to a standard-based quality reporting using SIMS, GSBPM and other standards. The experience gained by Statistics Denmark shows that this is possible, but there should be much more research into developing and implementing improved standards like SIMS and GSBPM, including the combination of those. In addition, more work should be carried out on creating awareness of how an overall quality management system can be fitted into the process model.

### **4.4 Standards and technical implementation**

#### *4.4.1 Challenge*

A main challenge is how to combine and gradually introduce standards like GSBPM and SIMS in an integrated fashion. Regarding metadata the challenge is how to implement these selected UN principles: a) Reuse metadata where possible for statistical integration as well as efficiency reasons (we don't want metadata graveyards); b) manage metadata as an integrated part of GSBPM; c) make metadata active to the greatest extent possible, active metadata being metadata that drive other processes and actions. Treating metadata this way will help to ensure that they are accurate and up-to-date. [7]

Seen from a metadata perspective the challenge is how to make sure that we introduce integrated standards, so short-term choices are not in conflict with future choices. In other words: we must make sure that short-term choices concerning e.g. standards on how to describe concepts, can fit into long-term more encompassing standards. Regarding quality declarations we produce metadata about products

and processes using the SIMS standard. This includes an inventory of statistical concepts that can be reused for other purposes, including dissemination and building a thesaurus. In doing so, we need to ensure that content on, e.g. statistical concepts comply with the ongoing standardization on description of concepts in the more complex model GSIM.

Regarding reporting to Eurostat, a technical challenge has been on detailed, domain-specific reporting as mentioned above. Today, the reporting can take place using the so-called national reference metadata editor (NRME). The problem is that this set-up is in conflict with ideas on how to integrate quality reporting into national system-to-system solutions, since NRME is just enhanced with HTML tables structuring the content without any consideration of how this should be implemented in systems at national level. This has been discussed at the latest meeting in the Eurostat metadata task force and there is consensus on a need for describing the deliverables at the semantic level and thereafter finding a suitable technical solution.

In general, it is difficult for Statistics Denmark to comply with standards since the work at Eurostat and UN-groups is pointing in many directions

#### *4.4.2 Response / solution at Statistics Denmark*

Statistics Denmark is making great efforts to introduce the most useful standards in order to ensure cost-efficiency, but also to be prepared for further development of GSBPM and GSIM. Therefore, we have chosen to introduce DDI (Data Documentation Initiative) covering the basics on micro-data. We have chosen to integrate SIMS covering the SDMX reporting formats ESMS and ESQRS. As a tool we have chosen Colectica [2] with a central metadata-repository. Colectica is using DDI in its core. We have enhanced the tool with the SDMX standard SIMS in order to ensure reporting to Eurostat, but also to provide standard-based dissemination of quality information for [www.dst.dk](http://www.dst.dk) and for other users. In addition, the tool has been enhanced with an interface following the phases in GSBPM.

#### *4.4.3 Suggestions for research and development*

It is suggested to conduct research into how the standards can be implemented at different levels of ambition and in different kinds of organizations. GSIM is an example of a complex model that is difficult to implement at different levels. It does not make sense to introduce a model based on advanced solutions in countries that are making very expensive and completely new enterprise architectures. It must be possible for the NSIs to use a business process perspective and the idea of continuous

improvement. This approach must take standards into account in order to create cost-efficient solutions in the short and the long run. This is where top management must make decisions based on thorough analysis of the situation at each NSI and ideas on how to move forward stepwise. This includes: setting goals and making decisions about integrating quality into processes, how to handle user needs and technical standard solutions.

## **5. Conclusion**

As promised in the abstract, the paper ends with a general discussion on how to ensure fulfilment of user needs with a cost-efficient use of standards both at Member State and Eurostat level in order to reach the goals set out for the European Statistical System.

The challenges mentioned in the four preceding chapters in this paper need to be addressed both at Member State and Eurostat level. The tricky part is how to solve this in a coordinated manner. The ESS Vision 2.0 is a positive step in this direction. Standards play a central role, but the goals for ESS can only be accomplished if Member States and Eurostat work closely together on implementing standards at different ambition-levels. This cooperation and the standards must ensure fulfilment of common goals and at the same time allow organizations to make decisions that fit their practices and “local” environment. This is due to the fact that each organization as a social system [8] is unique with historically based management practices, social aspects and professional skills.

Given these conditions, how do we introduce standards to ensure cooperation between statistical organizations in order to provide global information as requested from users? A way forward is to conduct research and support the implementation of generic standards with respect to the variety of organizations.

## **References**

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