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Topic (i): Metadata in a Corporate Context

PART A OF THE METADATA FRAMEWORK: STATISTICAL METADATA SYSTEM AND ITS ROLE IN A STATISTICAL ORGANIZATION

Invited Paper

Submitted by UNECE and Australian Bureau of Statistics[1]

I. INTRODUCTION

1. At the February 2004 METIS work session, a Task Force was established to draft a Statistical Metadata Framework for the UNECE region. The framework was divided into four parts: A –D. The contents of which align to the topics being discussed at this work session.

2. This paper is a draft of Part A: Metadata in the Corporate Context. Part A aims to outline issues surrounding the development and implementation of a Statistical Metadata System (SMS). It is intended particularly for senior managers within a statistical organization.

3. This draft is submitted for review and your input is requested. To facilitate this, we pose some questions for discussion:

   a. Does the group agree with the proposed content of Part A? Are any new sections needed, or should some be removed? For example, do we need to introduce 'access and use' metadata considerations?

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b. Do any METIS members have contributions to make to any sections? For example, case studies, examples, suggestions for additional principles, benefits, examples of vision statements?

c. Is any discussion necessary about of questions of detail – for example, terminology - use 'vision' or 'model'?; more exploration of use of metadata by external users, etc.

d. Finally, does the METIS group support, in principle and subject to application of amendments discussed, this draft? What should be the next steps with respect to Part A? Who would be involved in this work? Timeframe?

STATISTICAL METADATA FRAMEWORK DOCUMENT

Draft
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20.02.2006

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A. Statistical Metadata System and its role in a statistical organization

A.1. Executive overview

This document aims to outline issues surrounding the development and implementation of a Statistical Metadata System (SMS). It is intended particularly for senior managers within a statistical organization.

An SMS is an important tool for safeguarding the internal and external integration of a statistical information system (SIS). The varying needs of a diverse and large number of users of statistical metadata highlights the strategic nature of an SMS project. Knowing who the users are and understanding their needs, is the foundation for effective SMS development. To ensure its efficiency, the SMS must be an integral part of the strategic direction of a statistical organization. For this reason, it is vital that senior management is directly involved in any SMS project.

The management of an SMS project is a demanding task. Statistical metadata management is a developing field with many researchers and experts, both in statistical offices and in universities, continually contributing to its development. In addition, intensive international cooperation is going on in this area. For example, there have been a large number of European Union (EU) projects dealing with different aspects of statistical metadata management, such as AMRADS[2], MetaNet[3], METAWARE[4], COSMOS[5]. Standards and guidelines for statistical metadata have been developed, including GESMES [6]standard for exchange of statistical data and metadata and the UNECE Guidelines for Statistical Metadata on the Internet[7]. There is international cooperation on the development of the Statistical Data and Metadata Exchange[8] (SDMX) project, which aims to develop standards for metadata and data exchange between international organizations and national statistical offices.

Recent national experiences show that the successful development of the SMS must directly engage the senior management of the organization. Isolated involvement of metadata and IT experts is not sufficient. Furthermore, a shift from needing IT expertise, towards needing expertise in content oriented statistical issues, is clearly evident.

In the past, the prevailing, and very often a unique role of metadata in a statistical organization, was to support the production of official statistics. Today, the SMS should address many other important requirements. It should be a tool for the efficient functioning of the whole SIS; for the organization of statistical services; and for the systematic cooperation with major stakeholders of statistical data and metadata. In this framework, the SMS should be a self-sustainable project, supporting major functions of the SIS, including its further

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[2] Accompanying Measure to Research and Development in Official Statistics (AMRADS) website at http://amrads.jrc.cec.eu.int/.
[3] MetaNet website at http://www.epros.ed.ac.uk/metanet/index.html.
[4] METAWARE website at http://europa.eu.int/en/comm/eurostat/research/retd/metaware.html.
[5] Cluster of Systems of Metadata for Official Statistics (COSMOS) website at http://www.epros.ed.ac.uk/cosmos/.
[6] GESMES/TS (formerly called GESMES/CB) is the message used by the European Central Bank to exchange statistical data and metadata with its partners in the European System of Central Banks (ESCB) and other organisations world-wide. For more information see the website at http://www.ecb.int/stats/services/gesmes/html/index.en.html.
[7] Available online at http://www.unece.org/stats/publications/metadata.pdf.
[8] Statistical Data and Metadata Exchange website at http://www.sdmx.org/.

development. It requires a corporate and systematic management of all stages and activities dealing with SMS design, implementation and use.

The material in this framework concentrates on the major issues important for the corporate management of an SMS project.

Chapter **A 2, Corporate Value Proposition for Metadata Management,** delineates the role and functions of the SMS for a statistical organization. It describes the major users of statistical metadata and the benefits provided by the SMS project.

Chapter **A 3, Metadata Management Strategies And Policy Framework,** is devoted to the management and preparation of the corporate vision of SMS for the statistical organization. It presents potential objects for metadata description and formulates recommendations for the development of metadata management strategy and planning.

Chapter **A 4, Core Principles For Metadata Management,** formulates the most important principles and recommendations for managing the design and implementation stages of an SMS project.

Chapter **A5 -- Corporate Governance Model** outlines methods for good governance of an SMS project. It describes barriers, challenges, human and organizational issues and provides a case study of the governance model used by the Australian Bureau of Statistics.

A.2. Corporate Value Proposition for Metadata Management

A.2.1. Statistical Metadata System (SMS)

What is a Statistical Metadata System?

The definition "metadata is information about information" predetermines that the Statistical Metadata System (SMS) informs about the Statistical Information System (SIS).

In general, metadata has two basic functions. The first is to uniquely and formally define the content and links between objects and processes of the SIS. The second function is to determine all related technical parameters. When designing the SMS, priority should be given to issues relating to content.

In an environment of rapid development of information and communication technologies, developing efficient strategies for the production and dissemination of statistics is a challenge. The growing use of the Internet has caused significant change in the priorities of the SMS functions. In the past priority was often given to technical metadata and IT challenges, whereas now there has been a clear shift to prioritizing content and methodological issues.

Due to these changes, integrated and transparent description of information flows inside and outside statistical offices has become increasingly inevitable. The use of technology for data collection, interactive communication with users and dissemination of statistics, calls for a coherent and well functioning SMS.

SMS should be a self- sustainable project. Its implementation should be independent of the technology employed for the statistical data processing. However, the links between SMS and e-processing systems must be ensured. Processing of statistical data should be driven by metadata stored in SMS.

What is the Role of the SMS?

The success of an SMS can be measured by the extent to which the needs of diverse groups of statistical metadata users are satisfied. The need for metadata is defined by the various activities, tasks and processes carried out inside a statistical organization. All those activities and processes make up the SIS and strategy of the statistical organization. Therefore, the role of SMS should be understood in the framework of processes and activities of SIS.

In this context, the SMS should be a tool enabling a statistical organization to perform effectively the following main functions:

1. Production of official statistics. Management of all phases of statistical data production (data collection, storage, evaluation and dissemination).
2. Planning, designing, implementing and evaluating statistical production processes.
3. Management of methodological activities. To use coherent metadata in statistical methodology is of a primary importance.

4. Management of cooperation with end users of statistical data and information. Facilitation of user feedback.
5. Enhanced availability of statistical metadata and data for clients. Improved discovery and exchange of data between the statistical office (SO) and its users.
6. Improved quality of statistical data. Observing and evaluating the quality of statistical data is one of the most important goals of statistical activities. To this end, national and international SOs have adopted a set of criteria (relevance and completeness, comparability and coherence of statistical concepts, accuracy of statistical estimations, timeliness and punctuality of delivered statistical information, its accessibility and clarity). SMS should offer a relevant set of metadata for all of these criteria.
7. Management of statistical data sources and cooperation with respondents.
8. Dissemination of statistical information to end-users. End users need reliable metadata for searching, navigation, and interpretation. There should be also metadata available to assist post-processing of statistical data.
9. Improved integration of SIS with other national information systems. There is a growing need to use administrative data for statistical purposes. It calls for better integration and sharing metadata among statistics and state administration in order to ensure coherence and consistency of exchanged information.
10. Improved integration of SIS with information systems of international organizations. International organizations (eg Eurostat, OECD, UN, IMF and others) are increasingly requiring an integration of their own metadata with metadata of national statistical offices in order to make the flow of statistical information more comparable and compatible.
11. Management, unification and standardization of the workflows inside the SO.
12. Knowledge base on the processes of SIS. It enables also to share such knowledge among the statistical staff and to minimize the risk related with its migration.
13. Improved administration of SIS encompassing namely responsibilities, legislation, performance, users' satisfaction.
14. Facilitate the evaluation of costs and revenues for the SO.
15. Unified conception of statistical terminology as a vehicle for better communication and understanding between managers, designers, subject matter statisticians, methodologists, respondents and users of SIS.

A.2.2. Metadata users

A primary challenge for the SMS is to cope with the requirements of diverse metadata users. The use of various information and communication technologies has meant that users of statistics have increased and diversified. Effort should be made to understand who the users are, as their requirement for data and metadata may vary substantially. According to the goals of national statistical services the four major groups of statistical metadata users could be specified (see *Figure 1*):

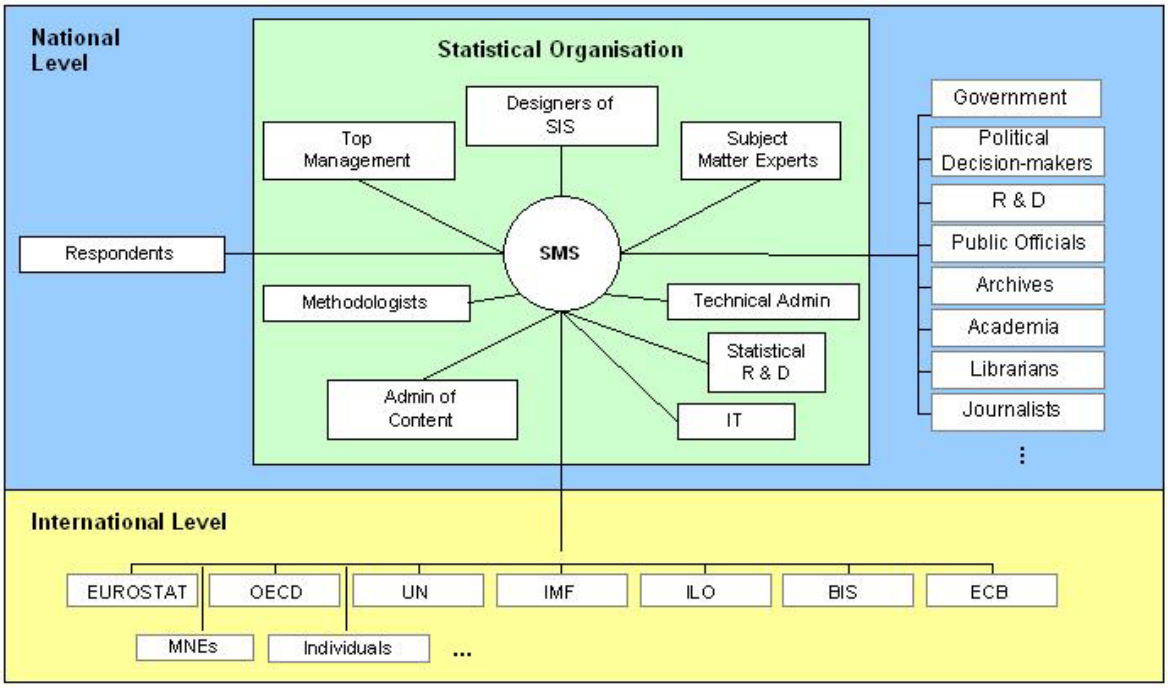

Figure 1: Metadata Users

(i) Users inside SO

This group of metadata users encompasses the many professions involved in the phases of preparation, production and dissemination of official statistics and the functioning of the SIS. These include the following metadata users:

- Senior management;
- Designers and evaluators of SIS;
- Methodologists;
- Subject matter statisticians;
- Statistical research and development;
- Administration of metadata content;
- Technical administration of metadata;
- IT unit responsible for statistical data processing;
- Dissemination specialists.

(ii) Respondents

This group consists of those that supply statistical data to the SIS. Information and communication technologies bring statistical data providers and statistical users closer together. Some institutional statistical activities, particularly in the health, education and justice sectors, require shared access to microdata. In these cases, respondents are both suppliers and users of metadata. Special attention was once given to the suppliers of administrative data on business enterprises. However, with the spreading use of Internet, the growing number of statistical users and their requirements calls frequently for new data sources and thus new data providers. The number of statistical respondents is changing rapidly.

(iii) End users on national level

This group includes: governmental institutions, political decision makers, researchers, public officials, archives, academia, librarians, journalists and the general public. As the audience of users grows it also diversifies. In the past, data dissemination methods typically assumed a certain level of economic and statistical sophistication. Frequently, users' knowledge for a given set of statistics was comparable to the knowledge of subject matter statisticians. This is clearly no longer the case. The audience for economic statistics, for example, can range from professional economists and policy makers, to interested members of the general public, to students working on school assignments. An understanding of economic and statistical concepts can no longer be taken for granted.

(iv) International users

Individuals, multinational enterprises (MNEs), international organizations and others are becoming important users of statistical metadata. As for international organizations at least the following most important should be mentioned: the Organization for Economic and Co-operative Development (OECD), Eurostat, the United Nations Statistical Division (UNSD), the United Nations Economic Commission for Europe (UNECE), the International Labour Organization (ILO), the International Monetary Fund (IMF), the Bank for International Settlements (BIS) and the European Central Bank (ECB). Integration of metadata from national statistical organizations with the statistical metadata of international users is becoming increasingly necessary.

A.2.3. Benefits of a Statistical Metadata System

Statistical organizations and other metadata stakeholders can benefit when metadata exists from creation until archival, rather than as captive to a particular statistical processing system or infrastructure package. The following benefits are valid for all categories of users outlined above:

- Improved statistical information and more efficient operations;
- Improved quality of metadata;
- Better location, retrieval and exchange of data and metadata between organizations to enhance availability to users of statistics;
- Use of a common set terminology, names and descriptions for standard metadata elements to improve communication;
- Central metadata repositories organized to facilitate reuse of existing data;
- Increased use of metadata standards; and
- Improved knowledge of metadata flows.

A.2.3.1. Benefits for Internal Users

Senior Management

SMS facilitates design, planning, decision-making and evaluation processes of SIS. Dissemination strategy, cooperation with end users on national and international level and

data suppliers would primarily belong to those processes. SMS should provide the tools for answering the questions like: to what extent do users actually use the statistical outputs? Are they satisfied with the qualities of data and metadata with regard to content, accuracy, timeliness, availability and coherence? Are there complaints or unmet demands from respondents? SMS should help in giving answer to these questions and should also serve as the administrative management of statistical system. And, last but not least, senior managers of SIS will be interested to learn about the costs and benefits of individual statistical activities.

For these purposes especially the following metadata will be needed:

- End users needs and other stakeholders requirements on a national and international level;
- External information systems related to SIS;
- Suppliers of data into SIS with special attention to the state administration and business enterprises;
- Sources of data for SIS;
- Available statistical services;
- Statistical publications, publication calendar, copyrights and others;
- Statistical production process;
- Responsibilities inside the SO, legislation, performance;
- Cost and revenues of the SO.

Designers and Evaluators

Designers and evaluators of a statistical system are responsible for the design, implementation, maintenance and evaluation of statistical systems.
Planners and evaluators need access to metadata from similar systems, either within or outside the organization, to inform the design, development and implementation of a new system.
For existing systems under their responsibility, they need feedback about performance (qualities and costs), usage and users' satisfaction.

When designing and developing statistical system the following information is required:

- How similar systems have been designed in the past;
- What observation data is already available and how these data can be observed;
- How can this data be obtained; and
- What methods, tools and software components are available and how can they be used.

For maintenance and evaluation of statistical system the following information will be needed:

- Detailed, up-to-date documentation of the system;
- Feedback information, both formal and informal, concerning production and usage of the SIS;
- Experiences from similar systems;
- Knowledge about methods, tools and software components;
- Special evaluation studies performed on an ad hoc basis.

Methodologists

An SMS creates a framework for design and implementation of statistical tasks and surveys to meet statistical obligations in production of official statistics and needs of end users. The SMS provides tools for safeguarding the integration of SIS at national and international level. Furthermore, maintenance, use and further development of statistical classifications and nomenclatures, use of statistical registers, evidence and maintenance about statistical standards, knowledge about statistical methods and relevant research methods, are all activities for which an SMS is indispensable. This group of users will operate namely with metadata relating to the following:

- Content of available statistical data (microdata, macrodata) and associated data concepts;
- Quality of statistical data (relevance, timeliness, accuracy, availability, coherence and comparability);
- Existing statistical tasks and surveys (questionnaires, other sources etc);
- End users and their feedback;
- Requests of international organizations and related standards;
- Data sources and their links;
- Respondents' information systems;
- Administrative data;
- Information systems and their output databases (portals)
- Statistical registers (population, farms etc);
- Statistical classifications, nomenclatures and related international standards;
- Statistical population, statistical units, measurement units time series;
- Statistical methods and relevant research projects.

Subject Matter Statisticians

The subject matter statistician is the expert in a particular field of statistics within a national statistical organization. They have the crucial role of understanding the users information requirements, in the context of the policy and program decision making of the users, and the capabilities of their national statistical office, ie what they can do to provide the required information. Subject matter staff work with other NSO specialists to design and construct an appropriate survey and generate statistics. However, the statistician then has the role of communicating the information to their user community through the creation of statistical products and the provision of associated metadata to assist users in understanding the results. Evaluation is also an important responsibility for the subject matter specialist.

Given these roles, the SMS (in very broad terms) is a knowledge management system for the subject matter statistician. In this information system ideally) they would want to be able to create, update, search, browse and retrieve many different types of metadata entities that would cover many aspects, such as:

- users (customers) requirements;
- standard concepts, data elements and classifications;
- operational information and quality metrics about the operation of their survey system;
- documentation about statistical techniques (methodology) applied to their survey; and
- products created from the statistical data.

The benefits of an SMS to the subject matter statistician include:

- a knowledge base about their statistical collection, including all previous cycles. This is an invaluable resource for new employees coming into a statistical field and for statisticians in other fields who might be researching a new collection - there may be elements in another survey that can be reused.
- access to a consistent store of standard classifications, data elements, process engines that can be used in new survey development with the knowledge that using these elements will assist greatly in ensuring statistical integration.
- as the SMS is a corporate facility, then it would be expected that many tools will be provided that utilize the information repository of the SMS, for example, the product creation environment of the NSO would use the SMS as a source of metadata and so enable the subject matter statistician to more easily create statistical products for the organization's web site with a 'common look and feel'.
- associated with the SMS are standard processes eg registration of new data elements, which would provide a common method across the organization for the subject matter statistician to create and use metadata, thereby reducing training efforts because of various local solutions. There would be better support and consultation services because of a common SMS, and more employees working with the same facilities.

Statistical Research and Development

A science of SIS should be interdisciplinary. It requires a good knowledge and understanding of statistical methodology but this is not enough. At the same time, it requires knowledge about technologies and methods used in information management, information systems and computer science. Furthermore, scientific studies of statistical system would need contributions from behavioral and economic sciences and other disciplines. Researchers will need similar kind of metadata as for designers and methodologists who work on more corporate level (not only on individual surveys and production systems). In addition, SMS should ensure the following metadata specific for the research purposes:

- General knowledge about statistical systems and statistics production (e.g. recognized theories and methods, standards, current best methods, current best practices);
- Specific knowledge and experiences from different statistical organizations;
- Costs and quality aspects in SIS processes.

Administration of Metadata Content

SMS should ensure smooth and systematic update and maintenance of statistical metadata. Maintenance of metadata content will be performed through firmly installed network in which subject matter specialists and methodologists, responsible for metadata content will cooperate. Metadata should be updated by the Administrator of the SMS corporate metadata repository (CMR), once only and in one place. This will help avoid inconsistencies and unnecessary redundancies. All linked updates in CMR have to be performed automatically, without any further human interference. Furthermore, it should ensure errorless metadata navigation of e-production of statistical data. Administrator will need a user-friendly interface, avoiding any special technical skill. To this end the administrator will need the following metadata:

- All metadata related to the content of and links between statistical metadata;
- Information about organization of metadata in CMR;
- Metadata allowing discovery and retrieval;

- Updating methods and procedures;

Technical Administration of Metadata

Technical administrator (IT expert) will use SMS tools for technical maintenance of the CMR. They should cooperate with designers, evaluators and content administrators in solving technological aspects and further development of SMS. The technical administrator will use, oversee and maintain the following metadata:

- Technical metadata related to the CMR, and to the links for e- production systems;
- Information and knowledge about technological aspects of statistical production;
- Information about technical links to other information systems.
- Information about tools and software used by content administrator.

IT Unit Responsible for Statistical Data Processing

Important metadata users are those people operating and monitoring the statistical e-production process.

Metadata driven statistical production creates favorable conditions for standardization and thus efficiency of statistical production system. Metadata on the content of statistical data and associated concepts, including all other delimiting metadata (statistical classifications, statistical units, measurement unit, time series, statistical population etc), are a key condition for the whole throughput of production phases (data collection, storage, evaluation and dissemination). Technical metadata on the organization of CMR and links to the production systems belong to the metadata set needed for fulfilling functions of e-processing.

Ideally, statistical production processes will generate metadata about their own performance, giving producers feedback about functioning and efficiency of metadata driven production. In this respect, producers should cooperate with SMS designers, subject matter specialists and methodologists, content and technical administrators on the design, implementation, evaluation, and further development of the SMS.

A.2.3.2. Benefits for Data Providers

Respondents are important partners of any SIS. Statistical data suppliers are often also the users of statistical data. Their role is becoming more important with the growing number of systems and on-line communication possibilities. In the past it was sufficient for respondents to know requests for statistical data in the framework of the methodological definition of statistical questionnaires, the requests of data suppliers nowadays are more demanding. Bearing in mind the possibility of on-line supply from respondents' information systems to the SIS and the possibility of on-line access of respondents to the SIS it is evident that the requests of data suppliers change. SMS will play a key role in those tasks.

As for the content, there is a growing need to harmonize methodological definitions of data and related metadata from respondents' and statistical information system. The attention should be drawn to the implementation and use of relevant technological metadata standards.

Within the business information systems the standard XBRL [9](Extensible Business Reporting Language) is frequently introduced as a technical metadata standard. Especially for statistical purposes the metadata standard SDMX[10] (Statistical Data and Metadata Exchange) has been developed in cooperation between IMF, OECD, Eurostat, UN, BIS and ECB. Metadata Common Vocabulary developed in the framework of the SDMX will be an important metadata standard used by both suppliers of statistical data and SOs as suppliers of statistical data to international organizations. Data suppliers will require from SMS especially the following information:

- Metadata related to the content (definitions, terminology) of statistical data in the input stage of the statistical production;
- Security and confidentiality of microdata;
- Feedback from statistical surveys;
- Information about the content of statistical warehouses;
- Knowledge about comparability of statistical and respondents data/systems;
- Technical parameters for search and retrieval of metadata in CMR and links to statistical warehouses;
- Knowledge about potential interface between SIS and respondents' information systems;
- Relevant technological standards for metadata and data e-supply;
- Information about software and other tools supporting e-supply of data and metadata;
- Information about strategies for further SMS development;
- Training in use of SMS;

A.2.3.3. Benefits for End Users on the National Level

Understanding different communities of end users and their classifying could help in classifying users requirements. SMS will help users to better discover, understand, interpret and interrogate needed data. The proliferation of information has raised the issue of consistency and comparability of data. Comparability of data is desirable, but not always possible. It is important to know what the differences are and the reason for them, explicated to the different level of users' sophistication. SMS will also assist to convey the credibility of statistical data and recognizing intellectual property.

It is important to monitor users feedback and to embrace the need for metadata in both directions. SMS will offer the possibility to understand how the users search and the terms/terminology that they use. SMS will also support handling access of users to microdata. The fact that users are increasingly requesting access to microdata, calls for tools that allow concerns about confidentiality protection to be overcome.

With spreading use of Internet it is important to provide clients with maximum information about statistical outputs via statistical websites. However, numerous statistical websites are offering diverse metadata to users for identifying and seeking statistical information. There is a potential to flood users with too much metadata. Appropriate communication of metadata

[9] XBRL website at http://www.xbrl.org/Home/.
[10] SDMX website at http://www.sdmx.org/.

should be based on principles of 'cognitive psychology', that is, there is a presentational aspect to metadata consumption.

This heterogeneity, together with more visible methodological differences and inconsistencies of statistics disseminated via Internet, poses difficulties for the users. Clearly, there is a need for a harmonization of metadata accompanying statistical information on Internet. Important role in this respect should play UN international standards ("Guidelines for statistical Metadata on Internet", UN-CES Statistical Standards and Studies –No 52).

Last but not least, SMS should support integration of statistical output databases and portals with the portals of other external institutions.

The following metadata is vital for end users of statistical metadata and data at the national level:

- Availability of statistical outputs;
- Metadata related to the statistical outputs (metadata and data concepts and definitions, classifications, aggregations, statistical and evaluation methods, terminology, history, etc);
- Coherence, comparability, explanatory notes;
- Access to microdata;
- Timeliness;
- Time series;
- Updating procedures;
- Statistical revisions;
- Responsibility for individual statistical outputs;
- Links to other information systems both national and international;
- Confidentiality;
- Planned changes in statistical outputs;
- Content related standards, both national and international;
- Statistical websites[11];
- Statistical output databases;
- Outcomes from statistical analysis on users feedback;
- Rules for searching, accessing and downloading statistical metadata and data from output databases;
- Technological standards relevant for extraction and transfer of data and metadata;
- Information about software and other tools supporting e-search, retrieval and downloading of metadata and data;
- Users training possibilities.

A.2.3.4. Benefits for International Users

There are more and more demands by international users for greater consistency when interacting with NSOs. In the case of international organizations, the metadata and data requirements (and their collection and exchange) have to be coordinated not to overburden

[11] The UNECE published A Guide to the Websites of National and International Statistical Organizations, 2001. Available online at http://www.unece.org/stats/publications/Webguide.pdf [accessed 27 January 2006].

countries with duplicate requests. In order to fulfill this task, better integration of metadata at the national and international level is needed.

A lot of metadata is available on websites of international organizations. Links could be inserted from the metadata of international organizations to more detailed metadata on national websites. Coordination of access could be achieved through a single gateway for data and metadata, e.g. through a portal side. To this end, the IMF launched a joint project, together with OECD, Eurostat, UN, BIS and ESB. The Task Force on the project called Statistical Data and Metadata Exchange (SDMX) was created. SDMX standards are at present under intensive development with Version 2.0 released in November 2005.

Another example is dealing with the multinational enterprises. MNEs can be significant in terms of a nation's economy. To understand the behavior and impact of MNEs, it is important to assess the effects of globalization. MNEs' information systems, however, may not correspond to concepts and models of the SIS. Such situations can potentially lead to gaps and anomalies in the measurement of the activities of MNEs by national SOs. National SOs should explore whether there are biases in national economics caused by gaps and overlaps in the coverage of activities of MNEs. To this end, standardization in the following areas will be needed: definitions of forms of organizations, statistical units, charts of accounts and classifications. Fulfilling such requests without existence of a coherent SMS would be very difficult.

Needs of international users increasingly impact the architecture of national SMS. National SOs face new tasks that can be solved only in close cooperation with international organizations and other international users.

Metadata needed by international users are quite identical with those needed by end users on national level (see the subchapter above). Furthermore, the following information would be required:

- Complying with international standards (coherence, comparability, explanatory notes);
- Standards used for e-metadata and data transfer (XBRL, SDMX, GESMES, others);
- Information about other international and national users;
- Indication of needs for revision and/or standardization of statistical data and metadata concepts.

A.3. Metadata management strategies and policy framework

The focus of this chapter is on the preparation of a corporate SMS Vision, related planning and on the major characteristics of a metadata management framework and management strategies.

A.3.1. SMS Vision

This subchapter presents major goals and functions of the Vision. Furthermore, it assists to understand better what could be the objects of metadata description related to the functions defined in the Vision.

The Vision should clearly state the goals or aims of the SMS. It should apply across the entire SIS and be realistic and within the capabilities of the SO. It should also include a statement about scope: what is included in the project and what is not.

A.3.2. Vision Goals

An important prerequisite for successful design, implementation and functioning of the SMS is the development of a corporate Vision of SMS in the statistical organization. The functions of SMS, centered upon metadata and data users, are oriented towards the diverse processes and activities of SIS. Organizational units within a statistical agency, respondents and end users are all involved in the preparation, implementation and use of the SMS tools. The Vision should be developed with the direct involvement of senior management within the statistical agency.

The Vision should be an integral part of the strategic direction of the statistical organization. It is an important task for the SMS management to ensure that not only the development of the Vision but also the SMS design, implementation and further development will be monitored by senior managers. For this purpose a relevant management structure of SMS should be established. Feedback and evaluation, supported by metadata accumulated in the previous processing cycles, should be an integral part of the SMS design.

The Vision should define major goals and functions of SMS for the SO (see “ The Role of SMS in the Chapter A1) and attribute the priorities for implementation. It should clearly identify the users of statistical metadata (inside and outside the SO) and determine their rights and obligations in the phase of design and development of SIS.

The metadata requirements associated with each element of standard business are articulated. That is all the points of contact between the metadata model and business processes, in terms of creation, update and use activities should be described.

Important part of the Vision should be analysis of the state-of-art of the existing statistical metadata objects and services, finishing by clear specification what kind of existing metadata can be used in the corporate SMS, what kind of existing metadata and services should be updated and what kind of existing metadata should not be used at all. Especially when the latest mentioned possibility appears, it is desirable to support SO in its decision to cancel such metadata blocks.

It is advisable, that the SMS is not developed as a purely technical project. It is still quite often the case in the SOs that the subject matter departments do not understand fully the requests formulated by the IT specialists. When developing the Vision, it is essential to express clearly that the first priority in the SMS is given to the safeguarding of the content and methodological integration of statistical data and metadata.

To make SMS a success story, the Vision and its functions should be based on the real existing possibilities of the SO. Effective management of SIS and integration process of information flows on national and international levels should remain one of the major goals of SMS.

The Vision should also encompass cost propositions of the SMS project. Costs should be proposed based on the real possibilities of the SO. Warning signs should be made to a very broad (although theoretically correct) requirements for the metadata functions. Such proposals should be very pragmatic, reflecting ultimate needs and metadata priorities. The experience shows that the human capacities and financial factor in the SMS developments could be quite demanding.

Experience shows, that many SOs implemented some functional blocks of metadata without having a complete SMS Vision at the beginning of the process. It is especially true for the objects dealing with the description of statistical data. It can be observed, that namely the following blocks of metadata have been frequently implemented: statistical variables and values sets, statistical surveys, social-economic classifications and nomenclatures, time series, statistical publications, statistical population, economic subjects, statistical units, aggregation and statistical evaluation methods, output tables and others.

Without having a coherent Vision there is very often a lack of coordination among individual metadata blocs. It causes many inconsistencies, duplications and, last but not least, the low efficiency of metadata tools from both, costs and staff capacities needed. The end users could, because of lack of coordination, struggle with unnecessary diversity of users' roles and related diversity of communication metadata languages. Such situation certainly does not stimulate enough joint cooperation of users with statistics on metadata implementation.

The Vision should contain a metadata model complying with the SMS functions. Such model should encompass metadata about data and processes behind them as well as metadata about other objects and processes of SIS relevant to the SMS functions, Metadata needed for the management and administration of statistical system and statistical organization like metadata about the costs and benefits, cost-effectiveness, satisfaction and complains should be also a part of such model. Metadata objects and links between them should be thoroughly defined.

An agreed conceptual metadata model should be linked to the standard business processes that are the part of the statistical life cycle. This linkage is used to determine what metadata should be collected. Metadata model should take account of and uses international standards where possible.

Figure 2 below provides an overview of the components of the SMS Vision.

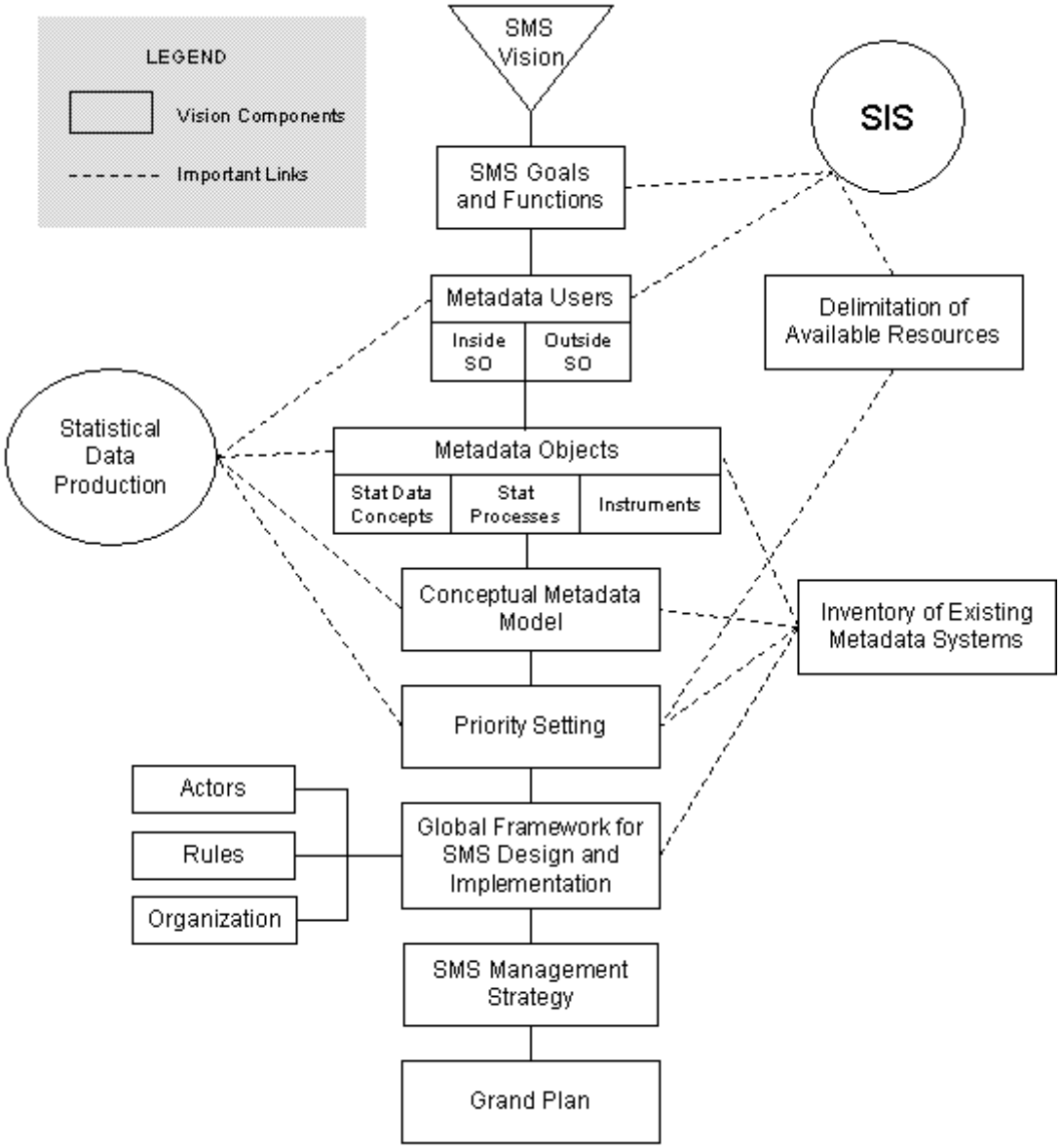

Figure 2: Schematic View of the SMS Vision and its Components

A.3.3. Metadata objects and metadata resources

Metadata should be structured according to the objects and the properties of those objects that they inform about. There are three major categories of metadata objects related to the functions defined by the Vision:

(i) statistical data and associated concepts
(ii) statistical processes and associated procedures
(iii) tools enabling production and usage processes

Different kinds of links exist between individual metadata objects, depending on the task being carried out.

(i) Statistical data and associated concepts

Metadata objects related to statistical data and associated concepts are all important tools supporting production processes and final use of statistical information. The most important objects are statistical concepts, statistical characteristics, statistical variables, population, classifications, registers, observation templates, statistical surveys, time series, aggregation and statistical methods, micro data, macro data, final outputs, statistical publications, statistical databases and archives. To this group belong, however, also respondents, end user, statistical websites and other metadata objects related to statistical data.

(ii) Statistical processes and associated procedures

Inside statistical processes and related procedures can be distinguished two major groups:

- those associated with statistical production (data collection, data storage, data evaluation, data dissemination); and
- those associated with SIS and statistical organization (planning and evaluation processes, supply processes, usage processes, total quality management and other management processes).

All processes as metadata objects are associated with several important metadata like costs, performance measures, errors and errors rates, diverse benchmarking indicators, etc.

Processes are related to metadata in three ways:

- they are objects of metadata, carries of metadata resources,
- they use metadata (about themselves and about other metadata objects and,
- they produce metadata (about themselves and about other metadata objects.

Figure 3 illustrates the links between the metadata objects described above at (i) and (ii).

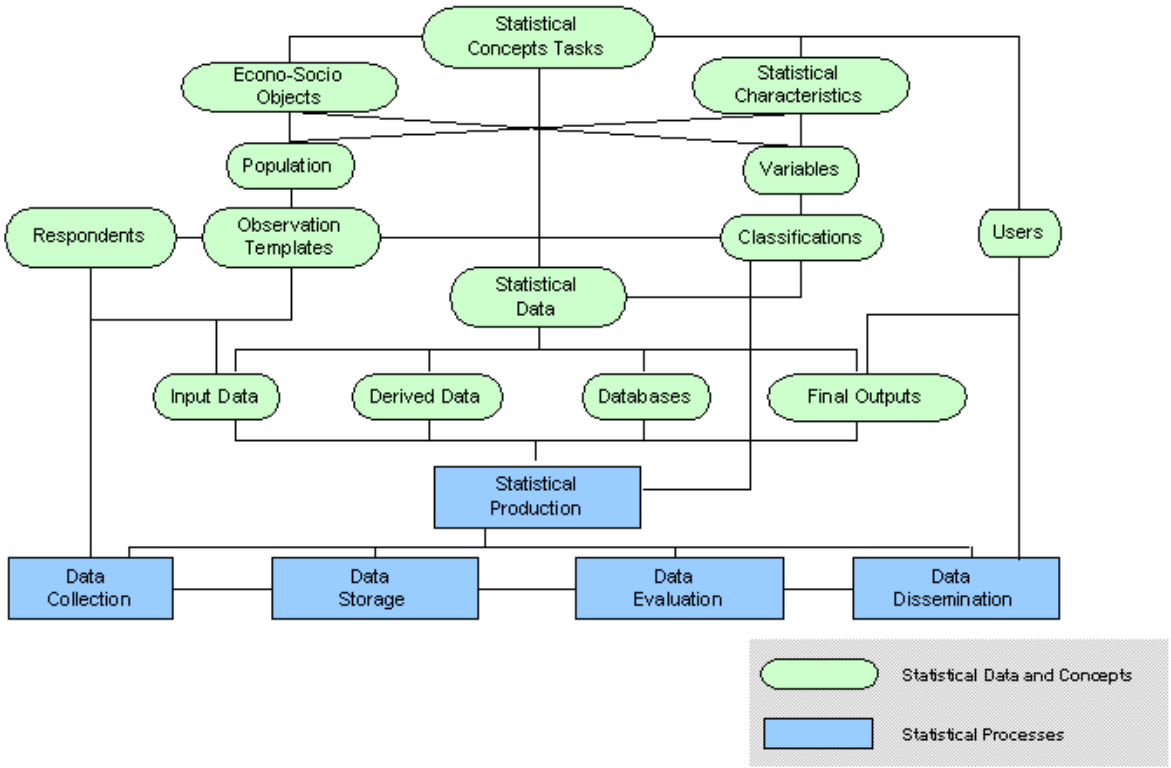

Figure 3: Example of metadata objects for statistical production process

(iii) Tools enabling production and usage processes

SMS should provide tools and vehicles that enable fulfilling the major SMS functions. Instrumental resources can be categorized, according to the functions they are supporting, as follows: (i) search and retrieval tools supporting use and other processes that need access to statistical data and metadata, (ii) production tools supporting statistical production and, (iii) knowledge resources supporting primarily the "intellectual processes" related around statistical system, such corporate management, planning and evaluation, research and development. Instrumental resources should be sharable by multiple processes. They need to be systematized and organized collectively in order to be easy to find and make use of.

In this respect, the Vision should promote the following:

- Development of common terminology for metadata elements across all processes in the statistical life-cycle;
- Development of common and consistent description of metadata elements allowing easy location, retrieval and exchange of data and metadata;
- Development of standard interchange representations allowing sharing of metadata and data between organizations;
- Implementation of consolidated metadata repositories facilitating reuse of metadata;
- Introduction of registration process giving authority to promote use of standard metadata elements and thereby increasing knowledge on metadata flows and statistical integration;
- Improvement of metadata quality;
- Ensure that the production process will be metadata driven.

A.3.4. SMS Planning

The aim of this subchapter is to draw attention to the preparation of a corporate strategic plan for the SMS development. A strategic plan should be an integral part of the SMS Vision, reflecting the goals and functions specified in this document. As a part of the Vision, the senior management of the SO should approve the strategic plan.

The development of a strategic plan needs to be a flexible and adaptive process, possibly with several iterations. The plan should give a visibility, clarity and stability in the development efforts, but aspects are likely to change during its implementation, which may take several years. Certain parts may never be implemented; other parts may be implemented in a different way than originally assumed. Completely new components may appear as a result of new needs, new methodological and technical developments and/or changes of some other basic conditions for the SMS development. Therefore, the plan should be regularly reviewed and revised.

Detailed plans should be developed and approved later on for the design and implementation phases of the SMS development. Such plans should reflect agreed priorities in the solution of individual components of SMS. Last but not least, specific plans should be prepared, of course, for the phases on the SMS use and evaluation.

When preparing a strategic plan, the number of activities, sensitivity of their solution and their priorities for the SO should be taken into the consideration. Links among individual activities and importance of their contribution to the SMS strategic goals should be thoroughly analyzed. Conditions, under which the goals could be carried out, should be clearly specified.

A part of the plan should be establishing of an organizational framework and management strategy.

The strategic plan should be developed and approved by all actors involved in the design, implementation and maintenance of SMS. It is therefore indispensable that such plan is prepared in close dialogue and cooperation with all actors involved in the process of SMS development. The planning could be often made more explicit, so that the whole SO, can discuss the strategies to be used and the choices to be made in the step-by-step development of SMS.

Some Practical Recommendations for Establishing the Strategic Plan:

- When preparing the plan, the SO should consider its current capabilities. Available human and financial resources, as well as organizational and technical feasibility, should be carefully analyzed in order to make the plan realistic.

- Goals defined in the Vision should be transformed into practical steps to which priorities are then assigned.

- Practice shows, that different countries often have similar priorities. This is especially true for the development of databases on statistical classifications and nomenclatures (Nordic countries, Switzerland, France, Australia, New Zealand), aggregated output databases (Nordic countries, Switzerland, the Netherlands, Australia, U.S. statistical agencies, CZSO), and metadata models for the websites (Nordic countries, Switzerland, the Netherlands, Australia). Some countries give priority to the microdata metadata models (the Netherlands, U.S. Bureau of Labour Statistics, Austria).

- Quality of data and metadata should be considered a high priority.

- External cooperation should be clearly defined; categorization and priority setting for external users should be specified. The plan should take the existing working plans of all external partners into consideration.

- The plan should be prepared in such detail that all partners will be able to commit their participation.

- External projects to establish data and metadata warehouses, both on the national and international level, should be considered for potential impact on the SMS.

- External activities on data security and data confidentiality related to the SMS should be considered.

- An integral part of the plan should be activities dealing with the development and implementation of international standards.

- The plan should also consider activities to promote the SMS and create an atmosphere of cooperation with all participating parties. To this end, prototypes for demonstration of SMS functions could be useful.

- Research activities on feasibility studies and analysis of user feedback should be also taken into the consideration when preparing an SMS plan.

- Transfer of know-how and training for participants in the SMS development process should be incorporated in the plan.

A.3.5. Management Strategies for Corporate SMS

The Vision should dictate basic rules for organization and management strategy. Establishment of the management structure for the SMS project should include senior management in a lead role. This senior management involvement should not just be from the technical and methodological areas, but most importantly, should include senior executives from the statistical areas.

A framework for the metadata management strategy should be specified in the Vision. Responsibility for development of metadata policies and procedures and for providing training and advice to developers should be clearly assigned.

An important part of the SMS management strategy should be a systematic cooperation with major metadata stakeholders.

Implementation of the metadata management strategy should follow two broad approaches. They are:

(i) User orientation – focusing on information relevant to usage such as finding and accessing data, understanding their structure and meaning, assessing their quality and relevancy, and using them correctly. This focus is dissemination oriented; and

(ii) Producer orientation – metadata driven approach focusing on the needs of information systems and e- processing.

A set of core principles that inform decisions and projects related to metadata should be established. A proposal of core principles for metadata management is presented in Chapter 4.

There are two major dimensions which should be taken into consideration when deciding on SMS management strategy: (i) the crosscutting nature of the SMS role and its functions in statistical organizations and, (ii) the requirement of corporate management during all phases of SMS development and use.

A.3.5.1. SMS management across the whole statistical organization

Diverse organizational units of the SO and external bodies will participate in the SMS project. Senior and middle management, subject matter experts, methodologists, IT units as well as respondents and end users of statistical metadata and data, are all important SMS partners. Functions of SMS partners will differ whether they will participate in the SMS as metadata users, designers, developers, producers, administrators or evaluators.

The points below outline some recommended practices to ensure involvement in SMS management across the whole organization.

- The roles and responsibilities of all partners should be clearly defined, understood and followed. Where possible, automated workflows can be used to enforce agreed role and responsibilities.

- The integration role played by SMS, both inside and outside the SO, and therefore the necessity of senior management involvements, should be clearly recognized when defining the SMS management strategy. The management of traditional statistical activities in the SO is performed in the framework of individual statistical domains, tasks and/or projects in accordance with the organizational structure of the SO.

- Metadata management is part of every project and should be considered alongside resource allocation and accountabilities, in the same way as business processes and data flows are considered.

- Establish SMS management boards to take an ultimate, corporate view on all decisions dealing with the SMS development.

- SMS management strategy should be specified in close alliance with the existing managerial structure of the SO. With the lead role of the senior management in the SMS management model, clear links should be defined also in the middle management level and in the experts' level (methodologists, subject matter statisticians, IT experts). A model showing a crosscutting nature of the SMS management is presented in the *Figure 5*.

- A multidisciplinary team should be the major organizational form for the development of SMS project. The ideal SMS Team(s) will include: statistical methodologists; subject matter statisticians; dissemination specialists; end users; specialists in the implementation of statistical standards; researchers; and IT specialists in data modeling, business process design, architecture and applications development.

- Implementation of a SMS management strategy may highlight the need for change in the organization of statistical activities, particularly where a corporate SMS does not exist. It is especially true for subject matter statisticians. Many critical moments could appear. Such moments should be as much as possible foreseen and reflected when progressing from the definition of the Vision goals and activities to the Vision plans. More detailed considerations about the corporate metadata management are given in the Chapter 5.

A.3.5.2. Good advice for metadata projects

If you are a designer

- Avoid uncoordinated capturing of similar metadata – build value chains instead. Similar, but not identical, metadata may be needed for different purposes. For example, different users of statistics may require metadata of different depth and presented in different ways. Capturing and maintaining similar metadata without sufficient coordination will cause duplications of efforts and may at worst result in metadata that are, or seem to be, in contradiction to each other. A way out of this problem is to create so-called value chains, starting from a basic set of metadata, and then refining these metadata in different directions into metadata end products that are tailor to different needs. For example, a basic documentation of a statistical production system may be refined into different kinds of product overviews and quality declarations.

- Transform data and accompanying metadata in synchronised, parallel processes, fully automated whenever possible.

- Data management processes in statistical organizations have been formalised and automated for a long time. In contrast, the necessary, accompanying metadata have remained manually handled to a great extent, and the manual metadata transformations have not been well coordinated with the automated data transformations. For example, one and the same variable may (more or less unconsciously) have been given different name labels by (a) the designer of a questionnaire, (b) the programmer of data collection and data management software, (c) a programmer of tabulations, and (d) an editor of output tables as presented in statistical publications.

If you are a project coordinator

- Form coalitions around metadata projects.

- All partners of a metadata project should both contribute something and gain something from the project. Preferable each partner should gain more than he or she contributes – a win/win situation. As a collective the coalition should control all resources needed, including the necessary management authority, to make the metadata project a success.

- Make sure that senior management is committed. Most metadata projects are dependent on constructive cooperation from all parts of the organization.

- Organise the metadata project in such a way that it brings about concrete and useful results at regular and frequent intervals.

If you are a senior manager

- Make sure that your organization has a metadata strategy, including a global architecture and an implementation plan, and check how proposed metadata projects fit into the strategy.

- Either commit yourself to a metadata project – or don't let it happen. Lukewarm enthusiasm is the last thing a metadata project needs. There is often scepticism in the organization against metadata projects – for both good and bad reasons. Moreover,

metadata projects are usually strategic projects for the organization. If they should be carried out at all, mangers on different levels and in different parts of the organization must be committed to the project. The senior manager is the obvious enabler of this commitment.

- If a metadata project should go wrong – cancel it; don't throw good money after bad money. Metadata projects are often more abstract, more complex, and more difficult to manage than many other types of projects. It is nothing to be ashamed over to fail now and then. But watch out for early signs of fatal problems, and encourage project leaders to admit that problems exist. Discourage idealizing progress reports.

- When a metadata project fails, make a diagnosis, learn from the mistakes, and do it better next time. There is not so much need for finding scapegoats. It is much more important to learn for the future.

- Make sure that your organization also learns from failures and successes in other statistical organizations. Benchmarking and international cooperation is always useful.

- Make systematic use of metadata systems for capturing and organising tacit knowledge of individual persons in order to make it available to the organization as a whole and to external users of statistics.

A.3.5.3. Corporate management of all phases of SMS development and use

The management strategy should encompass all phases of the SMS life cycle. The governance of metadata management and the monitoring of outcomes should be made clear in the SMS management strategy.

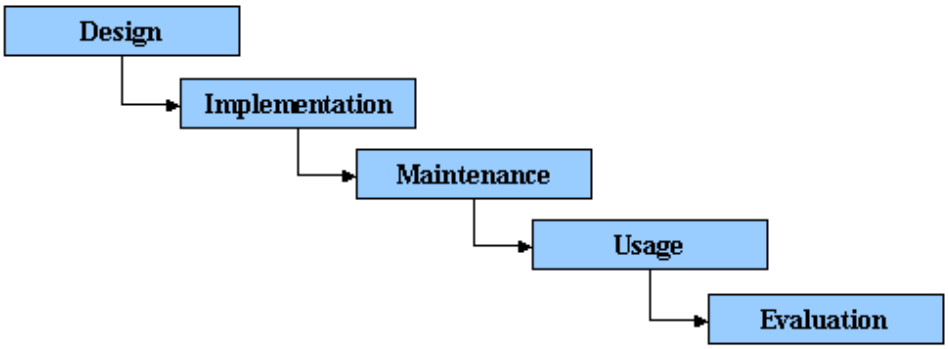

Figure 4 The SMS Life Cycle

As illustrated in *Figure 4*, the SMS life cycle is composed of the following five major phases: (i) SMS design, (ii) SMS implementation, (iii) SMS maintenance, (iv) SMS usage and (v) SMS evaluation. *Figure 5* below presents a model for management strategy of the SMS life cycle.

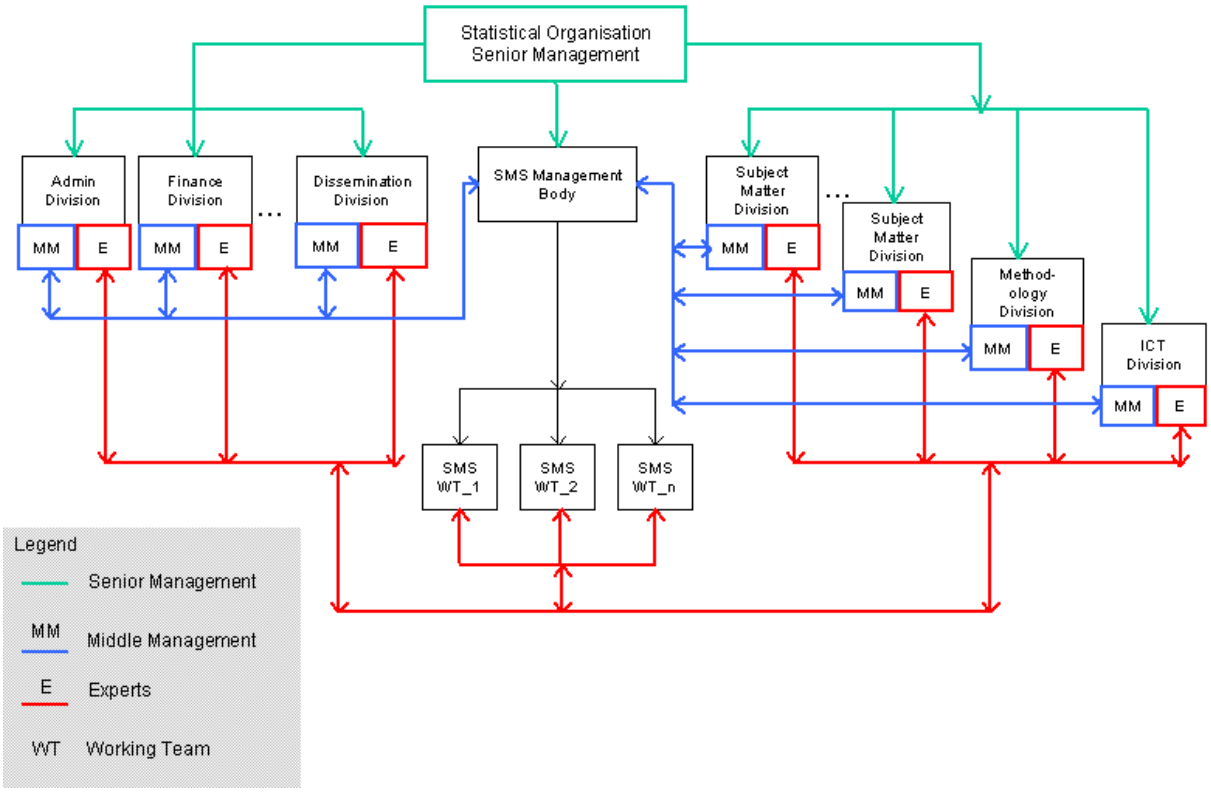

Figure 5: SMS Management Model - Cross-cutting Strategy

The most important activities in the individual phases of the SMS life cycle, which should be taken into the consideration when preparing the SMS management strategy, are outlined below.

(i) Management of SMS design

The role of the design phase is to develop the SMS Vision, global architecture and to establish a management and implementation strategy for the project. The most important functions, tasks and activities for consideration are as follows:

- The development of the SMS Vision is described in the subchapter A 3.1.

- Development of an SMS global architecture. A major strategy for ensuring the overall efficiency and usefulness of the metadata-related work in the SO is to develop a global architecture for all processes that will work with statistical metadata in the foreseeable future. There are several purposes for such exercise. One is to make an inventory of all metadata systems that need to be considered. This inventory should be developed in close cooperation between stakeholders in order to ensure, that nothing important has been forgotten. The inventory could be an excellent basis for putting priorities to different metadata tasks.

- Specification of common components. By analyzing and structuring an inventory it should be clear what metadata components are common for different purposes. For diverse systems, processes and tasks that are designed in a standardized way are able to communicate via standardized interfaces. Such components may be given a higher

priority from a global SMS perspective than they could have got if considered from a local point of view.

- Impact of SMS on existing statistical production system and other processes in the SO is evaluated in the Vision. Processes should be reengineered where necessary in preparation for implementation.

- The metadata requirements associated with standard business processes are articulated, i.e. all the points of contact between the metadata model and business processes, in terms of creation, update, and use activities, is described. For example, metadata associated with understanding user needs, frameworks and standards is acquired and used to inform later phases. To the greatest extent possible, the necessary input and output metadata is captured early on in the collection strategy stage, so that we know well in advance that the desired outputs are obtainable, fit for purpose, etc.

- SMS partners should be committed to participate in all phases of the SMS life cycle Major partners in the design phase are the users (both, inside and outside SO), methodologists, subject matter statisticians and IT expert.

- Feedback and evaluation is an integral part of the design process and is supported by metadata accumulated in diverse phase of the SMS life cycle.

- Financial requirements for implementation phase should be specified.

- A global plan for SMS development should be established and approved by all participants. Some important recommendations for planning are given in the subchapter A 3.3.

(ii) Management of SMS Implementation

The role of the implementation phase is to implement SMS so that it is ready for use. The following major function, tasks and/or activities should be considered when preparing a metadata management strategy.

- Tools and metadata vehicles specified in the Vision should be developed and tested by all users they were prepared for. Users' manuals and documentation should be developed. Testing should be conducted before making SMS available for the users. Training for all metadata users should be organized.

- Completeness of implementation. The implementation of all SMS subprojects could be a long process. Depending on the links between them, some subprojects can be implemented in parallel and some projects should be completed sequentially. A very important role of the SMS management is continuous monitoring of the implementation from the cost viewpoint.

- Coherent technical implementation. To implement SMS as a technically coherent project should be recommended. It will allow to settle standard links between metadata objects and processes, to develop standard metadata tools for searching, retrieval, exporting and downloading metadata and to harmonize, technical

administration will be easier. Standard operations for administration of diverse metadata can be easily ensured.

- An agreed set of definitions and terminology should be developed. Consideration of national and international terminology standards is of high importance.
- Corporate metadata repository (CMR). A crucial task in the implementation phase is to set up a CMR. This is the physical implementation of the metadata model defined in the Vision and it is likely to be used by all SO projects. The concept of the CMR should be developed, although there could be a number of physical repositories. To develop an appropriate CMR architecture is a demanding task and there is no blueprint for such an exercise. However, many national good practices exist[12] that may be a useful guide.
- Physical loading of metadata into the CMR. Metadata owners should accomplish those activities. This is a resource-consuming task and the impact on subject matter staff should be recognised. For many, capturing metadata is a tedious extra task that brings them no perceived benefit. A characteristic of the 'system' therefore, is that as much metadata as possible is captured automatically, as a result of a computer process or as a result of a required business process undertaken by a person. [Being realistic however, it is inevitable that some metadata will have to be re-entered by humans]. Thorough management and planning of those activities is imperative.
- Existing processes using statistical metadata should be reengineered.
- Outsourcing possibilities for the SMS implementation should be considered.
- Detailed and coordinated plans for all stages of SMS implementation should be prepared and approved by all partners at the beginning of the implementation phase. The basic framework of the SMS plan is defined in the Vision.

(iii) Management of SMS maintenance

The role of the SMS maintenance phase is to ensure that all metadata stored in the CMR is up-to-date for ongoing use. To keep metadata up-to-date is the requirement of primary importance for all metadata users. The following recommendations should be taken into the consideration when preparing a strategy for the management of this phase:

- The major functions to be considered by the SMS management are those relating to the Administration of metadata content.
- Ensure timeliness and coherence of maintenance activities.
- The metadata management should oversee the definition and maintenance of all metadata stored in CMR, although other SO units will contribute to its ongoing enhancement.

[12] The United Kingdom and the United States may provide examples of good practice in developing and maintaining corporate metadata repositories. Recommendations of any other countries that may provide a good example of this would be appreciated.

- SMS management is responsible for definition of policies, procedures and protocols around the CMR maintenance. A ‘registration authority’ manages all metadata entities in CMR. The major partners for the SMS management are the “owners” of metadata. The owners are, according to the concepts of registration of metadata object specified in the Vision, authorized for keeping up-to-date the metadata that they are responsible for.
- The concept of registration of metadata objects, ownership of metadata, what is the 'standard' for a particular classification or data item, what are the permitted variations from the 'standard' etc should be all clearly defined, agreed and used.
- Rules and guidelines should be developed for the maintenance of each metadata entity in the CMR and responsible metadata owner. It could be recommended that the rules and guidelines will be approved by the senior management and become official documents of the SO.
- Preparation of rules and guidelines requires joint work with owners. Methodologists are also the important partners in this process.
- Management should not only delimitate an organizational background for the maintenance activities, but also should also assure maintenance of metadata history and update links between metadata in the CMR.
- Ensure that all maintenance functions, performed by metadata administrators and diverse metadata owners, use a coherent/standard set of metadata tools and vehicles. Such vehicles should be available especially for the following maintenance functions: search and retrieval, inserting and deleting of metadata objects and related parameters, changes and corrections, presentations and exports, metadata editing and consistency controls, checking and updating of metadata links, maintenance of metadata history.
- Planning is an important instrument for managing the maintenance phase. Everyone participating in the maintenance processes should approve a detailed plan of maintenance activities, which meets required timelines. Such a plan is an indispensable instrument for management to fulfill a smooth and coherent monitoring of the phase of metadata maintenance.
- Training of metadata owners in the Rules and Guidelines prepared for maintenance activities.

(iv) Management of SMS use

The role of this phase is to ensure efficient use of metadata and metadata tools by all users specified in the Vision. Production of official statistics and other internal users in statistical organization together with all groups of external users of metadata specified in the chapter A 2.2. belong to potential metadata users. A great effort should be made by management to monitor and coordinate activities and processes dealing with metadata usage by diverse users. The metadata strategy in this phase should encompass especially the following functions:

- Prepare, maintain and coordinate detailed plans of metadata use by all metadata users. To ensure requested metadata quality within required deadlines. The coordination of plans developed for individual users is a major goal of the management.

- Statistical production process. The units responsible for statistical production are accountable for the preparation and maintenance of plans related to the activities dealing with the production process. In this case, the SMS management should ensure that all activities dealing with the use of statistical metadata and metadata tools are well planned and defined.

- Oversee the availability of metadata and metadata tools. It is important to ensure the links between the metadata maintenance and the metadata use. Metadata users should be sufficiently informed about all changes in the metadata contents.

- Organize a permanent feedback from users about metadata quality and the availability and efficiency of metadata tools. Feedback operations could be integrated in the regular activities of the metadata use. Specially organized surveys on users' satisfactions are useful, but not always fully satisfactory source of information.

- SMS management (in close cooperation with the SMS technical administrator) should be aware of the software and technological environment related to the use of metadata and metadata tools. As it was mentioned earlier, the metadata and metadata tools should be platform independent. However, it could be useful to maintain information about changes in the users' software environment.

- Statistical websites are an integral part of an SMS implementation and the use of metadata. Furthermore, they are a regular part of the dissemination strategy of SOs. The structure and quality of metadata presented on the website are important tool for the satisfaction of the metadata users. The needs for statistical metadata on websites varies according to the needs of the individual users groups'. It is therefore very important to monitor the use of statistical metadata on websites in order to keep track of users' satisfaction and evolution in their needs.

(v) Management of SMS evaluation

The goal of the evaluation phase is to determine the efficiency of existing SMS functions and make proposals for improvement or further development of SMS. There are clear links to the knowledge and experiences accumulated in the earlier phase of the SMS life cycle, namely in the phase of the SMS use. Preparing proposals for further SMS development, the SMS evaluation phase makes a loop between the use and design phase of the SMS.

The management strategy of the SMS evaluation phase should follow especially the following procedures and tasks:

- Specify major targets of SMS evaluation and, based on the targets, to prepare a plan of evaluation activities and procedures. It should be clear which functions and aspects of the SMS are to be evaluated.

- Evaluation of the users' satisfaction should be a permanent part of the SMS life cycle. The most important object of evaluation will certainly be the external user. It should be ensured however, that the satisfaction of other users' groups would also be evaluated.

- Other important aspects for evaluation are cost efficiency, implementation of standards, organization of work, maintenance procedures and technological implementation.

- In principle, there could be three major forms of evaluation: (i) regular long-term evaluations (e.g. at 3 year intervals) that examine overall effectiveness of SMS functionality; (ii) regular short-term evaluations (e.g. annually) that primarily assess user satisfaction; and (iii) ad hoc evaluations as deemed necessary.

- Benchmarks should be established for all defined targets and benchmarking parameters should be defined. Evaluation methods should be specified and agreed. For some cases an efficient benchmarking method is to compare experiences and plans with those of a similar organization. International cooperation could be highly efficient in this respect.

- Appoint evaluators for planned evaluation activities. For evaluating user satisfaction, a team of evaluators should include both staff from the SO and metadata users. For evaluation of the project's efficiency and the overall technological solution, it may be useful to hire external evaluators as they provide an independent view.

- Integrate information on the user feedback collected in the phase of the SMS use.

- Organize a preparation of specific surveys on users' feedback.

- Report to the senior management of the SO on the evaluation outcomes and, based on the conclusions made by the senior management, to organize steps for improvement of and/or further development for the SMS

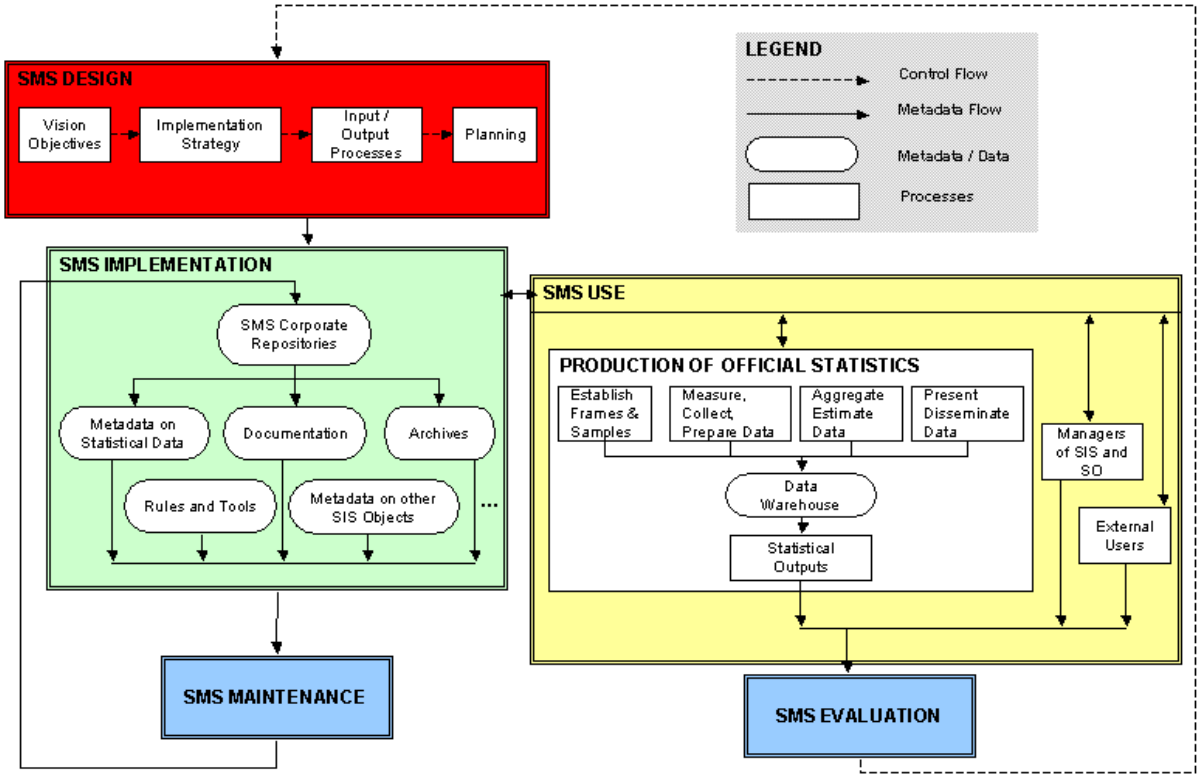

Figure 6: Model for integrated management of SMS

A.4. Core principles for metadata management

This section outlines the core principles and recommendations for effectively managing the design and implementation stages of an SMS project.

1. Make metadata-related work an integral part of business processes across the organization.
2. Describe metadata flow with the statistical and business processes (alongside the data flow and business logic).
3. Ensure that customers are clearly identified for all metadata processes, and that all metadata capturing will create value for stakeholders.
4. Metadata presented to the end-users match the metadata that drove the business process or was created during the business process.
5. Develop SMS as a self-sustainable project, independent of any e-production systems.
6. The SMS is the definitive set of tools, stores and services to support metadata use and further development in SO. If a metadata store, tool or service is not defined by the management to be a part of SMS, then it is not an “approved” metadata facility.
7. The diversity of metadata is recognised and there are different views corresponding to the different uses to which the data is being put. Different users require different levels of detail. Metadata appear in different formats depending on the processes and goals for which they are produced and used.

8. Make metadata active to the greatest extent possible. Active metadata drives other processes and actions will therefore be accurate and up-to-date.
9. Manage metadata with a life-cycle focus (including maintenance and update).
10. Preserve history (old versions) of metadata.
11. Capture metadata at their natural sources, preferably automatically as bi-product of other processes. Minimize errors by entering only once where possible.
12. Exchange metadata and use it for informing both computer based processes and human interpretation. The infrastructure for exchange of data and associated metadata should be based on loosely coupled components, with choice of standard exchange language, such XML.
13. All data and other objects of SMS are well supported by accessible metadata that is of appropriate quality.
14. Ensure that metadata is readily available and useable in the context of client's information need (whether client is internal or external).
15. Single, authoritative source ('registration authority') for each metadata element.
16. Registration process (workflow) associated with each metadata element, so that there is a clear identification of ownership, approval status, date of operation etc.
17. Reuse metadata where possible for statistical integration as well as efficiency reasons (no new metadata elements are created until the designer/architect has determined that no appropriate element exists and this fact has been agreed by the relevant 'standards area').
18. Cost/benefit mechanism to ensure that the cost to producers of metadata is justified by the benefit to users of metadata.
19. Variations from standards are tightly managed/approved, documented and visible.
20. Ensure a systematic training and transfer of know how for all partners involved. Train trainers.

A.5. Corporate Governance Models for Metadata Management

A.5.1. Introduction

It is not sensible to prescribe an ideal model for corporate governance of metadata. This is because every national statistical organization works under different legislation, organizational arrangements, organization culture, business rules, levels of autonomy with respect to central public sector agencies, etc.

Therefore, in this section of the manual, we look at 'good lessons' for governance. Each SO that is implementing a metadata management strategy might evaluate its objectives, strategies, organizational arrangements and plans against this wisdom that is generated from many metadata and other information management projects.

The Eurostat sponsored project, Metanet, concluded in 2003 had one working group looking at Adoption Issues in respect of statistical metadata systems. The third section in this chapter provides some extracts from the report about barriers and organizational issues - both matters are relevant to governance.

The fourth section is a case study of corporate governance at the Australian Bureau of Statistics to give readers a concrete example of the issues associated with governance.

A.5.2. Lessons for Good Corporate Governance of Metadata

What are some of the lessons for corporate governance of data and metadata management that have come from the experiences at national statistical agencies in the implementation of a metadata management strategy?

1. Senior management group, including the Chief Statistician, should be very involved in policy formulation, approval of development projects and monitoring of outcome achievement. It is very helpful when your CEO and other senior executives ask questions about metadata matters.
2. Clearly understood roles and accountability for all organizational units with respect to metadata. The subject matter areas are responsible for the creation, maintenance, re-use, and approval for dissemination of all the data and metadata content for their statistical domain. A 'corporate data management unit' could be accountable to provide client support to SMAs, develop and maintain infrastructure, provide training,etc
3. The organization should develop an information management culture. That is, all staff understand that it is their responsibility to work towards achieving the ideals of statistical integration, comparability of statistics across surveys and time, and to reuse statistical metadata as appropriate. These goals are achieved by adherence to the metadata management principles.
4. Utilise existing governance arrangements to reinforce the metadata messages, that is, do not create new committees. Particular specialist staff eg business and systems analysts, IT architects, statistical standards experts, are more likely than others to come across new opportunities for advancing better metadata integration, so a particular focus is needed on working with these staff.
5. Make sure that your organization has an endorsed metadata strategy, including a global architecture and an implementation plan, and that this strategy is integrated into broader corporate plans and strategies.
6. Either commit yourself to a metadata project – or don’t let it happen.
   Lukewarm enthusiasm is the last thing a metadata project needs.
7. There is often scepticism in the organization against metadata projects. Moreover, metadata projects are usually strategic projects for the organization. If they should be carried out at all, managers on different levels and in different parts of the organization must be committed to the project.
8. Metadata projects are often more abstract, more complex, and more difficult to manage than most other types of projects. These characteristics need to be recognised in project plans, and the importance of communication with the rest of the organization about the project cannot be overstated.
9. Make sure that your organization also learns from failures and successes in other statistical organizations. Benchmarking and international cooperation are always useful.
10. Make systematic use of metadata systems for capturing and organising tacit knowledge of individual persons in order to make it available to the organization as a whole and to external users of statistics.

A.5.3. Barriers to the Introduction and Use of Statistical Metadata Systems

One of the Working Groups in the Metanet Project explored adoption issues with respect to statistical metadata systems. Realisation that there are potential barriers is an important part of the management and governance of such projects. Consideration of appropriate risk mitigation actions is a significant part of project governance. This subsection explores some of the potential barriers to the adoption of metadata solutions - technical, organizational and human - that were identified by a survey conducted as part of the Metanet research.

The Metanet working group included in their survey of national statistical organizations questions seeking to identify in which area each of the potential problems were most important as well as to go into more detail concerning the different aspects of human related issues.

A.5.3.1. Most important challenges to introduction of metadata systems

The respondents were asked to answer the following question: "For each aspect of metadata please indicate what in your view poses the greatest challenge to the introduction or use of statistical metadata systems in your organization". The result of this for all organizations was the following.

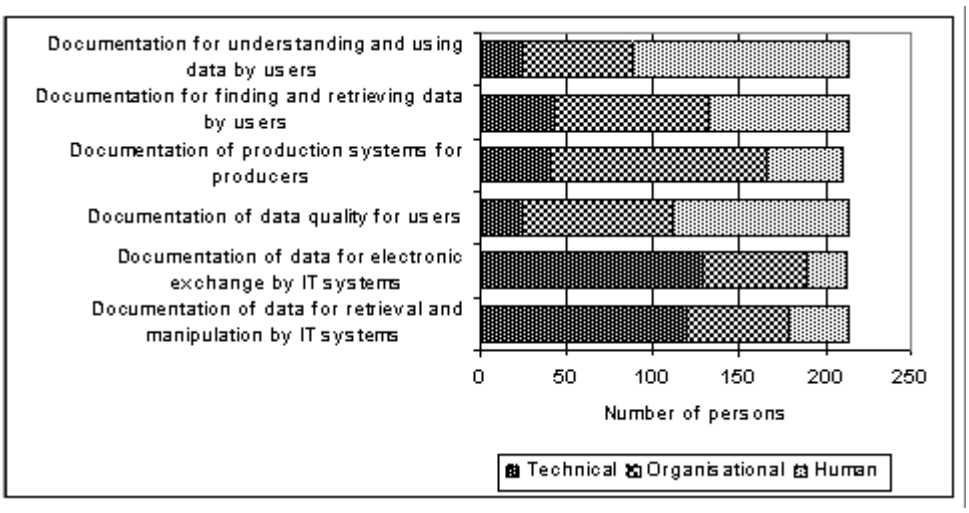

Figure 7 Perceived challenges to introducing or using statistical metadata systems

According to this, the greatest challenges in relation to documentation and retrieval of data are considered to be partly organizational and human. On the other side, the technical challenges are the most important in relation to documentation of data for exchange and retrieval by IT systems.

A.5.3.2. Human issues in relation to adoption of metadata systems

The Metanet working group reported: "The human factor is fundamental to the successful adoption of metadata systems, yet a number of challenges have been identified. At present there might be a substantial gap between some of the more theoretical and abstract contributions on metadata, as presented within the MetaNet project, and what is considered to

be applicable by many practitioners within statistical organizations. Some subject matter specialists tend to dig down into one specific area and not take into account the long time perspective for documentation. Motivation for general metadata solutions might therefore be low. There is a need to acquire input and feedback from subject-matter specialists from different areas regarding metadata/data concepts and methods in order to come up with viable common standards and methods for metadata. However, the viability of metadata solutions presupposes the motivation and commitment of metadata providers. Given that an inability to engage this community constitutes a major concern to many statistical agencies (as identified through initiatives such as AMRADS) it is important that underlying human barriers are fully understood, if they are to be redressed in future.

The respondents in the survey were asked to identify the most significant barriers to the provision of effective metadata within their own organization, as far as human issues are concerned.

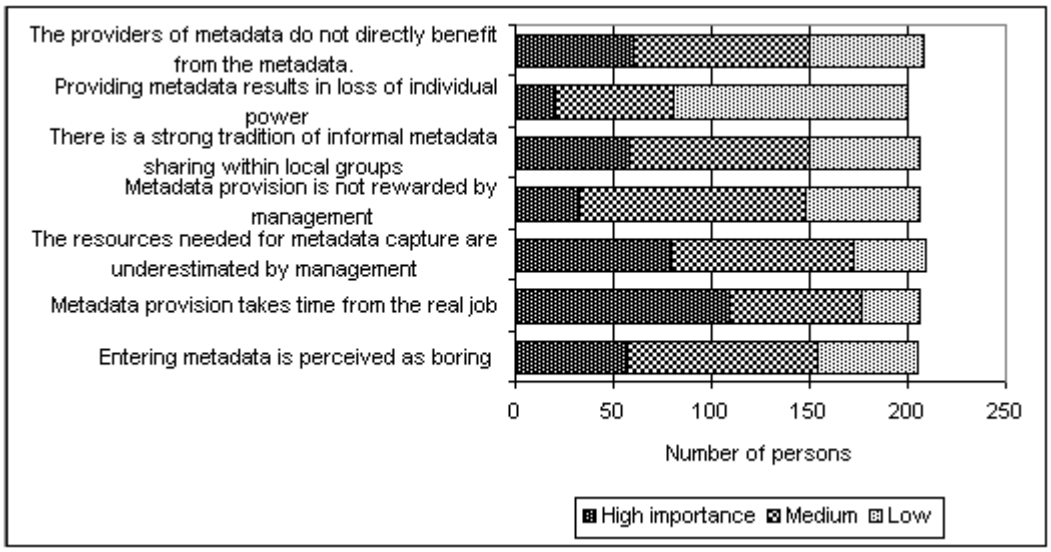

Figure 8 Perceived barriers to the provision of effective metadata

Whilst the result indicates that there is no clear consensus on what the main barriers are, the majority think that loss of individual power as a result of providing metadata, frequently *perceived* as a significant deterrent, is **not** significant. Other possible issues that have often been suggested, namely that metadata provision is boring and does not benefit the provider directly were largely identified as being of only medium importance. Of greater significance was the belief that time spent providing metadata detracts from the real job. This suggests that the importance afforded metadata creation is low and that this activity will inevitably suffer at the expense of traditional work aspects. Moreover, over 25% think that management underestimates resources needed for metadata capture. Thus, if the barriers to effective metadata provision are to be overcome, the status of the activity must be elevated. This demands not only the education and active involvement of would-be providers, but also increased management awareness and support."

A.5.3.3. Organizational issues

The MetaNet report says: "It is often emphasized that it is necessary to ensure the

commitment of top management in order to succeed in putting in place metadata solutions. In addition, organizational issues might be critical when planning and implementing metadata strategies and applications- even if these are not often put high on the agenda for meetings discussing metadata. Thus one should discuss questions such as what type of staff should be involved, and to what degree there should be a central unit, and what tasks should such a unit could cover. The survey tried to address some of these issues without trying to go into detail.

However, there are several more fundamental issues that need reflection in order to achieve this commitment and implement a proper organization:

- First of all it is necessary to reach a common understanding within the organization of what metadata is and what the functions are. The specification of these functions will have several implications on how projects should be designed and organised and how running tasks should be taken care of.
- Organization of tasks related to metadata should be based on a strategy for the information management of the organization. One reason for the failure of specific metadata projects can be that they are not anchored in a more global view of the information architecture.
- In order to sell the need for basic changes in technology or organization to improve data/metadata management it is necessary to present the benefits and the proposed solutions in an understandable way - possibly based on practical experiences acquired in other organizations. Management is not prone to take decisions involving risk to continuity of production. Once again, management might not be a barrier, but the limiting factor might be the experts' ability to come up with convincing and practical proposals related to metadata. Proposals that reach too far and have a too long time perspective will have difficulties as management normally will ask for quick results within a short time frame.

A.5.3.3.1. The degree of central coordination

One might assume that a central coordinating unit at least is a signal that metadata/documentation is important and that there is a relatively high level of horizontal coordination. According to the overview presented in table 6 only 3 NSIs reported to have a strong central coordinating unit, whereas a majority of the NSIs had a coordinating unit with limited tasks. The data archives apparently have a stronger central organization taking care of this topic. Even if the data archives often are rather small organizations having more limited tasks compared to the NSIs, this supports the impression that the data archives have taken documentation seriously for a long time, both for internal and external purposes.

	All	**NSIs**	**Data archives**	**Other**
A. Strong central coordinating unit -	9	3	5	1
B. Coordinating unit with limited tasks - decentralised organization	20	15	2	3
C. No coordinating unit - distributed organization	5	3	0	2
D. Other/no answer	4	1	1	2

Total	38	22	8	8

A.5.3.3.2. Tasks of a coordinating unit

The contact persons were asked to indicate the tasks allocated to any coordinating unit. It is interesting to note that for a majority of both the NSIs and the other organizations having some central coordination, an important task for this unit was to develop common systems and solutions. These coordinating units also have an important role to play in developing common terminology and standards and to ensure general coordination and information in this field of work. Supervision and training apparently is not an important task of many units.

	All	**NSIs**	**Other**
General coordination and information	20	10	10
Developing common terminology and standards	22	13	9
Developing common systems and solutions	23	14	9
Supervision and training	13	8	5
Other/not specified	2	2	0

A.5.3.3.3. The involvement of different types of specialists

IT specialists appear in most organizations to have central positions in relation to planning and development of metadata systems and solutions, which is not surprising due to the traditional importance of metadata in computer based systems. Also specialists in statistical methodology have in most organizations a central role in this area. On the other side it is perhaps somewhat worrying that management and subject matter specialists are to a lesser degree involved.

Expertise/Specialist	**NSIs**		
	Central involvement	**Partly involved**	**Not involved/not relevant**
IT specialists	15	5	1
Management	6	11	4
Statistical methodology specialists	12	8	1
Subject matter specialists	14	14	3

A.5.3.3.4. Cooperation with other organizations

Metadata is a field of work where one should expect a large degree of cooperation with other organizations in order ensure harmonisation and exchange of best practise. The survey confirms this. A large majority of the NSIs foresee cooperation with statistical organizations in other countries in this field, whereas many also see a possibility for cooperation with consultants and vendors of IT systems. Cooperation with international organizations is also foreseen. Many NSIs foresee cooperation with data archives/documentation centres.

	NSIs		
	Absolutely	**Possibly**	**Not planned**
IT system vendors/consultants	2	13	4
Other stat. org. in own country	6	5	8
Other stat. org. in other countries	14	4	1
International organizations	11	7	0
Data archives/documentation centres	5	9	5

Many large statistical organizations are searching for efficient models for handling data and metadata in an integrated way throughout the production process. Decentralisation of technology, in some cases also leading to loss of central documentation of files and processes, has in many organizations made it even more important to find ways and means for coordinating documentation across the organization.

Thus it is useful to look more into the experiences of different organizational models in order to achieve common and efficient metadata solutions. "

A.5.4. Case Study - Australian Bureau of Statistics (ABS)

What is the situation with corporate governance at the ABS?

The ABS is headed by the Australian Statistician - a statutory office. Administratively, the ABS is included in the Treasury portfolio, along with the Taxation Office. Although the Australian Statistician might occasionally work with the Treasurer (a very senior Minister in the Government), it is more usual for the Statistician to deal with a junior portfolio minister when interaction with the government is needed.

The Statistical Operations of the ABS are divided into two groups: the Economic Statistics Group and the Population Statistics Group. Each group is headed by a Deputy Australian Statistician. The staff responsible for the Technology Services, Methodology, Information Management, and Corporate Services Divisions, report directly to the Australian Statistician (known as First Assistant Statisticians).

ABS corporate governance arrangements ensure transparency in decision making and operation, and accountability to stakeholders by promoting strong leadership, sound management and effective planning and review.

An important element of the ABS governance arrangement is the Australian Statistics Advisory Council, established by the *Australian Bureau of Statistics Act 1975* to assist the ABS to fulfil its role. The Council is the key advisory body to the ABS and provides valuable input to the directions and priorities of the ABS work program and reports annually to Parliament. It is comprised of Federal and State government representatives, along with people from industry, academia and welfare constituencies.

An important feature of ABS corporate governance is the role played by senior management committees, which are active in identification of ABS priorities, ensuring appropriate planning and implementation to address those priorities, and effective monitoring of ABS activities. Those committees relevant to data and metadata management are:

1. ABS Division Heads Committee which includes the Australian Statistician and involves the heads of Divisions (Economic, Population and Social, Methodology, Information Management, Corporate Services, and Technology Services (the CIO)) ie all the 'direct reports' to the Statistician. This group could be considered as the 'Board' and they usually meet weekly. They review and approve all policies related to data and metadata management, approve specific projects that related to metadata infrastructure, and approve all funding proposals.
2. Information Resource Management Committee - the same group as in 1 above, minus the Statistician and including heads of the Technology Services Division branches, namely as Technology Applications (development), Technology Infrastructure (all hardware, software, communications services) and Technology Research (future tools and techniques). This committee focuses on the technology directions and proposals for the ABS, including data and metadata management. This group approved the detailed metadata management strategy, principles, etc.
3. Standing Committees. The two major subject matter groups in ABS - Economic Statistics, and Population and Social Statistics - have standing committees to review, discuss and approve subject matter projects, including the development of metadata content and the standardisation of metadata. These committees provide the strong articulation of the business drivers for data and metadata management work. They comprise the senior executives of each subject matter group, along with the senior executives of support divisions eg technology and methodology.

In addition to the senior management committees, there are a number of other important parts of the governance arrangements. They are:

1. Project Boards. Each major project in the ABS, whether a new infrastructure development eg our Input Data Warehouse, or a new survey, has suitable governance arrangement that would probably involve a Project Board. A Project Board is chaired by the owner of the project, ie the person who is ultimately responsible for achieving the outcomes and objectives of the project. They are assisted by senior people from relevant areas that are able to help the project deal with the tasks, issues and risks that arise. In terms of metadata, one of the roles of the Board is to ensure that corporate policies are followed and that the project

solution follows metadata management principles.

2. Architecture Panels. An architecture panel is usually convened for each project that has a significant IT component, with the view to determining the best technical solution for the project taking into account available development toolsets and the impact on the IT infrastructure eg storage capacity required, server and network load. One function of the architecture panel is to ensure that the solution proposed, in terms of metadata, makes appropriate use of corporate metadata facilities, and if any new metadata facility has to be developed that its potential use for other projects is assessed. Often, the Director of Data Management Section attends architecture panels to make this assessment.

3. Line Management. Responsibility for data and metadata management has been made very clear at the ABS. Corporate units, like the Data Management Section, are responsible for developing policy and practices, as well as specifying, developing and maintaining the corporate data and metadata management systems infrastructure, and providing training and client support in data and metadata management. Subject matter areas are clearly responsible for the statistical data and metadata content - they 'own' the data and metadata and are responsible for the adequate documentation, confidentiality and quality of that data and metadata. Each of our major statistical groups - economic and population/social - has a Standards area which is responsible for defining and maintaining standard classifications and data element definitions. Often they play a role in ensuring compliance with those standards by being part of the approval workflow, for example when collection forms need to be approved before use.

Glossary of terms and abbreviations

AMRADS
Accompanying Measure to Research and Development in Official Statistics (AMRADS) website at http://amrads.jrc.cec.eu.int/

COSMOS
Cluster of Systems of Metadata for Official Statistics (COSMOS) website at http://www.epros.ed.ac.uk/cosmos/.

Corporate Metadata Repository (CMR)
A database system that stores metadata records for an organization or group of organizations.

Designer
People responsible for the technical design of a statistical metadata system.

GESMES
GESMES/TS (formerly called GESMES/CB) is the message used by the European Central Bank to exchange statistical data and metadata with its partners in the European System of Central Banks (ESCB) and other organizations world-wide. For more information see the website at http://www.ecb.int/stats/services/gesmes/html/index.en.html

Metadata
A term used to describe data about data. This may include any information that is stored about the nature of data such as format, source, language, creation date, etc. Metadata may also be referred to as metainformation.

MetaNet
MetaNet was created as a network of excellence to harmonise and synthesise statistical metadata developments. It started in November 2000 and finished at the end of July 2003. See their website at http://www.epros.ed.ac.uk/metanet/index.html.

METAWARE
Statistical Metadata Support for Data Warehouses. See their website at http://europa.eu.int/en/comm/eurostat/research/retd/metaware.html

SDMX
Statistical Data and Metadata Exchange website at http://www.sdmx.org/.

Statistical Metadata System (SMS)
The processes and resources used to manage metadata within a Statistical Information System.

Statistical Information System (SIS)
The processes and resources used to produce statistical information.

Senior Management
The highest level of management in an organization, responsible for ensuring the organization meets its goals efficiently and effectively. May also be referred to as ‘Executive’ or ‘Top’ management.

Statistical Organization (SO)
An organization that is responsible for the collection, processing and dissemination of official statistics.

XML
Extensible Markup Language – a markup language primarily used to facilitate the sharing of data across different systems, either within or between organizations.

XBRL
Extensible Business Reporting Language.

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