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## Guidelines for production of quality statistics

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## Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Tourism, Trade and Industry established under Cap 327, of the Laws of Uganda. UNBS is mandated to co-ordinate the elaboration of standards and is

- (a) a member of International Organisation for Standardisation (ISO) and
- (b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and
- (c) the National Enquiry Point on TBT/SPS Agreements of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of representatives of consumers, traders, academicians, manufacturers, government and other stakeholders.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

### Committee membership

The following organisations were represented on the Technical Committee on Applied Statistical Methods, UNBS/TC 17, during the development of this standard:

- Bank of Uganda
- Ministry of Education & Sports
- Ministry of Finance, Planning & Economic Development
- Ministry of Health
- School of Statistics & Applied Economics, Makerere University
- Uganda Bureau of Statistics
- Uganda National Bureau of Standards
- Uganda National Council for Science & Technology
- Uganda Revenue Authority

## **Introduction**

Statistical standards facilitate quality assurance in the data production process as well as the final products, and provide a logical and coherent structure for collecting information. These standards support the maintenance of a unified statistical service that meets the needs of government and society.

Uganda Bureau of Standards (UBOS) is responsible for promoting standardization in the collection, analysis and publication of statistics to ensure quality, adequacy of coverage and reliability of statistics information. UBOS underlines data quality as a key determinant of its proficiency in the production of useful statistical products to inform national planning.

This standard provides guidance on the use and appropriate implementation of the guidelines for production of quality statistics. Variations from the agreed standard by different data producers in the National Statistics System (NSS) are not encouraged. All personnel involved in statistical activities are responsible for ensuring that quality has high priority in the design and implementation of statistical methods and procedures under their control.

# Guidelines for production of quality statistics

## 1 Scope

This Uganda Standard provides guidelines that promote the application of best statistical practices for producing quality national statistics. These guidelines cover the three main sources of quantitative data namely censuses, surveys, and administrative records.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

US ISO 3534-1, *General statistical terms and terms using probability*

US ISO 3534-2, *Applied statistics*

US ISO 3534-3, *Statistics — Design of experiments*

US 942, *Code of Practice for the production of official statistics*

*Compendium of Statistical Concepts and definitions*

*National Statistical Meta Data Dictionary*

## 3 Terms and definitions

For the purposes of this standard, the terms and definitions given in US ISO 3534-1, US ISO 3534-2, US ISO 3534-3, *Compendium of Statistical Concepts and Definitions* and *National Statistical Meta Data Dictionary* shall apply.

## 4 Symbols (and abbreviated terms)

<b>BOU</b>	Bank of Uganda
<b>CARIS</b>	Classifications and Related International Standards System
<b>COICOP</b>	Classification of Individual Consumption According to Purpose
<b>CPC</b>	Central Product Classification
<b>FAO</b>	Food and Agricultural Organisation
<b>FPOS</b>	Fundamental Principles of Official Statistics
<b>GDDS</b>	General Data Dissemination System
<b>HS</b>	Harmonised Commodity Description and Coding System
<b>ISIC</b>	International Standard Industrial Classification
<b>ISO</b>	International Organization for Standardization
<b>MDAs</b>	Ministries, Departments and Agencies
<b>NSOs</b>	National Statistical Offices
<b>NSS</b>	National Statistical System
<b>ONS</b>	Office for National Statistics
<b>SDDS</b>	Special Data Dissemination Standards
<b>SNA</b>	System of National Accounts
<b>UBOS</b>	Uganda Bureau of Statistics
<b>UNBS</b>	Uganda National Bureau of Standards
<b>WHO</b>	World Health Organisation
<b>WTO</b>	World Trade Organisation

## 5 Censuses

### 5.1 General

A census covers a precisely defined territory (for example, the entire country or a sample). In a census, individual units of interest are separately enumerated and their characteristics recorded. Examples of individual units include

- business for business censuses,
- school for school censuses,
- holding for agricultural censuses and
- household, a housing unit and/or individuals for population and housing censuses.



The data collected should refer to a well defined reference period. Censuses should be taken at regular intervals so that comparable information is made available in a fixed sequence. Censuses are the basis for developing sampling frames for surveys.

## **5.2 Census planning**

### **5.2.1 General**

The development of plans for a census includes the early preparation detailing a set of strategic aims and objectives used to guide the implementation process. Experiences from previous censuses, understanding user requirements and assessing changes in society and technology form the starting point for developing census objectives. The set standards form a benchmark against which outcomes can be assessed to help determine the success of a census.

The decision regarding the method of enumeration should be taken at an early stage on the basis of thorough testing of the various alternatives in terms of their costs and their operational feasibility.

The guidelines in 4.2.2 – 4.2.11 should be considered during census planning.

### **5.2.2 Legal basis for a census**

All censuses should be conducted in accordance with the prevailing statistical legislation. Legal authority for the census is required for

- fixing primary administrative responsibility,
- obtaining the necessary resources and
- determining the general scope and timing of the census.

### **5.2.3 Census budgeting**

A comprehensive financial estimate of each census activity should be made for effective planning and control of the census.

### **5.2.4 Census calendar**

A calendar or timetable indicating the sequence and estimated duration of each activity of the census should be drawn up to guide the entire census process.

### **5.2.5 Administrative organization**

The roles and relationships of the various executive and advisory organs at national, and sub-national levels are useful in the planning and preparations of a census and should therefore be clearly spelt out.

### **5.2.6 Census communication activities**

A comprehensive communication strategy for a census which covers data users, providers, producers and the general public should be developed and should be consistent with the overall census strategy.

### **5.2.7 Quality assurance**

Quality and performance measurement and process control systems should be developed to monitor data collection activities and integrated into the data production cycle. A census should have a well documented operational quality assurance plan.

### **5.2.8 Mapping**

Institutions undertaking the censuses should develop continuous cartographic capabilities to serve their specialized needs. The mapping exercise should be preceded by an assessment of the existing maps to determine the appropriate technology for developing new maps, if necessary.

### **5.2.9 Stakeholder consultations**

There should be focused extensive consultations where stakeholders clarify and specify their data requirements. A reasonable trade-off between the objectives and response burden should be considered.

### **5.2.10 Data processing and analysis**

The type of data processing equipment should be determined well in advance of the scheduled date of enumeration, in order to allow for appropriate questionnaire design and proper preparation of instructions to enumerators, development of coding schemes, specification of data handling controls and procedures, and recruitment and training of data processing personnel.

Control measures should be developed to ensure an uninterrupted flow of work through the various stages from receipt of the census questionnaires through preparation of the database and final tabulations.

### **5.2.11 Recruitment and training**

Required personnel to support the census exercise should be recruited in advance. Interviewers and other staff that interface with respondents should be trained and equipped with skills or techniques in obtaining respondent cooperation and building rapport with respondents. Techniques for building rapport include respect for respondents' rights, follow-up skills, knowledge of the goals and objectives of the data collection, and knowledge of the uses of the data. The data collection protocol or manual should be used by the field staff. Training for field staff on new protocols should be conducted as well as refresher training on a routine, recurring cycle.

## **5.3 Questionnaire development**

The development of a census questionnaire involves designing and pre-testing of the instrument through stakeholder engagement, taking into consideration the method of enumeration and the data to be collected. The criteria below serves as a guide in the development of the questionnaire:

- a) a tabulation plan should precede and inform the design of the questionnaire;
- b) questions should not be ambiguous;
- c) questions should not be offensive;
- d) questions should not be leading the respondent to a specific answer;
- e) questions should flow logically starting from the simple general information to the more detailed including extremely sensitive issues;
- f) related topics should, as much as possible, be covered in a single questionnaire in order to minimize respondent fatigue;
- g) the designing of the questionnaire should take into consideration the technology to be employed for data processing and analysis;
- h) where necessary, special provision should be made for translation; and
- i) whenever possible, pre-coded responses should be used in census questionnaires with numerical or alphanumerical codes being printed next to each category.

## 5.4 Census pre-test and pilot

### 5.4.1 General

In determining the effectiveness of the census instruments, both the pre-test and pilot should be undertaken. While a pre-test can be work in progress during the design of the instruments, a pilot census is a more detailed undertaking that is normally conducted one year prior to the actual census.

### 5.4.2 Pre-test

A pre-test determines the strengths and weaknesses of the census instrument in terms of format, wording, appropriateness of codes, and sequence among others. It is normally administered to a very small sample of respondents, taking into consideration the variations in the study population. The pre-test should test specifically for:

- a) question ambiguity, flow, consistency, redundancy, sensitivity and reliability,
- b) time required to administer the questionnaire;
- c) validity of the questions determined by how well it measures the purpose/objective it is intended to measure.
- d) after the pre-test, enumerators must share their experiences in order to improve the census questionnaire.

### 5.4.3 Pilot census

The pilot census is a mock census that should be conducted during a period comparable to the one in which the actual census will be conducted using the actual census instruments. Appropriate sampling techniques should be employed to ensure that all issues to be tested are taken into consideration. The pilot census should test:

- a) the operational feasibility of the census undertaking including human and financial resource requirements, logistics, publicity among others;
- b) the overall respondent interest and attention;
- c) the suitability of the entire census administrative structure; and
- d) data processing and analysis procedures.

## 5.5 Data collection

In a census, all the units of interest such as households, businesses, agricultural holdings, and housing units are enumerated. However, for some specialised censuses like agricultural census and census of business establishments, a large sample is used instead of total coverage. This is in agreement with the law of inertia of large numbers which states that large groups or aggregate of data show a higher degree of stability than small ones. The respondent should be a knowledgeable person in the relevant unit of interest preferably the head of that unit. The reference period for any census should be clearly spelt out. The following guidelines should be applied during data collection:

- a) selected enumerators should be well facilitated to locate and visit each and every enumeration unit;
- b) data collection should be undertaken during a period when the census is likely to be most successful and to yield the most reliable data; and
- c) rigorous supervision should be undertaken particularly in the initial phase of the enumeration exercise, to facilitate the correction of inefficiencies and maintain satisfactory progress during the enumeration period.

## 5.6 Data processing & analysis

It is critical that data processing and analysis are undertaken in tandem with the census tabulation plan. A successful data processing operation is dependent on effective collaboration, at all levels, between the data processing and the census technical team. The following guidelines should be applied during data processing and analysis:

- a) data entry applications should be developed and tested before embarking on the data capture;
- b) appropriate pre-coding and editing should be undertaken before data entry;
- c) coding should be based on the code books and standard classifications;
- d) regular data back-ups should be undertaken and stored preferably at off-site locations;
- e) double data entry is recommended where resources permit;
- f) appropriate imputation should be applied for missing data; and
- g) a master file containing original clean data records should be maintained.

## 5.7 Data dissemination

A census is not complete until the information collected is made available to potential users in a form suited to their needs. The information may be included in published tables and reports or monographs for general distribution, produced as tables in unpublished form for limited distribution or stored in a database and supplied upon request, or disseminated online. The following guidelines should be applied during data dissemination:

- a) information should be disseminated in line with the overall communication strategy;
- b) data and information to be shared should observe confidentiality principles;
- c) relevant metadata should be available and/or accessed in a standard format;
- d) the data should be disseminated in a way that facilitates widespread use;
- e) published census material should be subject to copyright rules;
- f) the choice of dissemination media should be guided by the context and the intended categories of users; and
- g) a comprehensive list of key stakeholder should be maintained.

## 5.8 Census evaluation

The purpose of census evaluation is to provide users with a level of confidence when utilizing the data, and to explain errors in the census result. Census evaluation is a critical ingredient in a continuous census improvement program. There are various tools that can be used for census evaluation including Post Enumeration Survey (PES) and demographic analysis. The evaluation should assess the degree of coverage and content errors registered during census enumeration in order to improve the current census results and inform the design of future censuses.

The following guidelines should be followed when conducting a census evaluation:

- a) effective evaluation mechanisms focused on census results should serve as a basis for constructing a best estimate of census aggregates, such as the total population, or to provide census results adjusted to take into account identified errors.

- b) the decision on whether to measure coverage error, content error or a combination of the two should be made in advance. In addition, both gross and net error should be considered when developing the overall evaluation plan.
- c) numerous methods to estimate the coverage and content error of censuses should be considered for example; simple techniques of quality assurance such as internal consistency checks. Comparisons of results with other data sources including previous censuses, current household surveys and/or administrative records. Such comparisons may be made in aggregate form where comparisons of the overall estimates from two sources (net error only) are made.
- d) the design of a PES is complex and should therefore be done carefully depending on the available alternatives. These will also depend on whether a single or dual system estimation will be utilized; and
- e) a periodic evaluation report should be produced, for example, a methodology report that itemizes all sources of identified error for recurring censuses. Where possible, provide estimates or bounds on the magnitudes of these errors; discuss the total error model for the census; and assess the census in terms of this model.

## 5.9 Census documentation

Documentation involves the collection of material that provides a description of the activity. Census documentation provides a description of the statistical production process and is presented in various formats (that is, electronic or hard copy). Census documentation includes all information necessary to analyze the data properly and should include the following:

- a) description of variables used to uniquely identify records in the data file;
- b) description of the census design, including unit identifiers to be used for analysis;
- c) final instrument(s) or a facsimile thereof for censuses conducted.
- d) definitions of all variables, including all modifications;
- e) data file layout;
- f) descriptions of constructed variables on the data file that are computed from responses to other variables on the file;
- g) descriptions of known data anomalies and corrective actions;
- h) comparisons with independent sources, if available;
- i) overall unit response rates and non-response bias analyses (if applicable).

Census documentation should be readily accessible to users, unless it is necessary to restrict access to protect confidentiality. The following guidelines should be applied for census documentation:

- a) provide complete census documentation for all data files and the entire census process. This documentation should be done according to the statistics archival policy; and
- b) retain all census documentation according to appropriate statistics archival policies. Data archiving should be well managed, such that data are available for historical research in the future years.

## 6 Surveys

### 6.1 General

A survey covers a precisely defined part of the entire population. Surveys are undertaken for businesses, schools, agricultural holdings, markets and households among others. The data collected refers to a well defined reference period. Surveys are preferably undertaken at regular intervals so that comparable information is made available in sequence.

### 6.2 Survey planning

#### 6.2.1 General

The planning process for a survey involves the definition of objectives, the current and potential user requirements and the key questions and/or issues to which analysis will be directed. Experiences from previous surveys and assessment of changes in society and technology form the starting point for developing the objectives. The guidelines in 5.2.2 – 5.2.6 should be followed when planning for a survey;

#### 6.2.2 Survey plan

An agency initiating a survey should have a well written plan that includes:

- a) a justification, goals and objectives, hypotheses, and definitions of key variables.
- b) a review of related literature
- c) the scope of the survey
- d) detailed budget;
- e) a survey design and
- f) standard elements of project management, the target completion dates, the resources needed to complete each activity, and risk mitigation.

All surveys should be conducted in accordance with the prevailing national and international legislation.

The choice of the data collection method should be determined apriori.

#### 6.2.3 Stakeholder consultations

Consultations with stakeholders are important to identify their requirements and expectations. There should be focused extensive consultations where stakeholders clarify and specify their data requirements. A reasonable trade-off between the objectives and response burden should be considered.

#### 6.2.4 Recruitment and training

Required personnel to support the survey exercise should be recruited in advance. Interviewers and other staff that interface with respondents should be trained and equipped with skills/techniques in obtaining respondent cooperation and building rapport with respondents. Techniques for building rapport include respect for respondents' rights, follow-up skills, knowledge of the goals and objectives of the data collection, and knowledge of the uses of the data. The data collection protocol or manual should be used by the field staff. Training for field staff on new protocols should be conducted as well as refresher training on a routine, recurring cycle.

### 6.2.5 Analysis plan

A plan for the analysis of survey data should be developed in line with the tabulation plan prior to the start of a specific analysis. This is to ensure that statistical tests are used appropriately and that adequate resources are available to complete the analysis. The following should be included in the analysis plan

- a) an introduction that describes the purpose, the research question, relevant literature, data sources (including a brief description of the survey data and any limitations of the data), tabulations expected, key variables to be used in the analysis, type of analysis, and significance level to be used where applicable;
- b) table and figure shells that support the analysis; and
- c) a framework for technical notes including the history of the survey program, data collection methods and procedures, sample design, response rates and the treatment of missing data, weighting methods, computation of standard errors, instructions for constructed variables, limitations of the data, and sources of error in the data.

### 6.2.6 Quality assurance plan

Quality and performance measurement and process control systems should be developed to monitor data collection activities and integrated into the data production cycle. A survey should have a well documented operational quality assurance plan.

## 6.3 Survey design

A survey design involves the identification of the target population, sampling frame, sampling techniques, the data collection instruments and methods, realistic timetable and cost estimate, and appropriate statistical methods. The size and design of the sample must reflect the level of detail needed in tabulations and other data products, and the precision required of key estimates. Documentation of each of these activities and resulting decisions must be maintained in the survey files for use in documentation. The following guidelines should be followed when designing a survey;

- a) the frame for the survey should be clearly defined and updated where necessary prior to the survey design;
- b) where a sampling frame is non-existent, appropriate methods should be used to construct it;
- c) frames for the planned sample survey should be appropriate for the study design and must be evaluated against the target population for quality;
- d) an appropriate sampling technique should be employed taking into account the probabilistic and/or non-probabilistic sampling methods;
- e) a representative sample should be developed taking into account the objectives of the survey, precision and the available financial resources;
- f) any use on non-probabilistic methods should be justified statistically;
- g) appropriate sample weights should be generated;

## 6.4 Survey instruments

The development of survey instruments involves the design and pre-test of the questionnaire through stakeholder engagement, taking into consideration the method of interview and the data to be collected. It also involves development of instruction manuals, code lists/standard classifications among others. The criteria below serve as a guide in the development of the instruments:

- a) a tabulation plan should precede and inform the design of the questionnaire;
- b) questions should not be ambiguous;
- c) questions should not be offensive;
- d) questions should not be leading the respondent to a specific answer;
- e) questions should flow logically starting from the simple general information to the more detailed including extremely sensitive issues;
- f) related topics should, as much as possible, be covered in a single questionnaire in order to minimize respondent fatigue;
- g) the designing of the questionnaire should take into consideration the technology to be employed for data processing and analysis;
- h) where necessary, special provision should be made for translation;
- i) whenever possible, pre-coded responses should be used in census questionnaires with numerical or alphanumerical codes being printed next to each category; and
- j) instruction manuals and code lists should be developed before training of interviewers.

## **6.5 Survey pre-test and pilot**

### **6.5.1 General**

In determining the effectiveness of the survey instruments, both the pre-test and pilot should be undertaken. While a pre-test can be work in progress during the design of the instruments, a pilot survey is a more detailed undertaking.

### **6.5.2 Pre-test**

A pre-test determines the strengths and weaknesses of the survey instrument in terms of format, wording, appropriateness of codes, and sequence among others. It is normally administered to a very small sample of respondents, taking into consideration the variations in the study population. The pre-test should test specifically for:

- a) question ambiguity, flow, consistency, redundancy, sensitivity and reliability;
- b) time required to administer the questionnaire;
- c) validity of the questions determined by how well it measures the purpose/objective it is intended to measure; and
- d) after the pre-test, interviewers should share their experiences in order to improve the survey questionnaire.

### **6.5.3 Pilot survey**

The pilot survey is a mock survey. Appropriate sampling techniques should be employed to ensure that all issues to be tested are taken into consideration. The pilot survey should test:

- a) the operational feasibility of the survey undertaking including human and financial resource requirements, logistics, publicity among others;
- b) the overall respondent interest and attention;



- c) the suitability of the entire survey administrative structure; and
- d) data processing and analysis procedures.

## 6.6 Data collection

In a survey, selected units such as households, businesses, agricultural holdings, and housing units are interviewed. The respondent should be a knowledgeable person in the relevant unit of interest preferably the head of that unit. The reference period for any survey should be clearly spelt out. The following guidelines should be considered:

- a) the data collection instrument should be administered in a manner that minimizes respondent burden, while maximizing data quality;
- b) methods to reduce item non-response should be employed;
- c) in order to maximize response rates and improve data quality:
  - the data collection period should be adequate,
  - the data collection materials should be forwarded to respondents in advance whenever possible, and
  - adequate follow-up should be done;
- d) the data collection manuals should be utilized by the field staff; and
- e) best practice mechanisms should be implemented to minimize interviewer falsification, such as monitoring interviewers, in-field validation and re-interviewing respondents;

## 6.7 Data processing and analysis

It is critical that data processing and analysis are undertaken in tandem with the survey design. A successful data processing operation is dependent on effective collaboration, at all levels, between the data processing and the survey technical team. The following guidelines should be applied:

- a) data entry applications should be developed and tested before embarking on the data capture;
- b) appropriate pre-coding and editing should be undertaken before data entry;
- c) coding should be based on the code books and standard classifications;
- d) regular data back-ups should be undertaken and stored preferably at off-site locations;
- e) double data entry is recommended where resources permit;
- f) appropriate imputation should be applied for missing data;
- g) a master file containing original clean data records should be maintained;
- h) appropriate weights should be used during analysis; and
- i) adjustments should be made to the initial weight to cater for non-response.

## 6.8 Survey response rates

Surveys are designed to achieve the highest practical rates of response, commensurate with the importance of the survey, respondent burden, and data collection costs. This is to ensure that survey results are representative of the target population so that they can be used with confidence to inform decisions.

Non-response has two effects on results, one contributes to bias of estimates when non-respondents differ from respondents in the characteristics measured and the other contributes to a decrease in the accuracy of the survey estimates resulting from the smaller effective sample size. Adjustments are subsequently made to data to compensate for non-response (for example, weighting adjustments or imputation). The following guidelines should be considered:

- a) the response rate should be computed using standard formulae for every survey;
- b) prior to data collection, the expected unit response rates at each stage of data collection should be identified, based on content, use, mode, and type of survey; and
- c) decisions regarding adjustment or imputation of data for item non response should be based on how the data will be used, the non response analysis and prior experience.

## 6.9 Data coding and standard classifications

International standard classifications for the respective data types that is, trade, national accounts, and prices etc) should be adopted and applied. Where possible, international classifications can also be customized to country specific products, activities etc which may not be clearly shown in the international coding. The following guidelines should be used:

- a) appropriate coding nomenclature to the specific data variables including provision for missing data should be adapted;
- b) when converting text data to codes to facilitate easier analysis, standardized codes should be used, if they exist;
- c) when setting up a manual coding process to convert text to codes, create a quality assurance process that verifies the different codes used for the respective data sets/types.
- d) establish a Classifications and Related International Standards System (CARIS) which will be a central repository for all classifications, concordances and coding indexes for storing and accessing classifications. If established, this system will do the following:
  - i. use database technology to provide centralized classification storage, maintenance and access facilities for classification data that are used both in the development and processing of surveys and in the subsequent analysis and evaluation of the data;
  - ii. help reduce the time and resources required when developing surveys and to contribute to improved data quality by supporting the use of standard classifications; and
  - iii. facilitate the comparison and analysis of data by storing concordances.

## 6.10 Protection of data

Data may only be used for the specific purposes for which it was collected. Data protection creates rights for those who have their data processed and stored, and those who store the data. The following guidelines should be applied:

- a) implement safeguards and data protection policies that preserve the data collected on respondents.

- b) for all surveys, appropriate procedures and mechanisms should be established to ensure protection of the data during the production, use, storage, transmittal, and disposition;
- c) ensure that:
  - i. individually-identifiable survey data are protected;
  - ii. data systems and electronic products are protected from unauthorized intervention; and
  - iii. data files, network segments, servers, and desktop computers are electronically secure from malicious software and intrusion;
- d) ensure controlled access to data sets so that only specific, named individuals working on a particular data set can have read only, write only, or both read and write access to the data set. Data set access rights should be periodically reviewed by the project manager.
- e) all temporary staff engaged in a particular survey should swear the oath of secrecy as stipulated in the statistical legislation. In addition individuals or research institutions using the data for further analysis should swear an oath of secrecy. However, appropriate mechanisms should be adopted to anonymise the individual records before they are used for further analysis.

### 6.11 Survey evaluation

Survey evaluation involves evaluating the final statistical output in light of the original objective of the statistical activity/survey. Such information allows users to make informed interpretations of the survey results, and also facilitates improvement for future surveys. The general types of data quality evaluation used include:

- a) macro editing or quality validation which is a process of reviewing data before official release to ensure that erroneous data are not released, or to identify data of marginal quality.
- b) sources of error studies: provide quantitative information on specific sources of error in the data. While timeliness is still important, the results of these studies are often available only after the official release of the data.
- c) estimation of the effects of potential non-sampling errors including measurement errors; non-response error; coverage error; and processing error.

The following guidelines should be applied when performing survey evaluation:

- a) evaluate the quality of the data and make the evaluation results available to users (that is through technical notes and documentation included in reports of results or through a separate report);
- b) include an evaluation component in the survey plan that assesses survey procedures, results, and errors. The following sources of error should be evaluated:
  - i. coverage errors, which consist of omissions, erroneous inclusions, and duplications in the frame used to conduct the survey;
  - ii. non-response errors, which occur when the survey fails to get a full response;
  - iii. measurement errors, which occur when the response received differs from the 'true' value, and can be caused by the respondent, interviewer, questionnaire, mode of collection, or the respondent's record-keeping system;
  - iv. processing errors, which can occur at the subsequent steps of data editing, coding, capture, imputation and tabulation; and
  - v. sampling errors, which occur when the results of the survey are based on a sample rather than the entire population;

- c) review past surveys similar to the ones being planned to determine likely sources of error and the appropriate evaluation problems that are likely to be encountered; and
- d) involve both internal and external users in setting the objectives for the data evaluation program and the overall evaluation process.

The following macro editing and quality validation methods should be used:

- a) checks of consistency with external sources of data, for example from other surveys or from previous instances of the same survey;
- b) internal consistency checks, for example calculation of ratios that are known to lie within certain ranges (sex ratios, average value of commodities, etc.);
- c) unit-by-unit reviews of the largest contributors to aggregate estimates, typically in cases of business, household and health surveys; and
- d) debriefings with staff involved in the collection and processing of data.

## **6.12 Developing estimates and projections**

Generally accepted theory and methods should be used when deriving direct survey-based estimates, as well as model-based estimates and projections. Error estimates are calculated and disseminated to support assessment of the appropriateness of the estimates or projections. The following guidelines should be considered when developing estimates and projections:

- a) prior to developing estimates, establish criteria for determining when the error (both sampling and non-sampling) associated with a direct survey estimate, model-based estimate, or projection is too large to publicly release the estimate/projection;
- b) develop direct survey estimates by applying weights appropriate for the sample design to calculate population estimates. (An agency may employ an alternative method (e.g., ratio estimators) to calculate its population estimates);
- c) use auxiliary data to improve precision and/or reduce the error associated with direct survey estimates;
- d) calculate variance estimates by a method appropriate to the survey's sample design, taking into account probabilities of selection, stratification, clustering and the effects of non-response, post-stratification, and raking;
- e) the estimates should reflect any design effect resulting from a complex design;
- f) develop model-based estimates and projections according to accepted theory and practices (that is, assumptions, mathematical specifications);
- g) subject any model used for developing estimates or projections to the following:
  - i. sensitivity analysis to determine if changes in key model inputs cause key model outputs to respond in a sensible fashion;
  - ii. model validation to analyze a model's performance by comparing the results to available independent information sources; and
  - iii. demonstration of reproducibility to show that, given the same inputs, the model produces similar results;
- h) document methods and models used to generate estimates and projections to help ensure objectivity, utility, transparency, and reproducibility of the estimates and projections; and

- i) archive data and models so the estimates/projections can be reproduced.

### 6.13 Inference and comparisons

Statements of comparisons and other statistical conclusions derived from survey data are based on acceptable statistical practice. The following guidelines should be followed for inferences and comparisons of survey data:

- a) specify the criterion for judging statistical significance for tests of hypotheses (Type I error) before conducting the testing;
- b) make comparison tests between two estimates, if either is constructed from a sample;
- c) use methods for comparisons appropriate for the nature of the estimates. In most cases, this requires estimates of the standard error of the estimates and, if the estimates are not independent, an estimate of the covariance between the two estimates;
- d) when performing multiple comparisons with the same data between subgroups, include a note with the test results indicating whether or not the significance criterion (Type I error) was adjusted and, if adjusted, by what method;
- e) test and report only the differences that are substantively meaningful when performing comparison tests. (that is, don't necessarily run a comparison between every pair of estimates; run only those that are meaningful within the context of the data, and report only differences that are large enough to be substantively meaningful, even if other differences are also statistically significant);
- f) given a comparison that does not have a statistically significant difference, conclude that the data do not support a statement that they are different. If the estimates have apparent differences, but have large standard errors making the difference statistically insignificant, note this in the text or as a note with tables or graphs;
- g) support statements about monotonic trends (strictly increasing or decreasing) in time series using appropriate tests. If extensive seasonality, irregularities, known special causes, or variation in trends are present in the data, take those into account in the trend analysis;
- h) use concurrent seasonal factors for seasonal adjustment. These are the factors obtained using all recent values of the series. This will give frequent, mostly small, revisions to seasonally adjusted series. Many series are published in seasonally adjusted form to reveal the underlying trend movements and to facilitate data analysis; and
- i) if part of a historical series is revised, data for both the old and the new series should be published for a suitable overlap period for the use of analysts.

### 6.14 Review information for dissemination

The information for dissemination should have appropriate content/subject matter, statistical and methodological review procedures to comply with the existing quality guidelines. The guidelines include:

- a) conduct a content/subject-matter review of all information products that present a description or interpretation of results from the survey, such as analytic reports or "briefs."
- b) select reviewers with appropriate expertise in the subject matter, operation, or statistical program discussed in the document. Among the areas that reviewers should consider are the following:
  - i. subject-matter literature is referenced in the document if appropriate;
  - ii. information is factually correct;

- iii. information is presented clearly and logically, conclusions follow from analysis, and no anomalous findings are ignored;
- c) conduct a statistical and methodological review of all information products. Select reviewers with appropriate expertise in the methodology described in the document. Among the tasks that reviewers should consider are the following:
  - i. review assumptions and limitations for accuracy and appropriateness;
  - ii. ensure that appropriate statistical methods are used and reported;
  - iii. review calculations and formulas for accuracy and statistical soundness;
  - iv. review data and presentations of data (for example, tables) for disclosure risk, as necessary;
  - v. review contents, conclusions and technical (statistical and operational areas) recommendations to ensure that they are supported by the methodology used;
- d) review all information products that will be disseminated electronically for compliance with the statistical legislation; and
- e) ensure that any product that is disseminated via special software is tested for accessibility and interpretability prior to dissemination.

### **6.15 Data release and dissemination**

A survey is not complete until the information collected is made available to potential users in a form suited to their needs. The forms of presentation and dissemination should facilitate access and easy interpretation by users. The information may be presented in the form of published tables and reports or monographs for general distribution. Information in unpublished form is also produced for limited distribution, stored in a database and supplied upon request, or disseminated online. The following guidelines should be followed for release and dissemination of information:

- a) information should be disseminated in line with the dissemination plan. The following should be considered when preparing the dissemination procedures for major information products:
  - i. develop schedules and modes for the release of information products;
  - ii. inform targeted audiences;
  - iii. ensure equivalent, timely access to all users; and
  - iv. ensure that data sources and technical documentation, including data limitations, are included or referenced;
- b) protect information against any unauthorized pre-release;
- c) if revisions to estimates are planned, establish a schedule for anticipated revisions, make it available to users, and identify initial releases as preliminary;
- d) establish a policy for handling unscheduled corrections due to previously unrecognized errors. The policy may include threshold criteria (for example, if the correction will change a national level total value by more than one percent or a regional value by more than five percent);
- e) identify conditions under which data will be corrected and re-disseminated appropriately;
- f) relevant metadata should be available and/or accessed in a standard format. In addition, the users should be provided access to the following information:

- i. quality-related documentation such as conceptual limitations and non sampling error;
  - ii. variance estimation documentation;
  - iii. time period covered by the information and units of measure;
  - iv. data taken from alternative sources;
  - v. point of contact to whom further questions can be directed;
  - vi. software or links to software needed to read/access the information and installation/operating instructions, if applicable;
  - vii. date the product was last updated; and
  - viii. standard dissemination policies and procedures;
- g) data and information to be shared should observe confidentiality principles;
- h) for information products derived using models, adhere to the following:
- i. clearly identify forecasts and derived estimates; and
  - ii. make descriptions of forecasting models or derivation procedures accessible from the product along with any available evaluation of its accuracy;
- i) include criteria for instances when information will not be publicly disseminated (for example, underlying data are of insufficient quality) in the agency's standard dissemination policies and procedures;
- j) for presentation of statistical results in tabular, chart or publication form, adhere to the following:
- i. for tables:
    - every table should have clear headings to clearly identify the content;
    - the table layout should be clear and easy to follow;
    - all units of measurement should be displayed clearly;
    - where a comparison between numbers is required, listing should be done in columns to facilitate reading;
    - ensure all rounding to significant digits is mathematically correct; and
    - ensure that footnotes are clearly marked and that the text is clear and readable;
  - ii. for charts:
    - the chart title must explain what phenomenon is represented and the time periods covered;
    - the chart should convey a clear and accurate representation of the phenomenon being studied;
    - all axes must be clearly labelled and include the units of measurement;
    - legends, labels and tick marks should all be clear and readable;

- all elements on the chart should be identified;
  - any apparent discrepancy should be highlighted and explained;
- iii. for reports/publications:
- be well-organized and easy to follow;
  - ensure titling and systematic page, chapter and section numbering;
  - text should be written in clear and unambiguous language;
  - for analytical reports and abstracts, the text should aim to describe inferences, rather than repeat numeric results;
  - should define all technical terms used;
  - should give references for all sources of both primary and secondary data used, and to any other publications quoted;
  - should be attractive to look at;
  - may include conventions for indicating missing data inclusion and style of notes; and
  - should inform evidence-based policy formulation and monitoring of development outcomes;
- k) published survey material should be subject to copyright rules;
- l) the choice of dissemination media should be guided by the context and the intended categories of users; and
- m) a comprehensive list of key stakeholder should be maintained.

### **6.16 Data confidentiality and disclosure for dissemination**

The national statistical legislation provides for confidentiality of the information collected which is intended for statistical purposes. Personal information provided by respondents is considered confidential and should therefore not be disseminated, shown or communicated to any person or body. The following guidelines should be adhered to regarding data confidentiality and disclosure for dissemination:

- a) when releasing statistical products, ensure strict compliance with the confidentiality pledge to the respondents as stipulated in statistical legislation;
- b) for survey information collected under a pledge of confidentiality, employ sufficient procedures and mechanisms to protect any individually-identifiable data from unauthorized disclosure; and
- c) do not publicly reveal parameters associated with disclosure limitation rules.

### **6.17 Survey documentation**

Documentation involves the collection of material that provides a description of the activity. Survey documentation provides a description of the statistical production process and is presented in various formats (that is, electronic or hard copy). Survey system documentation includes all information necessary to analyze the data properly. Documentation should include the following:

- a) description of variables used to uniquely identify records in the data file;
- b) description of the sample design, including strata and sampling unit identifiers to be used for analysis;



- c) final instrument(s) or a facsimile thereof for surveys conducted;
- d) definitions of all variables, including all modifications;
- e) data file layout;
- f) descriptions of constructed variables on the data file that are computed from responses to other variables on the file;
- g) unweighted frequency counts;
- h) description of sample weights, including adjustments for non-response and benchmarking and how to apply them;
- i) description of how to calculate variance estimates appropriate for the survey design;
- j) description of all editing and imputation methods applied to the data (including evaluations of the methods) and how to remove imputed values from the data;
- k) descriptions of known data anomalies and corrective actions;
- l) description of the magnitude of sampling error associated with the survey;
- m) description of the sources of non sampling error associated with the survey (for example, coverage, measurement) and evaluations of these errors;
- n) comparisons with independent sources, if available;
- o) overall unit response rates (weighted and unweighted) and non-response bias analyses (if applicable); and
- p) item response rates and non-response bias analyses, (if applicable).

Survey documentation should be readily accessible to users, unless it is necessary to restrict access to protect confidentiality. Meta data for the respective surveys should be documented and stored. The following guidelines should be applied for survey documentation:

- a) provide complete survey documentation for all data files and the entire survey process. This documentation should be done according to the statistics archival policy;
- b) to ensure that a survey can be replicated and evaluated, the agency's internal archived portion of the survey system documentation, should include the following:
  - i. survey planning and design decisions, including the Information Collection Request packages;
  - ii. field test design and results;
  - iii. selected sample;
  - iv. sampling frame;
  - v. justifications for the items on the survey instrument, including why the final items were selected;
  - vi. all instructions to respondents and/or interviewers either about how to properly respond to a survey item or how to properly present a survey item;
  - vii. description of the data collection methodology;
  - viii. sampling plan and justifications, including any deviations from the plan;

- ix. data processing plan specifications and justifications;
  - x. final weighting plan specifications, including calculations for how the final weights were derived, and justifications;
  - xi. final imputation plan specifications and justifications;
  - xii. data editing plan specifications and justifications;
  - xiii. evaluation reports;
  - xiv. descriptions of models used for indirect estimates and projections;
  - xv. analysis plans;
  - xvi. time schedule for revised data; and
  - xvii. documentation made publicly available in conjunction with the release of data;
- c) produce a periodic evaluation report, for example a methodology report that itemizes all sources of identified error for recurring surveys. Where possible, provide estimates or bounds on the magnitudes of these errors; discuss the total error model for the survey; and assess the survey in terms of this model;
- d) retain all survey documentation according to appropriate statistics archival policies; and
- e) data archiving should be well managed, such that data are available for historical research in the future years.

### **6.18 Release of public-use micro data**

Micro data should be well documented prior to release for public use. The documentation describes how the information is constructed and provides the appropriate metadata for users to access. The following guidelines should be used for release of public-use micro data.

- a) provide a file description and record layout for each file. All variables should be clearly identified and described (metadata).
- b) for complete metadata compilation and availability, the following should be adhered to:
  - i. responsibility centers should ensure that all concepts and definitions used in statistics production are clearly defined and harmonized;
  - ii. common methodology should be adopted when undertaking related surveys to avoid inconsistencies across data producing agencies which affect the quality of statistical results and outputs;
  - iii. the metadata should be stored on the National Databank and, should be reviewed and updated whenever a change is made to any part of the statistical activity; and
  - iv. standard rules for metadata management should be developed;
- c) clearly identify all imputed values on the data file;
- d) release public-use micro data and metadata in a timely manner to ensure timely availability for data users; and.
- e) retain all micro data products and documentation according to the appropriate statistics archival policies.

## 6.19 Revisions to published data

Revisions to published data can, and do, occur for many reasons. Occasionally, revisions arise from a change in methodology which may necessitate the re-compilation of data from the previous period using the new methodology. Common sources of revisions to statistics are:

- a) the availability of additional information (e.g. late survey responses; a new period's data available for the calculation of seasonal factors);
- b) the receipt of amended information (e.g. as a result of the response to a query); and
- c) changes resulting from additional and more detailed data editing.

The following guidelines represent best practices that may be useful when revising published data:

- a) produce for users a clear and concise data revisions policy for all published statistics that undergo revisions;
- b) the users should be made aware of the frequency of data revisions
- c) when publishing data that is likely to be subsequently revised (for example, preliminary estimates), always indicate this to the user;
- d) describe the main reasons why particular statistics are subject to revision; and
- e) for established statistical data series, inform users of the frequency and size of past revisions.

## 7 Administrative data

Administrative data is generated during the process of executing administrative functions to inform policy and decision-making. For it to serve a statistical purpose, there is need to compile administrative data following a systematic, objective and standardized approach. Statistical use of administrative data include creation and maintenance of frames, the complete or partial (via record linkage) replacement of statistical collection, editing, imputation and weighting of data from statistical collection and evaluation of statistical outputs.

The following guidelines should be followed in administrative data production;

- a) the agency or organization should describe the primary purpose of data collection through administrative sources;
- b) actively investigate and assess all potential sources of administrative data;
- c) describe the format in which the administrative data are available;
- d) describe and document the concepts, definitions and procedures underlying the collection of administrative data;
- e) each administrative dataset should be accompanied by metadata about its contents so that users assess their suitability for their purposes;
- f) describe the main uses of administrative data, including where applicable the statistical processes and/or outputs that require data from administrative sources;
- g) describe the extent of coverage of the administrative data and any known coverage problems;
- h) describe the known sources of error in administrative data;
- i) describe the timescale since the last update of data from administrative sources;

- j) describe the common identifiers of population units in administrative data;
- k) set up an edit and imputation procedure or a weight adjustment procedure to deal with non-response;
- l) describe the extent to which the data from administrative sources meets statistical requirements;
- m) describe any changes in the legislative environment through which the administrative data are provided and the effects on the statistical product;
- n) the confidentiality implications of the publication of information from administrative records should be considered;
- o) maintain continuing collaboration with the providers and suppliers of administrative data; and
- p) implement continuous or periodic quality assessments for administrative data production.

## **8 Indicators and index numbers**

### **8.1 Indicators**

An indicator measures change over time or against benchmarks, targets or visions for the future. It is a pointer used specifically to show the state, level or condition of a variable of interest. The condition of interest may be demographic, social, economic or political. Indicators are categorised under input, output, process, outcome or impact.

The following guidelines should be considered in indicator development and reporting:

- a) define the purpose for developing indicators;
- b) develop and publish metadata for the indicators;
- c) identify key stakeholders and define their process of engagement;
- d) establish common working groups for key statistical and high frequency indicators that are produced regularly;
- e) develop an operational plan for indicator development and reporting;
- f) determine the methods for compilation and reporting of indicators and frequency of update in advance;
- g) compile statistical indicators in line with recommended national and international standards and guidelines;
- h) document the compilation processes for statistical indicators and archive the information;
- i) disseminate the indicators in line with the release calendar; and
- j) review the indicator framework and indicators periodically to ensure that it is reflective of the current economic situation.

### **8.2 Index numbers**

An index number is a positive number measuring the average change in a group of related items over a specified period. There are two types of index numbers, price and volume index numbers. The index number may be used in studying the general level of activity conditions over a specified time period. Indices are key macro- economic indicators used to monitor price movements and net output of the different sectors of the economy.

A price index measures the percentage change in a set of prices of a group of items over time. There are three types of price indices namely Consumer Price Index (CPI), Producer Price Index (PPI) and import and export price indices. The volume index describes relative change in the volume of output over time.

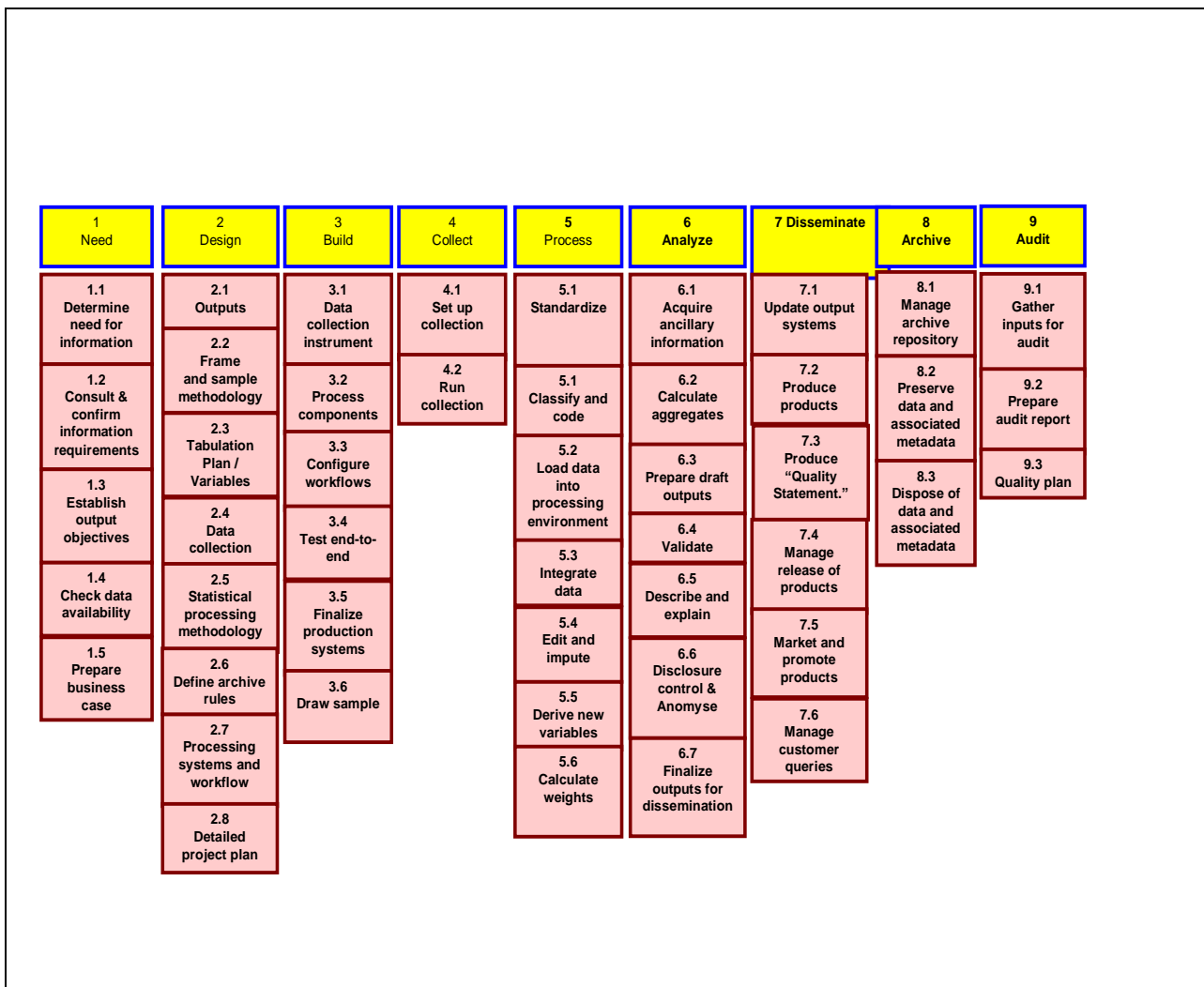
Volume indices include Index of Production (IoP) and Index of Services (IoS) among others.

The following guidelines should be considered when computing indices:

- a) define the purpose of the index to be computed;
- b) derive weights based on the relevant survey/census/administrative data and specify the base period;
- c) determine the scope of the index;
- d) classify the relevant components of the index according to international standards and classifications;
- e) undertake regular data collection and compute the index in line with the internationally recommended formulae;
- f) disseminate the index in line with the release calendar;
- g) document the compilation processes and archive data;
- h) revise the index in line with the revision policy of the organisation; and
- i) rebase the index periodically to ensure that it is reflective of the current economic situation.

## Annex A (normative)

### Statistics Production Cycle



## Annex B (informative)

### UN Fundamental Principles for Official Statistics

- Principle 1.** Official statistics provide an indispensable element in the information system of a democratic society, serving the Government, the economy and the public with data about the economic, demographic, social and environmental situation. To this end, official statistics that meet the test of practical utility are to be compiled and made available on an impartial basis by official statistical agencies to honour citizens' entitlement to public information.
- Principle 2.** To retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data.
- Principle 3.** To facilitate a correct interpretation of the data, the statistical agencies are to present information according to scientific standards on the sources, methods and procedures of the statistics.
- Principle 4.** The statistical agencies are entitled to comment on erroneous interpretation and misuse of statistics.
- Principle 5.** Data for statistical purposes may be drawn from all types of sources, be they statistical surveys or administrative records. Statistical agencies are to choose the source with regard to quality, timeliness, costs and the burden on respondents.
- Principle 6.** Individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes.
- Principle 7.** The laws, regulations and measures under which the statistical systems operate are to be made public.
- Principle 8.** Coordination among statistical agencies within countries is essential to achieve consistency and efficiency in the statistical system.
- Principle 9.** The use by statistical agencies in each country of international concepts, classifications and methods promotes the consistency and efficiency of statistical systems at all official levels.

**Principle 10.** Bilateral and multilateral cooperation in statistics contributes to the improvement of systems of official statistics in all countries.



## Annex C (informative)

### Rules for statistical meta data management

**Metadata Rule 1:** Good statistical metadata conforms to international and national standards in a way that is appropriate to user needs, the purpose and procedures for statistics production.

**Metadata Rule 2:** Good statistical metadata supports interoperability and intercomparability in statistics production and use across MDAs in the NSS.

**Metadata Rule 3:** Good statistical metadata uses quality guidelines and standardised instruction manuals to describe the type and general procedures for various statistics produced and related outputs. For every statistical indicator, the indicator name and description are specified. **Content rules** (*how content must be formulated*), *representation rules* (e.g., *how the metadata is illustrated and presented*), and *allowed element values* (e.g., *the vocabulary used*) can also be specified optionally.

**Metadata Rule 4:** Good statistical metadata includes a clear statement of the conditions and terms of use for various statistics produced.

**Metadata Rule 5:** Good statistical metadata supports long-term improvement and maintenance of data/statistics collected. Appropriate mechanisms for storage/archive, effective retrieval and process management are imperative.

**Metadata Rule 6:** Good statistical metadata records are an integral part of process documentation. Accordingly, compilation and maintenance of metadata records should be uniform, authentic, continuous, participatory, and perceptive towards the different institutional structures that support statistics production and use in the MDAs. These may vary from systematic and unique reporting mechanisms, intra and inter departmental linkages, to cross-sectoral collaborative arrangements & committees for data/statistical purposes.



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