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Statistical Regulation, Planning, Standardization
and Normalization Division
(DIRPEN)

GUIDE FOR THE PREPARATION OF STANDARD METHODOLOGICAL DOCUMENTS OF STATISTICAL OPERATIONS

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PRESENTATION

The National Administrative Department of Statistics, DANE as the coordinator entity of the National Statistical System (NSS), within the framework of the “Statistical Planning and Harmonization” project, works to strengthen and consolidate the NSS. This is carried out through several processes such as: the production of official statistics; the generation, adaptation, adoption and dissemination of standards; the consolidation and harmonization of statistical information, and the connection of instruments, stakeholders, initiatives and products. These actions are carried out in order to improve the quality of strategic statistic information, and its availability and accessibility to respond to users demand.

The latter implies improving the quality of strategic statistical information, its availability, timeliness and accessibility, in response to a growing demand for such information.

Following the fundamental principles of official statistics of the United Nations (UN) pertaining to the coherence, comparability, completeness and quality of statistics it is necessary to provide users with the best products with respect to statistics. For this purpose, the national code of good practice and the standard guide for the presentation of methodological documents of the institutions producing statistical information were developed within the framework of the NSS. These documents contribute to the visualization and understanding of the statistical process; they facilitate transparency, trust and credibility in the technical quality of the producing entity, and improve the understanding and use of statistical information.

The guide presents the guidelines and technical considerations that are necessary for institutions to prepare methodological documents for their statistical operations.

INTRODUCTION

Since 1998, DANE has designed guidelines for the standardization of methodological documents of statistical operations, in order to harmonize them with the standards, principles and international and national procedures as well as to strengthen the statistical production process and the National Statistical System – NSS.

These guidelines also aim at the fulfillment of the programs and commitments acquired in the course of meetings held with international organizations and statistical agencies. The commitments also consider the biennial program of Regional and International Cooperation Activities of the Statistical Conference of the Americas of ECLAC 2009-2011.

The preparation of a Guide for the Preparation of Standard Methodological Documents of DANE's Statistical Operations started in 2008. The process of updating the documentation of the different investigations began with this guide. Its soundness provides users with a proper orientation as to the quality of the procedures and methods used in the statistical production process.¹

The dynamics and evolution of the methods used to produce statistics require periodical adjustment of standardized instruments. Therefore, this new version of the guide involves methodological issues that were not addressed initially such as: the documentation of the information needs that gave rise to the statistical operation, established indicators and variables, the objectives of the chapters and the questions of the survey, a greater precision in the presentation of the statistical-methodological components, and in general, the main characteristics of the different phases of the statistical process.

The guide contains general considerations that describe the objectives and basic concepts of this study, and a chapter addressing the structure and content of the methodological documents of statistical operations.

¹ In this document, the concept of *statistical production* is assumed as the process that implies obtaining the information, its processing, the obtaining of results and their subsequent analysis, in accordance with the methodology developed for that purpose. (Adapted from the definition of the United Nations Economic Commission for Europe UNECE, "Terminology on Statistical Metadata", Conference of European Statisticians on Statistical Standards and Studies, No. 53, Genoa, 2000).

I. GENERAL CONSIDERATIONS

A. OBJECTIVES

1. General Objective

To provide guidelines for the preparation of methodological documents of statistical operations produced by different entities belonging to the NSS, under standardization² and harmonization³ criteria in terms of its structure, presentation and content.

In order to provide users with adequate soundness and guidance with respect to the methods used in the statistical production process, these guidelines should observe national and international standards.

2. Specific Objectives

- a. To establish guidelines to facilitate the use of statistical information produced by the institutions that make up the NSS.
- b. To provide guidelines for developing standard documents that document in detail the methodologies of the different statistical operations in the country.
- c. To provide a tool that enables those responsible for generating statistical information, the ability to revise the statistical investigations. This revision is accomplished through a clear map of the technical processes that make up these investigations. This exercise seeks the replication of statistical information and a greater control in the production of information.
- d. To adopt and adapt internationally accepted standards covering the statistical process from its initial phase through the dissemination of results.

² Understood as the introduction of a set of definitions, classifications, methods, indicators, etc., which can be applied in statistical production processes in order to ensure comparability, statistical information integration and interoperability of information systems.

³ Process that seeks a common agreement regarding the handling of data so that the information produced is easy to construe, it also enables comparison with data series produced by international peers.

B. BASIC CONCEPTS

1. National Statistical System - NSS⁴

It is an organized structure that ensures the production and dissemination of official statistics in Colombia. It is formed by public and private entities that perform public functions or provide public services, who carry out statistical activities or who are relevant sources of statistics. It is also formed by the policies, standards, processes, resources, plans, strategies, instruments and mechanisms for statistical activity.

2. Statistical Operation⁵

It is a set of processes and activities based on the systematic collection of data leading to the production of aggregate results.

According to the source of information, statistical operations can be:

2.1 Sampling⁶

It is a statistical method by means of which a phenomenon is researched and analyzed by selecting a sample from which parameters of the total population can be inferred. Sampling can be probabilistic and non-probabilistic.

Probabilistic sampling: Specific statistical method of sample selection that must meet the following conditions⁷:

- a. A set of possible samples derived from the proposed selection process can be defined.

⁴ National Administrative Department of Statistics-DANE. Estandarización de conceptos (*Standardization of concepts*). Retrieved on March 2011 from:
http://190.25.231.249/aplicativos/sen/aym_index.php?url_pag=con_estan_ver&alr=&id=141

⁵ Resolution 1503 of 2011, of DANE, that regulates the dissemination of statistical information.

⁶ National Administrative Department of Statistics (DANE). Estrategia Nacional para el Desarrollo Estadístico (*National strategy for statistical development*) ENDE, 2010-2014, Política Estadística Nacional (*National statistical policy*). Retrieved on March 2011, from:
http://190.25.231.249/aplicativos/sen/aym_document/aym_ende/ENDE.pdf

⁷ Universidad Nacional de Colombia. Bautista, S. Leonardo. Diseños de muestreo estadístico (*Statistical sampling designs*), 1998. Page 3.

- b. Each possible sample has a corresponding known selection probability.
- c. The selection process ensures that every element of the universe has a positive probability, different from zero, to be included in a sample.
- d. The proposed selection process consists of a random mechanism that ensures that each sample receives exactly the same probability of being selected.

Non-probabilistic sampling: Specific statistical method of selecting a sample where its units do not have a known probability of being selected, and where some units of the target population may not have any probability of being selected in the sample.

2.2 Census⁸

It is a statistical procedure, which investigates the entire universe of study, in order to obtain data or individual statistical information with respect to each and all the elements of the population.

2.3 Statistical use of administrative records⁹

It refers to the use of administrative data collected by public and private companies on a fact, event or action, subject to regulation or control, as part of their function, in order to generate statistical information that is useful for decision-making.

2.4 Derived Statistics

It is a method that integrates data from other statistical operations, using a specific model or process for the production of new statistical information. In their condition of derived statistics they do not require in-field research for the collection of information and they feed on data collected or processed by other statistical operations for their production.

⁸ Adapted by DANE from the definition of the United Nations Economic Commission for Europe, UNECE, "Terminology on Statistical Metadata", Conference of European Statisticians on Statistical Standards and Studies, No. 53, Genoa, 2000.

⁹ Administrative records are a series of data relating to an action subject to control or regulation that are obtained by a public or private entity as part of their function, and that results from tax or other needs. These data are created with the purpose of enabling the administration of government programs, or for monitoring compliance with legal obligations to society. <http://www.eclac.cl/publicaciones/xml/2/14332/lcl2007e.pdf>, page 10.

3. Methodology

It refers to the set of ordered steps and procedures that are carried out in order to develop a research or statistical operation. The methodology defines the aspect that will be researched or studied with respect to an economic, social or environmental phenomenon, explaining the reason why it is required, how it will be developed, what tools, instruments and resources are available to obtain the desired results.

The methodology is based on a theoretical position that leads to a selection of specific methods or techniques pertaining to the procedure to perform the tasks related to a research or statistical operation and therefore it should not be confused with the methodological document where it is presented.

II. STRUCTURE AND CONTENT OF METHODOLOGIES

Methodological documents that are prepared based on this guide, should consider the following structure:

PRESENTATION

1. INTRODUCTION

2. BACKGROUND

3. DESIGN OF THE STATISTICAL OPERATION

3.1. THEMATIC / METHODOLOGICAL DESIGN Thematic/Methodological Design

3.1.1. Information Needs

3.1.2. Objectives

3.1.3. Scope

3.1.4. Reference Framework

3.1.5. Design of indicators

3.1.6. Results Plan

3.1.6.1. Design of output or results tables

3.1.7. Design of the form or questionnaire

3.1.8. Standards; specifications or validation rules; consistency and imputation

3.1.9. Nomenclatures and Classifications*

3.2. Statistical Design

3.2.1. Basic components of the statistical design

3.2.2. Statistical units

3.2.3. Reference and collection periods

3.2.4. Sample design (applicable in researches by sampling)

3.2.5. Coverage adjustments (or coverage adjustment for non-response)

3.3. Implementation design

3.3.1. Training System

3.3.2. Preparatory activities

3.3.3. Design of instruments

3.3.4. Data Collection

3.4. IT DESIGN IT Design

3.5. DESIGN OF METHODS AND MECHANISMS FOR QUALITY CONTROL

3.6. DESIGN OF PILOT TESTS

3.7. DESIGN OF THE RESULTS ANALYSIS

3.7.1. Statistical Analysis

3.7.2. Context Analysis

3.7.3. Expert committees

3.8. DISSEMINATION DESIGN Dissemination Design

3.8.1. Data Repository Management

3.8.2. Dissemination products and tools

3.9. Design of the Assessment

4. RELATED DOCUMENTATION

GLOSSARY

BIBLIOGRAPHY

ANNEXES

Below is a summary relating to the contents of each of the chapters of the guide, so that they serve to support users in: methodological documentation with respect to censuses and sample surveys. New guides are generated for the production of statistical information from administrative records and derived statistics.

It is important to clarify that the edition of DANE's methodological document is governed by the "Manual de estilo" ("Style manual") issued by the Dissemination, Marketing and Statistical Culture Division. In the case of the other entities that are part of the NSS, they can follow the criteria they have established for editing their documents or adopt the guidelines established by DANE.

Given the dynamics or evolution of the phenomena and technical and technological developments, it is imperative to update the methodological documentation on a continuous basis and assure that single versions are being monitored and used at different points of usage.

PRESENTATION

It is the part of the document where a brief presentation of the institution is made, the objective, mission and vision statements, as well as the explanation of the appropriateness of the entity to structure and implement the respective statistical operation.

1. INTRODUCTION

It is recommended to consider the following elements in the introduction of the methodological documents of statistical operations:

- Description and location of the thematic context of the statistical operation, incorporating the main theoretical and practical backgrounds.
- Justification of the statistical operation, indicating the data source and the reasons why it is performed. In addition, the importance that the statistical operation has for the country is described.
- General purpose of the operation based on the general objective and a summary of specific objectives that are considered to be the most important.
- It presents the structure of the document, the topics and subtopics that comprise it.

It is necessary to present the document in an organized manner and to describe how it is formed: its chapters or sections (it is advisable to write a minimal description of all chapters or sections that make up the methodology).

2. BACKGROUND

It presents the origin and historical evolution of the statistical operation as well as its most important modifications. This enables contextualizing users with respect to the work developed, the accumulated experience in performing the statistical operation, and the characteristics of studies that address similar issues. It also gives the possibility to build a comparative vision with respect to the methodological changes that could affect obtaining and analyzing the results.

3. DESIGN OF THE STATISTICAL OPERATION

It refers to the structure and strategies to be developed in order to satisfy certain information needs. The structure corresponds to the sketch, diagram or operation model of variables, the strategies proposed for the development of the statistical operation, and the selection of methods that will be used to gather, process and analyze data.

The following aspects are described in this part of the document: the information needs of users, the general and specific objectives, the different frameworks that are considered necessary to include, the statistical methods and components that will be part of the operation, the methods used for the sample design (sample surveys), in order to enable a clear and brief vision of the manner in which the planning and formulation of the statistical operation is carried out.

This chapter covers the following designs: thematic and methodological; statistical; production (which in turn includes data collection or gathering and data processing); systems; results analysis and the dissemination process.

3.1. Thematic/ Methodological Design

This chapter documents the following items:

3.1.1. Information Needs

This phase documents the identification of the needs for new information of the users, or feedback pertaining to existing statistics that can be reviewed. Identified needs must be studied, consulted and confirmed, specifying the objectives of the relevant statistical operation. This description includes sectoral information requirements and the contribution of the statistical operation for the design of public policies, when appropriate.

3.1.2. Objectives

They refer to the desired purposes or the final product of a particular process, in other words, the expression of a goal that is sought and that will enable articulating a series of actions for its achievement. Objectives usually obey to a logical construction and are formulated as follows:

a. General objective

It is the purpose of the operation or research. It can also be considered as the general representation of the desired result, which must match the central research question. This means that both the general objective and the central research question should speak of the same thing, in terms of the type of analysis, the object, the population to be studied as well as their geographical and temporal delimitation.

The general objective refers to the title of the project and the research question posed in terms of action. It is desirable to limit its content so that it serves to the delimitation of the proposed project.

b. Specific objectives

They are qualitative expressions that should lead to an answer or solution to the general objective and the central question.

These objectives should be consistent with the general objective and the expected results of the statistical operation. The specific objectives must be evaluated in each step of the statistical operation in order to understand the different levels of results.

Each specific objective should be explained in detail, be addressed to the basic elements of the problem, be measurable and observable, be clear and precise and follow a methodological design.

3.1.3. Scope

It describes the thematic coverage of the statistical operation, i.e. it specifies the thematic aspects that will be investigated and which will generate the results. It also lists those subjects that will not be taken into account and justifies their exclusion. In addition, the scope defines the spatial and temporal aspects of the statistical operation.

3.1.4. Reference Framework

It represents the analytical framework under which the research or statistical operation is developed. Its construction is based on a review of existing literature on the subject.

The reference framework consists of: the theoretical framework, the conceptual framework, used references and those issues that are deemed necessary for inclusion, in order to define the statistical operation in the best possible manner.

a. Theoretical Framework

It contains a summary of the reviewed literature on the subject related to the statistical operation. It also describes the state of the art and the contributions that are made in the thematic field.

This process enables obtaining the necessary arguments to define the research problem; it makes it possible to know the theories that help locate the theme; it helps to better interpret the results obtained and to generate new approaches in the manner in which problems are addressed.

b. Conceptual Framework

It corresponds to the basic concepts and technical terms used in the statistical operation. Other terms that are used are listed in a glossary, annexed to the methodology.

It is important that the concepts used in the statistical operation are standardized by DANE, taking into account international benchmarks like the United Nations, Eurostat or the OECD, or other statistical offices of leading countries. The aim of this exercise is to guarantee the comparability, integration and interoperability of statistics.

c. Legal Framework

It describes the normative environment of the statistical operation.

d. International benchmarks

It describes the main works developed by international organizations that are leaders in the field of study. These organizations include: the United Nations, the National Statistical Institutes, the International Organization for Migration, the World Health Organization, the International Labour Organization, and the International Monetary Fund, among others. This description aims to reflect the main recommendations that were adopted and/or adapted in statistical operations.

e. National benchmarks

It mentions those standards and documents that provide input on the theme, the methodology and on the subject of quality assurance for the construction of statistics and documents, as well as on the relationship with respect to other statistical operations associated with the theme under study.

3.1.5. Design of Indicators

Indicators are the translation of the goals into measures that summarize the statistical information that will be obtained. They correspond to indices, ratios, proportions, averages, percentages, totals or special indicators. It is essential for the indicators to be prepared and documented in a precise manner, because they are the basis for defining the necessary variables to enable their own calculation. Indicators also affect the design of the form and the result tables.

The documentation describes the methodology defined for obtaining these indicators, which are calculated or estimated with the statistical operation. The documentation also presents the indicators' objectives and corresponding formulas¹⁰.

3.1.6. Results Plan

It is important to specifically determine the type of reports, graphics and type of analysis to be performed as part of the objectives of the statistical operation, since a processing and information analysis plan that is based on the objectives and within the budget and schedule must be carried out.

3.1.6.1. Design of output or results tables

Output or results tables are an organized set of data designed for the purpose of indicating the requirements of the information users.

The tables present the results of the statistical operation, with their respective levels of thematic and geographic disaggregation together with the annotations, headers, footnotes, etc. that facilitate the analysis and interpretation of such results. It is important that the title indicates its contents in a clear and concise manner. The title must present the place to

¹⁰ For more information refer to: Metodología de la Encuesta sobre Ambiente y Desempeño Institucional Departamental (The Methodology of the Environment and Institutional Departmental Performance Survey), at: http://www.dane.gov.co/files/investigaciones/fichas/EDI_Departamental.pdf, page 20 consulted on September 11, 2012.

which the information refers; the phenomenon that is being presented; the subordinated variables and the reference date.

The titles of the output tables can be listed within the methodological content and they are presented in the annexes section or as an attached document.

3.1.7. Design of the form or questionnaire

The content of the questionnaire is defined according to the study's objectives, translating these goals and information needs into indicators, output tables and variables to finally reach the questions. The number of questions is reduced to those deemed strictly necessary in order to comply with the results plan and to obtain the required statistical information that will be reflected in the results tables.

The design of the questionnaire should be based on the indicators that express the results and the manner in which the information will be collected. The questionnaire is generally structured in thematic blocks or chapters formed by groups of questions that have a logical sequence.

It is necessary to understand and document the objectives of each one of the modules or chapters that comprise the questionnaire as well as the objectives of the questions. The questionnaire should be part of the annexes.

In the case of continuous statistical operations it is essential to define the needed criteria for including or eliminating questions from the form or questionnaire, as this can affect the design as well as the quality of collected information by overloading the respondent with too much information.

Another essential aspect is the definition of form or questionnaire pre-testing and pilot testing. This definition ensures that the questionnaire is consistent with the phenomenon of study and with the logical sequence of the questions and information flows.

3.1.8. Standards; specifications or validation rules; consistency and imputation

It is essential to document the rules that will be applied during the collection and processing of the data set for debugging in order to ensure completeness, correctness and consistency.

In general rules refer to:

- The values that variables can assume individually (validation process).

- The relationships that should exist between some variables and others (consistency process).
- The expected overall structure of the data set.
- The manner in which a value is “assigned” to a missing or inconsistent datum (imputation process).

The statistical edition process is determined from the questionnaire design when using the Mobile Capture Device (DMC for its acronym in Spanish) in statistical operations, since default validations are included in the capture program enabling the critique process for validation directly in the field.

The determination of the specifications is more relevant as it will be a starting point for developing the applications within the DMC¹¹.

The documentation lists the validation and consistency manuals as well as the imputation manuals (when applicable) and these are attached to the methodology.

3.1.9. Nomenclatures and classifications

It is necessary to describe the classification or classifications used by statistical operations, indicating levels of disaggregation with which the results are presented.

It should be taken into account that nomenclatures are conventions for describing observations, rules and annotations that identify the categories of a classification on a specific topic of interest.

Classifications are a linguistic system through which economic, cultural or social phenomena, are ordered and grouped systematically, including all nominal modalities or numerical ranges admitted by a variable, and depending on the use the classification will have.

Just like concepts, nomenclatures and classifications used by statistical operations must correspond to versions updated for Colombia, taking into account the international benchmarks in order to ensure comparability and integration of the statistical information that is generated.

¹¹ ANDESTAD. Cooperation Project EU-CAN. TDDE. Teacher Training in Survey Design Techniques and Development. Design of questionnaire. Lima - Peru. Page 29-41.

3.2. Statistical design¹²

It consists of the definition, construction and/or formulation of the statistical framework, the universe, population, statistical units, periods and the sample design in the case of statistical operations by sampling.

3.2.1. Basic components of the statistical design

These are the elements that each statistical operation must contain in its statistical design. Such elements are:

- **Universe:** It describes the set of units or individuals referred to in the study or that constitute the group of interest and that satisfy a common definition. The universe reflects the objectives of the study, since it describes them in terms of the content, units, space and time. Moreover, the exclusion or inclusion of groups in the universe must be justified.
- **Target population¹³:** It delimits the portion of the universe with respect to which it is possible to generate estimates due to the exclusion of some elements that do not meet the definition of universe, or due to practical considerations of the field operation (e.g., institutionalized individuals, the street-dwellers, or those who cannot be accessed without incurring in an excessive cost).

The documentation explains the difficulties and reasons why the population is established or limited. The reasons can be of various types: budget-related, operational, political, economic or social, or they are not an object of study.

It is necessary to specify the units and their characteristics and to delimit them geographically and temporally.

- **Statistical framework:** The set of observation units from which data are obtained, according to the defined variables. In the case of sample surveys it is called the sampling frame; for the case of censuses it is referred to as census frame.

Its design should contain the variables that enable the characterization, identification and location of the observation units, as well as its methodology of construction and update.

¹² The National Institute of Statistics and Geography of Mexico (INEGI) Capture of sample surveys. Series: Documentos para la generación de estadística básica. (Documents for the generation of basic statistics). Mexico, 2010.

¹³ Statistics Canada. (2003). Statistics Canada Quality Guidelines 4th edition. Retrieved on January 2011, from: <http://www.statcan.ca:8096/bsolc/english/bsolc?catno=12-539-X&CHROPG=1>

It is important to indicate the environment in which the frame is located: listed on paper, cartography, and magnetic media, among others. It should also refer to the information integrity of the statistical framework information and its safety.

- **Definition of variables:** It mentions and describes the main variables considered in the design of the statistical operation.

From the moment in which variables are defined it is necessary to establish and document those microdata that should be anonymized in order to ensure the confidentiality of the information units according to the anonymization protocol and the resolution 1503 of 2011, which regulates the dissemination of statistical information.

- **Data source:** It describes the type of source from which required statistical information is obtained, which can be: census, sample survey, statistical operation based on administrative records or derived statistics.
- **Geographic coverage**¹⁴: It refers to the territorial extension over which a statistical operation is implemented. It can be national, regional, departmental, etc.
- **Geographical disaggregation**¹⁵: It presents the level of detail of a territorial division, which is required for disseminating information according to the geographic coverage. This is determined in the project plan.
- **Thematic disaggregation:** It refers to the level of detail of the subject of study which is required for disseminating information. It is also established in the project plan.

3.2.2. Statistical units

They include: the observation unit, the unit of analysis and the sampling unit that is used for sampling operations.

- **Observation unit:** It is the subject of research or study, from which information is received and statistics are compiled. Some examples, depending on the statistical operation are: persons, families, homes, crops, businesses, institutions, parcels or agricultural lands, seasons, administrative areas, among others.

¹⁴ National Administrative Department of Statistics (DANE). Year not available. Glossary. Geostatistical information system. Retrieved from:
http://www.dane.gov.co/index.php?option=com_content&task=category§ionid=23&id=347&Itemid=832

¹⁵ INEGI. (2010). Capture of sample surveys. Series: Documents for the generation of basic statistics.

- **Unit of analysis:** It corresponds to the entity under study that is measured and from which the conclusions of the statistical operation are drawn. The statistical operation may have several units of analysis. For example, in agricultural surveys it can be: the land, the farm and the agricultural production unit. In social surveys it can be: individuals, households and dwellings.
- **Sampling unit:** It describes, defines and justifies the element or set of elements to be selected in the sample. It applies for probabilistic and non-probabilistic sampling. An operation can have multiple sampling units.

3.2.3. Reference and collection periods

Reference period: It refers to the specific date (day) or the period (month, quarter, semester, etc.) to which the information contained in the study variables belongs.

There can be different reference periods in a statistical operation; for example, the table below shows the periods used in the second semester of ENA (National Agricultural Survey) for year 2010:

Sowing and Harvesting	Interview day
Year-round plants and dispersed trees	Interview day
Pasture and fodder	Interview day
Forest plantations	Interview day
Livestock activity	Interview day
Reproductive technologies	During the year 2010
Number of births	Last year(from the day of the interview backwards)
Milk production in the farm or production unit	Day before the interview
Egg production	Week before the interview
Vaccination against classical swine fever	Last 12 months
Poultry vaccination	During the year 2010
Current use of land	Interview day
Agricultural infrastructure	Interview day
Irrigation in the production unit	During the year 2010
Technical assistance	During the year 2011

Source: DANE's technical team, with information from the 2010 National Agricultural Survey-ENA

- **Collection Period:** It indicates the interval of time or the date in which information collection or gathering is carried out.

3.2.4. Sample Design¹⁶

It consists of the definition of the design, the sample selection and the estimation of results, specifying the stages, phases and algorithms used in the selection process.

Elements such as: the universe, the population, the sampling frame, the sample and the statistical units that are part of a group of basic concepts that help defining the sampling design.

The documentation should include the adjustments made, considering the findings of the pilot tests performed.

- **Type of sampling:** It describes the method of sample selection. It justifies the design taking into account the characteristics of the variables, the sampling frame, the type of study, the population, the budget, etc. That is, it defines the sampling design used to achieve the objectives of the statistical operation.

It explains in detail the advantages of that particular design, arguing, where applicable, the stages, phases, as well as the criteria used for forming, setting and defining the size of strata or clusters.

- **Defining the size of the sample:** It presents the methodology for the calculation of the sample sizes of the study: by stages, strata, levels or areas as appropriate, determining aspects such as: elements involved, costs of the statistical operation, allocation mechanisms¹⁷, precision, reliability, design effects, as well as the methodology for the maintenance of the sample, when needed, according to the type of measurement. It describes the procedures that are used and the frequency of their application.

Similarly, the methodological documentation must present the algorithms that were developed for the sample selection.

¹⁶ It applies only to statistical sampling operations.

¹⁷ Allocation: Distribution strategy / allocation of the sample in different strata. This can be:

Simple Allocation: It refers to the equal distribution of the sample between known strata.

Proportional Allocation: It refers to the proportional distribution of the sample among the different strata, based on the number of effectives of each one of them (In this manner the elevation coefficient remains constant).

Optimum allocation: it refers to the distribution of the sample between strata based on the size and variance of each one of them, maintaining a constant dispersion for the whole sample.

- **Weights:** It describes the criteria applied for the generation of weights and/or expansion factors and for determining the necessary computer processing. In a like manner, it is required to present the types of adjustments that are carried out and their computer processing.
- **Estimation procedure:** This procedure has the following characteristics: a) it describes the statistical procedure established to estimate the values of the parameters with respect to the target population. b) It presents the formulas of the estimators that are used to obtain the parameters. c) It defines and justifies the chosen methodology, the formula and its components. d) It indicates how the calculation of the expansion factors is made and the elements involved therein. e) It describes the methods of adjustment to the expansion factor, either for total non-response or adjustments by high quality exogenous variables that capture the dynamics of the target population.
- **Calculation of the accuracy of results:** It describes the methodology used to estimate sampling errors and their presentation to determine the confidence level. It summarizes the design of the variance estimation method. It makes it possible to know the formulas to calculate the standard error and/or the coefficient of variation of the estimators.
- **Rotation:** In the case of continuous sample surveys it is essential to document the aspects related to sample rotation.

3.2.5. Coverage Adjustments (or coverage adjustment for non-response)

It describes the procedures for coverage adjustments of the statistical operation. The coverage adjustment occurs in cases of sample loss (sample surveys) so as to avoid bias in the estimates and censuses. The adjustment is done due to the non-response of the elements of the universe that were not measured for some cause.

3.3. Implementation design

It refers to the description of the manner in which the process of data gathering will be carried out according to the methodology developed for that purpose.

While data processing and the generation of the results are part of the implementation stage, the methodological documentation will be included in the system design. This circumstance arises since this component is the one which carries out the corresponding computer developments, considering the specifications or criteria defined by the subject-matter experts and methodologists.

3.3.1. Training System

It describes the training method or methods and the methodology for carrying out the training of the operational personnel who will be collecting data. The training system should specify, among other things, the structure, processes or sub-processes that compose the training, the media and audiovisual aids and the profiles of instructors or trainers.

It is necessary to establish the requirements, the number of trainers, the profiles and other requirements that must be met in order to carry out the training process.

The following aspects should be considered among those that were identified and documented for the training of operational staff: thematic and conceptual knowledge, criteria for thematic monitoring, tools management, assessment criteria and validation of work quality taking into account the specifications defined for data validation and consistency.

3.3.2. Preparatory activities

- **Awareness-raising:** It describes in a general manner the process used to disseminate statistical activities to be developed. In order to facilitate data collection, this process must include formal communication channels such as spoken or written press, television or different media, such as brochures, magazines, newsletters, letters, billboards, flyers, visits, etc.
- **Personnel selection:** It refers to the general procedures for the selection and recruitment of staff, the profiles that are generally required, such as analysts, assistants or professionals.

3.3.3. Design of instruments

In addition to the questionnaire, other instruments necessary for the data collection process and its monitoring should be designed according to the type of data source. Some recommended instruments are:

- Protocols
- Manuals
- Guides or instructions

- Enlistment forms¹⁸
- Follow-up Forms

These instruments can be listed and explained briefly within the methodological documentation and presented as part of the annexes.

3.3.4. Data Collection

The collection or gathering method and the instruments designed for this purpose should be considered in the data collection design, observing aspects such as:

- **Operational scheme:** It refers to a synthesis of the strategy¹⁹ to be used in the field operation that finally reaches the informant or the information unit, and is designed to obtain data on the observation unit. It is necessary to make the mechanisms for coordination, monitoring and control of the field operation explicit.
- **Methods and mechanisms for collection:** It refers to the procedures used to obtain and store data supplied by sources. When using magnetic media the procedure for data capture or data entry must be established, and if an electronic form is used for this purpose, data collection will be carried out through the Web.

If the system for data and characters automatic recognition (such as image and optical character recognition, optical frames readings, among others.) is designed for this process, its characteristics should be described or documented. If the data collection process for the Statistical Operation is done only on paper, the procedures of capture, critique, analysis and other phases established for a statistical operation must be included.

- **Data transmission:** It describes the manner in which data are sent during collection so they can be stored in databases, when using the Data Capture Device-DMC.
- **Paper forms:** It consists of reviewing the steps and the manner in which forms are organized and classified and the criteria that are taken into account for the numbering and formation of form sets. If the collection process of the statistical operation is carried out only on paper, the procedures of capture, critique, etc. should be incorporated.

¹⁸ According to DANE, the enlistment process is understood as the operational process for the construction of a list frame.

¹⁹ For example, defining the scheme with an operations coordinator, a field coordinator, and a supervisor for every three or four interviewers and defining their respective roles.

- **Data Capture Devices - DMC:** When the collection is carried out using DMC or similar electronic media, a brief explanation on backup copies, structure of files and the means of data transmission should be provided.
- **Electronic forms in web environment:** It refers to the process of storing data online, according to user roles, their consolidation and debugging.
- **Coverage Control:** Coverage monitoring and evaluation of the information units that were defined for the operational process should be documented as well as the mechanisms defined for data loss control. These mechanisms can be: revisits from supervisors and coordinators during the collection and the critique of statistical information. In addition, established mechanisms or processes to minimize information unit wear and overload should be included.

3.4. IT Design

It refers to the description of the design and structure of the tools that were built or adapted in the technological platform and from the database. It includes the “Entity Relationship” model or data model and the data dictionary, both updated. This model enables identifying the variables that will be used as a reference point in the statistical operation. It also explains the data architecture, the development tools and modules developed.

It describes how to carry out the processes of consolidation of the database, the anonymization and processing to generate a debugged database that provides useful information. This database will be analyzed and subsequently used by other statistical activities or operations requiring it.

The IT department should determine and document the methods that will be used for the anonymization process based on the identification (by the thematic experts) of the variables that must be restricted in the database in order to ensure the confidentiality of the information units. Anonymization is implemented after consolidating the database. In case there is information integration, this process will be carried out upon completion of such integration.

This part of the document describes data processing as well as the explanation and implementation of procedures that ensure internal consistency of data and the mechanisms for their correction in case of error or omission.

It also explains the procedure for the generation of results and output tables defined in the statistical operation.

Moreover, the documentation describes the security mechanisms that guarantee the integrity of databases, backup and recovery of produced information and the tools that are used for each one of the stages of the statistical process.

There is a need to manage the storage and disposition of statistical data and metadata. Therefore, the disposition must be defined: for data that is disseminated, for data from previous stages of the statistical operation and intermediate files (e.g. the sample file, raw data from the collection phase, the results of the various stages of the statistical process and the analysis phase).

The policies or rules established by DANE, for the process of filing and storage of statistical production should be implemented. They establish the means and location of the file as well as the need to maintain duplicated copies. It also considers the conditions under which the data and metadata should be arranged and retrieved.

3.5. Design of methods and mechanisms for quality control

This section describes the methods and mechanisms of quality control and monitoring. That is, those elements and means used to ensure the quality of the results, in line with the objectives that were set at the beginning of the statistical operation.

There are critical points during the different processes of a statistical operation, therefore quality monitoring and assurance tools are designed as a preventive measure.

In addition, supervision processes should be established, especially during data collection or gathering and indicators should be designed for the control of collection and processing.

Recommended indicators are:

- Returns calculation
- Percentage error in the filing of forms
- Coverage Rates (under coverage or over coverage)
- Percentage error in data encryption and critique
- Rates of non-response (partial or total)
- Non-response Bias Evaluation
- Imputation rates by variable
- Opportunity indicators

It is advisable to periodically estimate the first three indicators during the field operation in order to make necessary adjustments in the field and get information of better quality.

In the case of censuses, coverage can be determined by means of cocensus surveys²⁰, sampling, or mathematical models.

In probability sampling surveys, variation coefficients are excellent quality indicators and are presented in the results tables.

All these aspects as well as the results obtained must be methodologically documented, in case pilot tests are performed.

3.6. Design of Pilot Tests

Pre-testing the forms or questionnaires and pilot testing the processes are essential for the optimal performance of the processes, procedures, activities and tools. It is important to methodologically document these experiences that will generate adjustments for the statistical operation.

Pilot tests are equivalent to performing the operation on a small scale (because all stages of the statistical process are developed) and should be documented as such. In addition, the most important aspects that such tests provide should be presented within the general methodological document (of the statistical operation). This is also useful for users of the results.

3.7. Design of the Results Analysis

3.7.1. Statistical Analysis

Statistical analysis can be descriptive or inferential. The first one involves the whole population, and the second one comprises the methods and procedures to deduce properties (to infer) of a population from a small part of it (sample).

Data analysis aims to establish through a variable, in the most approximate manner, the specific characteristics of such population. This is achieved by focusing on three core aspects: the central and temporal tendency, dispersion and the distribution type. This

²⁰ Cocensus Surveys are a methodology that is used with the purpose of finding, simultaneously with the census, some additional characteristics of the population under study. Usually, two questionnaires are developed for its implementation: a short one containing the basic characteristics that will be inquired with respect to all elements of the universe, and a longer one which includes additional or expanding questions which will be collected only for those elements included in a probabilistic sample of dwellings, households or individuals. For more information refer to: Luna Hernández, Angela. "La Encuesta Cocensal en el Censo General 2005" (*The cocensus survey in the 2005 General Census*), *IB Virtual Magazine Vol. 1, No. 1*, retrieved from: http://www.dane.gov.co/revista_ib/html_r1/articulo6_r1.htm, February 12, 2013).

analysis also enables the control of possible errors, i.e. values that are out of the range or the presence of missing values, aspects that must be described in the corresponding technical and methodological document.

Every possible analysis can be defined and documented from the design of the statistical operation. This documentation enables identifying all the necessary elements for the development of this process.

3.7.2. Context Analysis

The methodology should include the procedures that will be implemented for comparing historical results with other similar data sources and with the events that occurred in the universe of study on the studied subject so as to provide an explanation of the statistical information that was obtained.

3.7.3. Expert Committees

It describes the development of internal and external discussions with respect to the results with the entity's national and international internal experts, in each one of the socio-economic sectors, in order to contextualize, analyze, validate and/or adjust the results for their dissemination.

3.8. Dissemination Design²¹

It refers to the mechanisms and means provided for the dissemination of information generated by the statistical operation. It is also necessary to define the characteristics that products need according to the requirements of users and the usefulness that the statistical information could have.

3.8.1. Data repository Management

It specifies the manner in which storage, maintenance and dissemination of microdata, macro-data and metadata (historic data) is managed, under technological tools with a centralized management scheme.

²¹ National Administrative Department of Statistics (DANE). Regulation, Standardization and Normalization Division (DIRPEN), Standardization of concepts. NSS. Retrieved from <http://190.25.231.249/aplicativos/sen/>

3.8.2. Dissemination products and tools

It describes the manner in which the results produced by the statistical operation will be presented and the means by which they will be delivered in order to be consulted by all users.

It includes:

- Output Tables (results) with all generated disaggregations and designed and calculated indicators.
- Graphics with explanatory notes.
- Variation coefficient or sampling errors, estimated for each datum (cve %), in the case of probabilistic sampling operations.
- Metadata for a better understanding of the results.

The above implies a presentation in detail of the results produced by the statistical operation, indicating different means to disseminate information, such as: newsletters, summaries, extracts and yearbooks, autonomous databases on CD and DVD, static and dynamic databases, briefly indicating the method of access (e.g. via website).

Whatever the means chosen for the dissemination of results, the release schedule for the different statistical operations that were generated should be defined and documented. This documentation shall include defined regulations on the dissemination of anonymized microdata in order to ensure the confidentiality of information units.

It is also necessary for the released data to be accompanied by metadata, i.e. necessary information that describes how data were generated and that ensures the correct use thereof.

3.9. Design of the Assessment

Planning, designing and documenting the assessment phase of the statistical operation that is going to be developed is fundamental. The assessment phase formally takes place at the end of the statistical process using the inputs collected during partial assessments performed to each of one of the stages of the process. It enables determining the improvements or adjustments that need to be implemented in future versions.

The assessment material includes: user comments (feedback), process metadata, system measurements, and results of inspections and staff suggestions. The progress reports of an action plan agreed upon during a previous iteration may also feed the assessments of

the following iterations. This sub-process gathers all these evidences, and makes them available to the person or team carrying out the assessment.

The evaluation will take into account that all entries are synthesized in a report. The report generated will detail the specific quality problems for this iteration of the statistical production process, and if necessary, to make recommendations for future changes, adjustments or redesigns.

Similarly, a meeting will be held in order to develop and agree upon an action plan based on the assessment report. As a recommendation, it is pertinent to include a mechanism to monitor the impact of those actions and that can serve as the basis for assessments of future versions of the process.

4. RELATED DOCUMENTATION

It consists of presenting a list of technical and methodological documents used in the generation of statistics, such as: manuals, instructions, questionnaires, methodology for calculating indicators, etc., the codes of collection and processing software, their documentation, and the description of their content and purpose. When necessary, the site or place where this information can be consulted must be listed.

GLOSSARY

Methodologies can contain two glossaries: a mandatory glossary on standardized terms and concepts and an optional one on other acronyms. It is recommended to list both glossaries, sorted in alphabetical order, including standardized concepts and acronyms of the investigation, their definitions or explanations that are necessary for the understanding of the document. When a new term appears, it is advisable to explain its definition.

BIBLIOGRAPHY

It presents the entire bibliographic material consulted during the development of the research in order to document the work.

The bibliography is sorted alphabetically, by the authors' last names. For the cases in which there is no information about the author or where it is anonymous, the bibliography is sorted according to the title of the document.

DANE uses the "Manual de estilo" (Style manual) for preparing its documents. For the other entities it is recommended to use the APA (American Psychological Association) standard for preparing documents.

ANNEXES

They show additional information to that presented in the body of the document in order to support, explain or expand the information for example: tables, graphs, forms, data collection forms, output tables, functional schemes, available results, etc.

GLOSSARY

Census: Statistical procedure whereby the totality of the units of the universe of study are investigated²².

Examples of censuses are:

- **Agriculture and Livestock Census:** A large-scale statistical operation conducted periodically to collect, process and disseminate data on the structure of the agricultural sector of a country or of a substantial part of it. The typical collected data are: agricultural and livestock producer, size of the cultivated area, land tenure and usage, cultivated areas, irrigation, livestock inventory, infrastructure, machinery, equipment, labor and environment²³.
- **Economic Census:** The study of establishments engaged in production of goods and services, to account for the country's economic structure, understood as the distribution of the types of activities that are performed, as well as the productive resources (capital and labor) used in this production²⁴.
- **Housing Census (habitation):** It refers to the set of processes consisting of the collection, compilation, assessment, analysis and publication or dissemination statistical data pertaining to all habitation units (housing) and their occupants in a country or in a well-defined part thereof at a given date.
- **Population census:** It refers to the set of processes consisting of the collection, compilation, assessment, analysis and publication or dissemination of demographic, economic and social data pertaining to all the inhabitants of a country, or a well-delimited part thereof at a given time.

Metadata: It refers to necessary information for the use and interpretation of statistics. Metadata describe the conceptualization, quality, generation, calculation and characteristics of a set of statistical data²⁵.

²² Adapted by DANE-Standardization of concepts- from the definition of the United Nations Economic Commission for Europe UNECE, "Terminology on Statistical Metadata", Conference of European Statisticians on Statistical Standards and Studies, No. 53, Genoa, 2000.

²³ DANE. Basic design of the third national agricultural and livestock census of Colombia, 2013

²⁴ INEGI. Methodological summary of economic censuses. 2003. Page 5.

²⁵ Ibid.

Microdata: It refers to data pertaining to the characteristics of the units of study in a population (individuals, households, establishments, among others), which constitute a unit of information of a database and that are collected by means of a statistical operation²⁶.

Microdata anonymization: It refers to the process that prevents the identification of the study units that are sources for the individual records of the set of microdata.²⁷

Statistical information: Set of results obtained from statistical operations and that describes or expresses the characteristics of an element, phenomenon or situation of study²⁸.

Statistical quality: It refers to the set of properties that the statistical process and product must have in order to meet the information needs of users.²⁹

Statistical standards: They are guidelines to improve international comparability, since they can be used to harmonize the processes of generation, compilation and dissemination of statistical information. Statistical standards are developed by means of agreements between technical experts from various countries under international cooperation and they constitute international recommendations with no binding character³⁰.

²⁶ Ibid.

²⁷ Resolution No. 1503 of DANE of 2011, which regulates the dissemination of statistical information.

²⁸ Resolution No. 1503 of DANE of 2011, which regulates the dissemination of statistical information.

²⁹ National Administrative Department of Statistics (DANE). Resolution 691 of DANE of May 2011 on the quality certification process of statistical operations.

³⁰ <http://mapserver.inegi.org.mx/estandares/Index.cfm?Ligas=EstandarEst.cfm>

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