

**National Administrative
Department of Statistics**



**Methodology and Statistical Production Division
DIMPE**

**Monthly Manufacturing Survey Methodology
MMM**

NATIONAL ADMINISTRATIVE DEPARTMENT OF STATISTICS

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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 strategic statistics; the generation, adaptation, adoption and diffusion of standards; the consolidation and harmonization of statistical data, and the connection of instruments, stakeholders, initiatives and products. These actions are carried out in order to improve the quality of strategic statistical data, and its availability and accessibility to respond to users demand.

In this context DANE, aware of the need and obligation to provide better products for its users, developed a standard presentation guide for methodologies. The aim of this guide is to contribute to the visualization and understanding of the statistical processes, allowing further analysis, control, replicability, and evaluation. The documents are presented in a standard and comprehensive manner, thus facilitating the understanding of the main technical characteristics involved in the processes and sub-processes of each research, making them available for both specialized users and the general public.

These guides promote the transparency and credibility of the technical expertise of DANE, for a better understanding and use of statistical information. This information is produced according to the principles of coherence, comparability, integrity and quality of the statistics.

INTRODUCTION

The Monthly Manufacturing Survey Methodology (MMM by its acronym in Spanish) is a statistical research through which the National Administrative Department of Statistics (DANE) collects and consolidates data regarding the short term evolution of the Colombian manufacturing industry.

Based upon the information about production, sales, employed personnel, employment, wages and salaries, social benefits and hours worked monthly provided by manufacturers, DANE will generate indices and variations for different public and private users. Once the data is collected and processed, the DANE publishes a set of indicators for the use of its public and private customers. This survey uses nationwide data and takes into account 48 ISIC¹ Rev. 3 classes.

This methodology aims at presenting to the user and general public the basic processes related to the Monthly Manufacturing Survey. The information is presented in the following order: Chapter one shows the background of the statistical survey. Chapter two includes this survey's designing process, objective, scope, conceptual framework among other topics. In Chapter three we explain the consecutive stages along the statistical production process. Here the reader will find the most important issues concerning research forming activities, data collection, critique, codification, supervision and data consolidation of the Monthly Survey of Manufacturers. Chapter four discusses this survey's output information and establishes how our indicators are built. Chapter five specifies how data and statistics are disseminated, whereas chapter six recommends additional reading for the MMM comprehension.

¹ ISIC: *International System Industrial Classification of All Economic Activities, Rev.3 adapted for Colombia.*

1. BACKGROUND

Since 1962, the DANE has been creating indicators to describe the trend of the manufacturing industries using several economic variables. These estimations have been based on statistical analysis of random samples whose size has been established from the information collected in the Annual Manufacturing Survey (EAM by its acronyms in Spanish). Random variables such as gross production, employment, wages and salaries, etc. aggregate data from a sample of manufacturing establishments grouped according to the ISIC (International Standard Classification of All Economic Activities) principles.

In May's 1968 Monthly Statistical Bulletin No. 294, says: "Due to the fact that data and estimations regarding the trend of the manufacturing industries derived from the Annual Survey of Manufacturers are only available after a long period of time, it is said that they possess no real value for the short term industrial policy decision making process. The only way to correct this situation is to initiate a monthly survey based on statistical sampling. This decision responds to the growing need for regular and short term information availability.

The first monthly survey was implemented with the aim of generating employment and salary indicators using a random sample of 1400 manufacturing establishments. The sampling frame was the 1962 Annual survey of manufacturers. Soon after, another survey was carried out, this time to generate statistics on production of manufactured goods. This new survey included 1200 manufacturing establishments to generate the production indicators.

Since July 1970 the two surveys were unified. This time a stratified random sample of 800 production units was surveyed. Based on this random sample the DANE was able to build indicators for production, employment and salaries. The last two indicators were disaggregated into direct and indirect manufacturing industry workers. It accounted for the nationwide manufacturing industry and the 20 classes defined in the ISIC 1.

In 1978, thanks to improvements on research techniques and due to the new dynamics of the domestic economy and to the need of unifying the Annual Survey with the new International Standard Industrial Classification – ISIC 2 - for Colombia, the Monthly Survey of Manufacturers was redesigned, this time using a new conceptual framework. The new survey used a sample of 818 manufacturing establishments and generated indicators for the 28 classes defined. This new methodology was in use from January 1980 to December 1990.

In 1988, the sample size of the monthly survey was again redesigned for the same reasons as mentioned above, plus, now it took into account the fact that three strong industrial regions developed in the country. The new sample 874 manufacturing establishments surveyed. This new methodology and sampling technique were used in the surveys from 1991 to the year 2000 and its estimates gave insight into the same 28 industrial classes defined in the ISIC 2.

By the end of 1999, the survey was again redesigned and its sample size refreshed. The main reasons for this change were: changes in the industry activity, low representativeness of the random sample used in the survey, the need to include the third revision of the ISIC and the commitment to comply with the latest international requirements on industry data availability. This time, the sampling frame was the 1997 Annual Survey of Manufacturers, which at that time counted 8321 manufacturing establishments. From January 2001 the sample size includes 1344 representative manufacturing establishments across the country and gives insight about the trend of each of the 48 classes defined in the ISIC 3. adapted for Colombia.

In 2007, an independent expert commission was hired by DANE to review and qualitatively grade the processes involved in the MMM. Some of the resulting suggestions were: to keep a frequently upgraded manufacturing establishments contact guide, to generate data within the regional level and to include certain classes not included so far. These suggestions have resulted in new goals we expect to achieve in the short term; in fact, progress has been made in building statistical models that will allow measuring quarterly industry behavior in the most industrialized regions of the country.

2. DESIGN

2.1 CONCEPTUAL FRAMEWORK

2.1.1 Objectives

General Objective

The MMM aims to estimate the evolution of the manufacturing sector in a short term, publishing the indicators regarding production, sales, employment, wages and salaries and hours worked of the Colombian manufacturing industries.

Specific Objectives

- To gather the information required in order to develop reliable indicators of the sector and the industrial activity regarding the variables to be surveyed.
- To release statistical information enabling the government the adoption of industrial development politics.
- To provide a base of indicators for estimating the Gross Domestic Product.

2.1.2 Reference Framework

Conceptual basis

The manufacturing industry is defined as physical or chemical transformation of organic or inorganic substances into new products; it includes the work performed by power-driven machines or hand-made goods, production performed in a factory or in a different place, where products are sold both through wholesale or retail sale. Assembly of components of manufactured products and recycling of waste materials (except for the cases where this part belongs to the building industry) are also included in the manufacturing process. The statistical unit used in the MMM corresponds to the establishment.

International references

The working guidelines that govern the methodological framework of all manufacturing surveys carried out by the DANE are those stated in Recommendations for the 1973 World Program of Industrial Statistics series M no. 54. On the other hand, the ISIC provides the criteria for grouping the manufacturing establishments according to their activity. At present, DANE is working on the adaptation of the fourth revision of the ISIC.

2.2. STATISTICAL DESIGN

2.2.1 Basic components

Type of statistical operation

The MMM is a sample survey with stratified design. It has national coverage. The statistical unit is the manufacturing establishment. The sample size and its elements are derived from the EAM. The survey's methodology makes the assumption that each manufacturing establishment has a well-known, equal among all establishments, non-zero probability of being chosen. Stratification is carried out in homogenous and non-homogenous subgroups. This leads to increase the accuracy of the estimations for each class.

Universe of study

Universe of study is the total of establishments which develop their manufacturing activities within the national territory and are classified as manufacturing industry according to the International Industrial Classification adapted for Colombia (ISIC,Rv.3 A.C) It comprises the total of industrial establishments which, according to the results of the Annual Manufacturing Survey, either employed 10 or more individuals , or presented annual production levels equal or greater than \$60 million Colombian pesos in 1997.

Coverage and geographic disaggregation:

The MMM covers nationwide data.

Statistical unit

The unit of observation, sampling and statistical analysis of the MMM is the manufacturing establishment which is defined as a manufacturing business with 10 or more employees or whose annual production is \$60 million or above (1970=100). The concept of manufacturing activity complies with the ISIC Rev 3.

Grouping and coding criteria

Since the beginning of the MMM, the ISIC has been the grouping criteria for manufacturing establishments and also the criteria for releasing the MMM results in order to facilitate the comprehension of the trend of each manufacturing activity. As previously noted, the 1980 and earlier MMM's grouped the manufacturing industries in 20 particular activities (2 first digits grouping ISIC Rev 1). From January 1981 to December 2000, 28 manufacturing activities were taken into account (3 first digits grouping ISIC Rev 2). Since January 2001 up to the present, 48 different activities (3 first digits grouping ISIC Rev 3) have been identified for data classification. The criteria

for using the ISIC Rev 3 grouping are:

Statistical: the MMM takes into account the relative relevance of the manufacturing classes, their level of atomization, and the sample size required to obtain reliable and disaggregated group estimates. Classes with heavier weight in the total production of manufactured goods were broken into smaller classes and classes with lighter weight remained aggregated.

Internationally comparable data: it is not only an important issue for cross-country examination, but it is also keeps time comparability among the variables.

Economic: the more classes to be analyzed, the bigger the sample size required to make reliable estimations about each class. To keep up with this principle, the MMM grouped all manufacturing activities in 48 classes. Almost every class follows a 3 digit classification criteria. Table 1 shows the 48 ISIC classes defined for the survey.

The first nine manufacturing activities, except for coffee thresh and ethanol refining, are aggregated into Manufacture of food and beverages.

Table 1: Nomenclature and description of the ISIC Rev 3 A.C. re- grouped classes for the Monthly Manufacture Survey 2001.

Nº	MMM Class Code (based upon ISIC Rev 3 A.C.)	MMM Class Definition
1.	1510	Production, processing and preservation of meat and fish
2.	1520	Processing and preservation of fruits, vegetables, vegetable oil and fat
3.	1530	Manufacture of dairy products
4.	1540	Manufacture of grain mill products, starches and starch products
5.	1550	Manufacture of bakery products
6.	1561	Manufacture of Threshed Coffee
7.	1570	Manufacture of sugar
8.	1580	Manufacture of other food products
9.	1590	Manufacture of beverages
10.	1600	Manufacture of tobacco products
11.	1720	Spinning, weaving and finishing of textiles
12.	1740	Manufacture of other textiles
13.	1750	Manufacture of knitted and crocheted fabrics and articles
14.	1800	Manufacture of wearing apparel
15.	1910	Tanning and dressing of leather
16.	1920	Manufacture of footwear
17.	1930	Manufacture of luggage, handbags and related products
18.	2020	Sawmilling and plaiting of wood. Manufacture of plywood, laminboard, particle board and other panels and boards
19.	2030	Manufacture of builders' carpentry and joinery
20.	2090	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
21.	2100	Manufacture of paper, paper products and corrugated paper
22.	2210	Publishing activities
23.	2220	Printing and service activities related to printing
24.	2230	Other activities related to printing
25.	2321	Oil refining
26.	2322	Manufacture of refined petroleum products
27.	2410	Manufacture of basic chemicals and synthetic fibers
28.	2420	Manufacture of other chemical products
29.	2510	Manufacture of rubber products
30.	2520	Manufacture of plastics products
31.	2610	Manufacture of glass and glass products
32.	2691	Manufacture of non-structural and non-refractory ceramic ware
33.	2699	Manufacture of non-metallic mineral products NEC.
34.	2710	Industry of iron and steel. Casting of metals
35.	2720	Industry of basic precious and non-ferrous metals
36.	2800	Manufacture of metal products, except machinery and equipment
37.	2910	Manufacture of general purpose machinery
38.	2920	Manufacture of special purpose machinery
39.	2930	Manufacture of domestic appliances NEC
40.	3100	Manufacture of electrical machinery and apparatus NEC
41.	3200	Manufacture of Television radio and communications equipment.
42.	3300	Manufacture of medical appliances and instruments. Appliances for measuring, checking, testing, navigating and other purposes. Optical instruments
43.	3410	Manufacture of motor vehicles and their engines
44.	3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
45.	3430	Manufacture of parts and accessories for motor vehicles and their engines
46.	3500	Manufacture of transport equipment NEC
47.	3610	Manufacture of furniture
48.	3690	Manufacturing NEC

Source: ISIC Rev 3 A.C.

Reference and Collection Period

The data reported by the manufacturing establishments belongs to the month prior to the month of data collection. The data is collected during the 20 business days following the end of the reference month.

2.2.2 Indicators design

The data that the data processors collect from each manufacturing establishment is organized under 8 main variables:

Nominal Value of Production: it states the monetary value, average ex-works price and no indirect taxes included of the manufactured goods of all surveyed establishments. It includes end or by-products, as well as manufacturing waste, which are put on sale.

Nominal Value of Sales: it states the monetary value, ex-works price and no indirect taxes included of the manufactured goods shipped to a customer. It includes also sales as raw material or by-product for other establishments. Value of sales is defined as domestic trade and foreign trade, according to its objective. “Nominal sales” distinguishes between domestic or foreign sales.

Total personnel employed: it states the amount of people working in a manufacturing establishment during the reported month. Each of the last three employment variables is sub grouped according to the contractual modality (permanent or temporal). Table 2 shows three classifications of this variable according to the type of job and the contractual modality.

Table 2: Employed Personnel Structure.

Type of Job	Contractual Modality
Administrative and sales personnel	Permanent
Personnel directly involved in the manufacturing process	Temporal contract directly signed between the worker and the manufacturing establishment
Personnel directly involved in the manufacturing process	Temporal contract not directly signed between the worker and the manufacturing establishment

Personnel directly involved in the manufacturing process: it states the amount of people directly involved in the manufacturing process or personnel who supported the process.

Wages and salaries: it states the monetary retribution that the employer pays his work force for offering time and skills. It includes base salaries, bonuses, commissions, and other monetary benefits specified in the job contract. It is calculated before tax payments, social security and benefits contributions.

Value of the Contributions to the social security system: it states the monetary value that the employer transfers to the social security system: annual mandatory bonuses, vacation, severance payments and interests, health, insurances, retirement plans, and mandatory benefits.

Remunerations for services rendered: it adds the value of “wages and salaries” and “Value of the Contributions to the social security system”, but only for the personnel contracted through a job outsourcing firm.

Hours worked: it states the total amount of hours that the working personnel spent carrying out the establishment’s manufacturing and administrative processes during the coverage of the survey. It is clear that this holds for hours worked, not paid. Thus it does not include permits, vacation, sickness absences, weekends or holidays.

Hours worked are classified as follow:

- Regular hours: states the total amount of hours that the personnel directly involved in the manufacturing process spent doing their tasks.
- Extra hours: states the total amount of hours that the personnel directly involved in the manufacturing process spent outside their regular time schedule (hours). It does not account for the administrative and sales personnel activities.
- Productivity: It is the ratio between production and total personnel employed.

Productivity= total production / total employed personnel.

Processing and imputation methods

Imputation takes place only within the “” “take-some” stratum. It is always expected that the statistical units inside the “take all” stratum supply the data requested.

2.2.3 Design of Instruments

The DANE collects the data through an electronic questionnaire or a paper sheet questionnaire. The former can be downloaded from the office website and the latter is directly handled to the statistical unit whenever it is declared that there is no internet access in the manufacturing establishment. The form is structured in 6 sections:

Heading (for exclusive use of the DANE): registry number, month, year, location, ISIC class code and type of stratum.

Section 1: Name and address of the establishment.

Section 2: average employed personnel, wages and salaries and social security contributions.

Section 3: Total hours worked of the personnel directly involved in the manufacturing process.

Section 4: Nominal value of production

Section 5: Nominal value of sales

Section 6: Nominal value of inventory

2.2.4 Sampling design

Sampling framework

Since 2001, the 1997 EAM provides the major part of the sampling frame of the MMM. Also, contact data coming from phone guides by CONFECAMARAS, manufactures unions and related associations (ANDI y ACOPI, etc), contribute to the MMM sampling frame. The EAM and the latter phone guides contain the target population of the survey. The target population is the manufacturing establishment.

The MMM establishments are manufacturing businesses with 10 or more employees or whose annual sales are \$60 million or above (1997=100). As a result, the total population of the survey accounts for 8321 manufacturing establishments.

Sampling methodology

Sample design

The MMM uses a stratified probabilistic sampling approach. Due to the marked positive skewness of the distribution function found inside each class, we follow the Hidioglou method (1986)² and use the “value of nominal production” as the cut-off variable. The (take-all) stratum accounts for some of the largest establishment, and are surveyed entirely, while (take-some) stratum includes the remaining units and a probabilistic sample is drawn from it. The statistical units of the (take-some) stratum are used to conduct a cluster analysis (also using the “value of nominal production” variable) in order to derive all probabilistic stratum for each of the 48 classes.

Within each class, a non-equal number of stratum are designed and defined as follows:

- **Stratum 0:** it includes all the establishments of the Take-all stratum.
- **Stratum 1:** it includes the smallest establishments within the Take-some stratum.
- **Stratum 2:** it includes the following establishments in size within the Take-some stratum.
- **Stratum H:** it includes the biggest establishments within the Take-some stratum.

² Hidioglou (1986) defined an algorithm in order to divide the population into a non probability (take-all) stratum and a probability (take- some) stratum with the purpose of minimizing the sample size, assuming a simple random sampling without replacement in the probability (take-some) stratum. The algorithm is iterative and is based on variance calculations.

The stratum and boundary values for each class are fully described in Appendix B.

Sample size

The MMM sample size is determined by multiplying the number of manufacturing establishments within each class (n) times the number of classes (d). It can also be calculated by adding the entire Take-all stratum units (ndf) and the entire Take-some stratum units (ndp). Once the sample size of the Take-some stratum for each class is determined, the size of each stratum (nh) is assigned proportionally to a size and variance criteria.

$$\hat{CV} = \frac{\sqrt{\hat{V}(\hat{R}_d)}}{\hat{R}_d} \times 100$$

\hat{R}_d = Estimator of the Ratio of the dth class

$\hat{V}(\hat{R}_d)$ = Variance of the Estimator of the Ratio

The result of this approach is a sample size of 1344 establishments distributed along 48 classes (appendix C), whose number of units is calculated at the stratification process.

The sample size of each probabilistic stratum is determined by a determined variability coefficient. The process of stratification complies with the independence and invariance principles. As a result, the estimate of the variability coefficient is the product of adding the coefficients for each stratum.

Estimators and expansion factors

The data supplied by the manufacturing units is used to estimate the trend of the Colombian manufacturing industry according to the behavior of a set of variables. The estimations are designed to provide insight into the nationwide level, region level and class level.

Type of Estimations

The data supplied by the MMM is used to estimate level and ratio indexes for the set of variables taken into account.

Level estimators

The following are the nationwide level estimators of the **y** variable of the **d** class in the **ith** month of study.

The nationwide estimator of the **y** variable in the **ith** month is defined as follows:

$$\hat{I}_{(i)y} = \frac{t_{(i)y}}{t_{(io)y}}$$

Where:

$t_{(i)y}$: Nationwide value of the **y** variable in the **ith** month.

$t_{(io)y}$: Nationwide value of the **y** variable in the base month.

To estimate $t_{(i)y}$, we add the values of the **y** variable for all classes in the **i** month.

$$\hat{t}_{(i)y} = \sum_{d=0}^{48} \hat{t}_{(i)dy}$$

Where:

$\hat{t}_{(i)dy}$ = estimate of the **y** variable of the **d** class in the **i** month

$$\hat{t}_{(i)dy} = \underbrace{t_{(i)doy}}_{\text{Total Take-all stratum}} + \sum_{k=1}^H \underbrace{\hat{t}_{(i)dhy}}_{\text{Estimate for the Take-some stratum}}$$

$$\hat{t}_{(i)doy} = \sum_{k=1}^{ndf} y_{dok}$$

$$\hat{t}_{(i)dhy} = \sum_{k=1}^{nh} y_{dhk} (f \text{ exp})$$

Where:

H: number of Take-some strata estimated for the **d** class.

ndf= number of establishments in the Take all stratum (stratum 0) in the **d** class.

nh= sample size of the **h** stratum of the **d** class.

t(i)doy= observed value of the **y** variable on the Take all stratum of the **d** class in the **i** month.

$\hat{t}_{(i)dhy}$ = estimate of the **y** variable on the **h** stratum of the **d** domain in the **ith** month.

y_{dok} = observed value of **y** variable of the **k** manufacturing establishment on the Take all stratum of the **d** domain in the **ith** month.

y_{dhk} = observed value for the y variable for the k manufacturing establishment of the Take some stratum of the d domain in the ith month.

$f(\text{exp})$ = factor of expansion of the k manufacturing establishment in the Take some stratum.

The index of the y variable of the d domain is:

$$= \frac{\hat{t}_{(i)yd}}{\hat{t}_{(io)dy}}$$

Where:

$\hat{t}_{(io)dy}$ = estimate of the y variable of the d class in the base month.

Ratio estimators

The following are the nationwide ratio estimators of the y variable of the d domain in the I month of study.

The nationwide ratio estimator for the y variable in the I month is determined as follows:

$$\hat{I}_{(i)y} = \frac{\hat{R}_{(i)y}}{\hat{R}_{(io)y}}$$

Where:

$$\hat{R}_{(i)y} = \frac{\hat{t}_{(i)y}}{\hat{t}_{(i)Z}}$$

Where:
 $\hat{R}_{(i)y}$ = Estimate ratio of the y variable in the i month.

$\hat{t}_{(i)y}$ = Total value of the variable to be averaged. E.g. Salary accrued by the personnel, estimated for the I month.

$\hat{t}_{(i)z}$ = Total Value of the ratio denominator variable. E.g. Employed personnel, estimated for the i month.

and:

$$\hat{R}_{(io)y} = \frac{\hat{t}_{(io)y}}{\hat{t}_{(io)z}}$$

Where:

$\hat{R}_{(io)y}$: The average of the y variable, estimated for the base period.

The MMM provides estimates of the analyzed variables according to two categories: occupation and contract modality of each manufacturing establishment surveyed.

The estimate of the nationwide ratio index of the y variable for the c job division corresponds to:

$$\hat{I}_{(i)cy} = \frac{\hat{R}_{(i)cy}}{\hat{R}_{(io)cy}}$$

with

$$\hat{R}_{(i)cy} = \frac{\hat{t}_{(i)cy}}{\hat{t}_{(i)cz}}$$

and

$$\hat{R}_{(io)cy} = \frac{\hat{t}_{(io)cy}}{\hat{t}_{(io)cz}}$$

Where:

$\hat{I}_{(i)cy}$ = Nationwide ratio index between the y variable and the c job division in the I month.

$\hat{R}_{(i)cy}$ = Nationwide ratio between the y variable and the c job division in the I month.

$\hat{R}_{(io)cy}$ = Nationwide ratio between the y variable and the c job division in the base month.

$\hat{t}_{(i)cy}$ = Estimate of nationwide value of the y variable of the c job division in the I month.

$\hat{t}_{(i)cz}$ = Estimate of the nationwide value of the z variable of the c job division in the I month.

$\hat{t}_{(io)cy}$ = Estimate of the nationwide value of the **y** variable of the **c** job division in the base month.

$\hat{t}_{(io)cz}$ = Estimate of the nationwide value of the **z** variable of the **c** job division in the base month

The index of the **d** domain is:

$$\hat{I}_{(i)cdy} = \frac{\hat{R}_{(i)cdy}}{\hat{R}_{(io)cdy}}$$

with

$$\hat{R}_{(i)cdy} = \frac{\hat{t}_{(i)cdy}}{\hat{t}_{(i)cdz}}$$

and

$$\hat{R}_{(io)cdy} = \frac{\hat{t}_{(io)cdy}}{\hat{t}_{(io)cdz}}$$

Where:

$\hat{I}_{(i)cdy}$ = Ratio Index of the **y** ratio variable and the **c** job division of the **d** class in the **I** month.

$\hat{R}_{(i)cdy}$ = Class ratio between the **y** variable and the **c** job division in the **I** month.

$\hat{R}_{(io)cdy}$ = Class ratio between the **y** variable and the **c** job division in the base month.

$\hat{t}_{(i)cdy}$ = Estimate of the **y** variable of the **c** job division of the **d** class in the **I** month.

$\hat{t}_{(i)cdz}$ = Estimate of the **z** variable of the **c** job division of the **d** class in the **I** month.

$\hat{t}_{(io)cdy}$ = Estimate of the **y** variable of the **c** job division of the **d** class in the base month.

$\hat{t}_{(io)cdz}$ = Estimate of the **z** variable of the **c** job division of the **d** class in the base month.

Sampling errors

The Coefficient of Variability (CV) measures the reliability of the estimates derived from

the sample used in a survey. The CV is determined as follows:

$$\hat{CV} = \frac{\sqrt{\hat{V}(\hat{R}_d)}}{\hat{R}_d} \times 100$$

$\hat{R}_d =$ Estimator of the Ratio of the dth class

$\hat{V}(\hat{R}_d) =$ Variance of the Estimator of the Ratio

It is a measurement of the variability of the sampling distribution of the estimate and it concludes whether the estimator is a reliable parameter of the population or not.

The MMM indexes and ratios are estimated to bringing insight about the 48 classes and the nationwide manufacturing industry. Predictions intended to bringing insight into more disaggregated levels could carry to unreliability and prediction errors.

The confidence level of the survey is 95% and normal distribution of the data is assumed.

3. STATISTICAL PRODUCTION

3.1 PRELIMINARY ACTIVITIES

3.1.1 Awareness-raising

Whenever a new establishment is introduced into a survey, either by sample refresh or by updates of the sampling frame, DANE sets a meeting with the personnel in charge of the data supply process in the new statistical unit. On that meeting they acknowledge the aim of the survey and the relevance of supplying an appropriate report. Likewise, DANE provides accompaniment and training in order to fill out the questionnaire properly. The manufacturing establishment is also provided with a phone number and an e mail address for support purposes.

3.1.2 Staff training

During the induction course at each Territorial Branch, new candidates for data processing will get familiar with the survey methodology, the variables involved in the survey and with the survey's manuals. This is a two day preparation period and at the end, the candidates take a written test. The candidates with the highest scores are shortlisted for the next interview stage.

3.1.3 Staff selection

The selected personnel for the Territorial branches hand in the questionnaires to the statistical units, carries out the processes of information collection, critique, codification, capture and analysis. The personnel hired for DANE Central put together the nationwide data, analyze it, detect and correct inconsistencies, produce and go through the outcomes.

The selected personnel go through the following stages:

- Budget programming and approval
- Public notice
- Candidate registry and pre selection
- Training
- Written test
- Interview
- Final selection
- Training refreshment

These are the available positions for candidates:

Senior Analyst I
Senior Analyst II

3.2 DATA COLLECTION

3.2.1 Operative Flow Chart

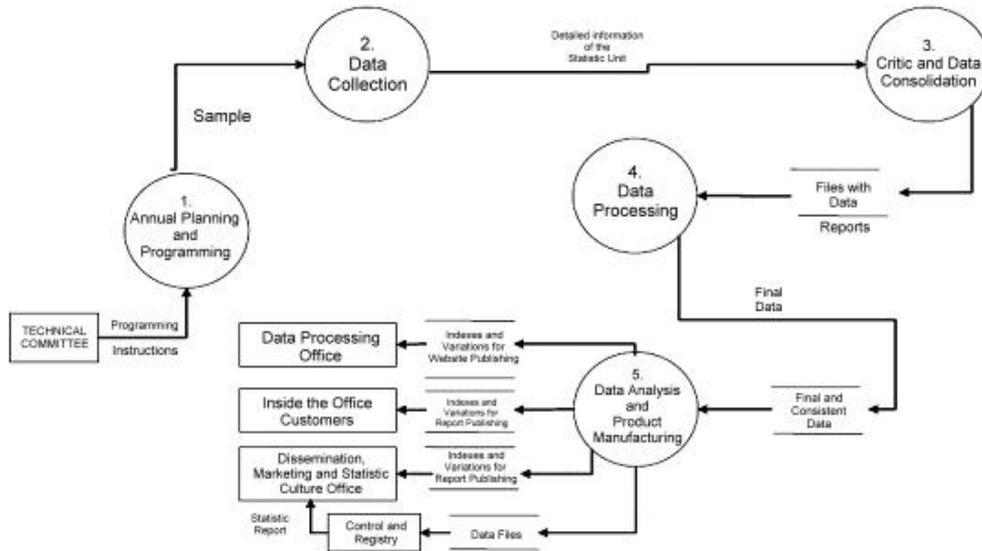
Diagram 1 displays the MMM flow chart. The chart takes into account the processes carried out by both the Territorial Branches and DANE Central.

3.2.2 Operative structure, methodology and data collection process

This is one of the most important stages of the process. The Territorial branches and auxiliary offices are in charge of its completion. The following actions are accomplished before beginning the survey:

- The DANE Central receives the documents in paper form (questionnaires, fill-out manuals and critique manuals). The written material is sent from the Headquarters Office. The personnel organize the written material and distribute it according to its purpose.
- DANE hires the personnel in charge of the operative procedures. The hiring process takes place once a year or more depending on the needs of the office.
- The IT Staff installs and manages the interactive capture-cleansing software. The Department also updates the software whenever it is required and provides constant support.
- Constant data analysis and data cleansing of the reported information supplied by the manufacturing establishments through the electronic questionnaires. This action aims to accomplish the deadlines of the data supplying process.

Diagram 1: MMM Operative structure



Procedure for Data Collection

DANE collects data through an electronic questionnaire or a paper sheet questionnaire. The former can be downloaded from the office website and the latter is directly handed in to the statistical unit in cases where it is declared that there is no internet access in the manufacturing establishment.

The paper sheet questionnaire is distributed among the manufacturing units following geographic criteria. It is sent either by mail or fax; it is taken right to the manufacturing establishment or can be picked up at the Territorial Branches. Whenever the manufacturing establishment is out of the city limits, the questionnaire is sent to the region chief who is in charge of its distribution.

The data returned by electronic means is analyzed by the critic-collect personnel. In case of finding inconsistencies or delays in data supply, they notify the manufacturing establishment about the situation.

The Data collection process has a duration period of 30 days from the first day of the month after the surveyed period. This is done in this way because the vast majority of establishments do monthly close. There are cases when data collection can take a little longer than usual because relevant statistical units do not return the questionnaire on time. There are also regular delays in the collection process at the beginning of the year due to heavy load in the accounting departments.

Cartography

Due to the fact that the Monthly Manufacturing Survey MMM uses the Annual Manufacturing Survey EAM and some updated contact guides, there is no need for cartography.

Control and supervision for the data collection process:

The following actions have been designed for managing data collection. These actions take place in the Territorial branches and auxiliary offices:

- Nationwide availability of the questionnaire uploaded in the office website.
- Data consolidation and data dispatch to the headquarter office within the scheduled deadlines.
- Data verification in case of inconsistent data.
- Direct contact, follow up and support for the manufacturing establishments that did not supply the data or that did it partially.

Codification and critique

The codification and critique processes take place in the DANE'S territorial branches and auxiliary offices.

The critic process starts as soon as the questionnaire is returned for data processing. It is fed into the main database and simultaneously the information is checked for consistency. The data processor has the ability to find basic mistakes or bad reports.

After the data is inserted into the database, the MMM GENERAL PROCESSING SYSTEM (SISTEMA GENERAL DE PROCESAMIENTO DE LA INVESTIGACION) SGPI verifies the information. The SGPI then submits a highly specialized report for the use of DANE personnel. This report notifies cases of data inconsistency, atypical data or information that need to be clarified by the manufacturing establishment.

3.3 DATA TRANSMISSION AND PROCESSING

Data bases

After consolidating the database, Sampling Design Staff identifies the manufacturing establishments that are in debt (statistical units that did not report the requested data). It is established that the percentage of imputation, or establishments in debt, cannot exceed 2%.

With the consolidated data, the system checks for:

- Date consistency
- Numeric fields
- Missing data or wrong order registries
- Zero values

Due to the fact that many manufacturing establishments pay their employees in different manners, it is common that on the surveyed date, some information is not available. It is also common that the manufacturing establishment uses the INDUSTRIAL CALENDAR; if these are the cases, the collected data is updated and converted into a unique calendar.

The system also checks for accounting data which does not belong to the surveyed month. As a result production variables are presented in business days and sales to calendar days.

3.3.1 Data processing

Adequacy of files

The data collected in the MMM is now organized according to the variables described in chapter 2. DANE uses a SAS (Statistical Analysis System) database and variables are introduced in the following order:

- Total employed personnel.
- Total hours worked.
- Total hours worked for the personnel directly involved in the manufacturing process (regular hours and extra hours).
- Wages, salaries and contributions to the social security system for the administrative and sales personnel.
- Wages, salaries and contributions to the social security system for the administrative and sales personnel.
- Wages, salaries and contributions to the social security system for the personnel directly involved in the manufacturing process.
- Direct and indirect Taxes.
- Year and month of surveying.

Data editing

Data editing involves revision and analysis of all the information introduced into the system. Following tools are used in this process:

- Time series of participations and variations by industrial class and for each of the sample establishments (For all the surveyed variables)
- Time series of contributions by both industrial class and establishment updated until the process month. Procedure which is done once the Logistics staff have preliminary data.
- Time series of indices and annual variations, year to date and annual aggregate at the level of industrial class which is specifically worked at Economic Thematic Division; as well as series at the level of establishment, which are observed at the Self filling out and Records Division (LAR for its acronyms in Spanish).

Once the preliminary information is obtained, the Economic Thematic Division performs the following activities:

- The department performs the cross-analysis the preliminary information with historic data to find atypical or temporary changes on the class trend. In case of finding such data, the Economic Thematic Staff sends a report to the LAR, for data verification. LAR then confirms or corrects the data and in case of doubt contacts the statistical unit for confirmation.
- The Economic Thematic Staff analyzes the time series according to the macroeconomic and sectoral context, taking into account both the information provided by the manufacturing guilds and specialized reports generated by ministries and other government offices. Data provided by other public and private offices.

Imputation methodology

In case of finding missing data, the MMM appeals to time and cross-section information. The methodology makes the assumption that there is auto-correlation in the time series data and homogeneity among the aggregates. This means that sudden shifts among or between classes have very low probability of occurring. The imputation process uses a growth ratio or/and a variance ratio defined as follows:

$$\text{Variation} = \frac{X_t}{X_{t-1}}$$

Where:

X_t = value of X in the t month

X_{t-1} = value of X in the t-1 month

The expected variation of the missing data takes into account the historical trend of both the manufacturing establishments and the 48 classes in the survey.

The statistical model for estimating the variation of the missing value is defined as:

$$\text{Variation}_t = \beta_1 Vhe_{(t-1,t-2,t-3)} + \beta_2 Vhe_{(t-11,t-12,t-13)} + \beta_3 Vha_{(t-1,t-2,t-3)} + \beta_4 Vha_{(t-11,t-12,t-13)}$$

Where:

Variation (t): variation of the missing value.

Vhe: Average variation of the variable in *n* manufacturing establishment in **t-1**, **t-2** and **t-3** and in the **t-11**, **t-12** and **t-13** month.

Vha: Average variation of the variable in the *d* class in the last (p) periods or in the last **t-11**, **t-12** and **t-13** periods

The model states that the variation of the missing value of the *y* variable of the *n* establishment is a weighted average of the variations of the variable among the establishments as well as across the 48 classes. This is an autoregressive time series model and it is estimated through an ordinary least squares regression. The restriction that the sum of the estimated coefficients is equal to 1 satisfies the convergence assumption of the model. LOZANO (2000)³

As soon as the imputations for all missing values are estimated, the database is

³ Lozano, A. (2000). *Estimación de novedades en estado de deuda (Estimation of novelties in information debt state)*. DANE.

refreshed and consistency at the class level is now tested. Variations of the entire set of variables are analyzed in monthly, quarterly, half-yearly, annually and year to date periods for all 48 classes.

Once the database is refreshed again, the team generates preliminary informative charts for economic analysis. The class analysis is made by the Economic Thematic Staff members.

Factors of expansion:

The parameters estimated from the MMM are indexes with their variations and their estimated variances.

Indexes are estimated for the following variables:

- Nominal value of production.
- Nominal value of sales: Both real and by destination.
- Total employed personnel: both by type of job and contract modality.
- Wages and salaries: according to the type of job.
- Value of the Contributions to the social security system: according to the type of job.
- Total hours worked: average, regular and extra hours.
- Productivity index.

For the production, sales and total personnel employed variables; indexes are estimated from the aggregated levels. For the wages, social security, remunerations and hours worked variables; indexes are estimated from ratio values.

The expansion factors are associated with every unit in the Take some stratum of every class.

Data integration

Imputed data is integrated into the database after verifying:

- Its level and trend according to the data of the stratum it belongs.
- Its level and trend according to the data of the statistical unit.

This process is carried out by the Economic Thematic Staff and the integration process by LAR.

4. DATA ANALYSIS

4.1 STATISTICAL ANALYSIS

The Monthly Manufacturing Survey's descriptive analysis firstly consists of the calculation of all variables measured in this survey. From the results of the descriptive variables' frequencies, the economic characteristics are determined and the evolution of the population observed in the sample for the 48 manufacturing activities under study are described.

The information consistency analysis is developed through the application of both calculation models and the analysis of contributions and variations (the result from the industry's historical behavior at the level of the 48 manufacturing activities and also, from the establishments that report the information requested to the MMM.

Furthermore, the monitoring of the series of deflators used by the MMM is carried out, and the analysis of the macroeconomic context is developed. For the sake of these, the Monthly manufacturing survey interacts with other economic investigations inside DANE, such as: Foreign trade, retail trade, buildings, price indices and national accounts.

There are three processes, parts of the coherence analysis:

1. Compound Producer Price Indices (IPPC by its acronym in Spanish): Monitoring of the IPPC's evolution of different manufacturing activities observed is carried out monthly, contrasting it with the 4 digit evolution of the PPI produced and consumed (PyC). In this activity, the evolution of the export opening rate in each class is also taken into account. At the same time, it is necessary to verify the consistency to the implicit indices calculated for the petroleum refination and coffee hulling activities (activities which rely on a quantum index).
2. Secondly, a revision and analysis of preliminary information sent by the Self filling out and Records Logistics' staff are carried out. In order to fulfill this task the Economic Thematic staff relies on the following instruments:
 - a. Participations and variations series by industrial class for each of the sample's establishments, for all the surveyed variables.
 - b. Contributions series by industrial class and establishment, updated until the month under study. This procedure is carried out once Logistics staff has preliminary data.
 - c. Indices and variations series at the level of industrial class and establishment.

The preliminary revision consists of engaging an initial scanning to the data base, where the preliminary information obtained in the reference month is contrasted with the previous results (month prior to the reference month) by establishment, which are given by the logistics staff of each enterprise. Atypical changes between these months are analyzed.

3. Economic analysis at the level of industrial classes: This process consist of the observation and the trends analysis of , annual variations, cumulative annual variations and year to date variations in accordance with its relevance; as well as the changes of contributions mainly at the level of industrial classes. Subsequently, the verification at the level of establishment is carried out. With this process, it is possible to identify atypical cases, industrial classes and establishments that affect the most the sector`s behavior for the month under study.

Atypical data and possible inconsistencies are sent to DANE`s Logistics staff. They verify or confirm, supported by the responding unit, the correct information report. Otherwise, Logistics staff will correct the data and inform the Economic thematic staff about the result of the verification. From this process, a consistent, cleansed and validated database is obtained. Subsequently, the macroeconomic analysis and MMM results consistency activities are initiated, in order to develop the press bulletin and the executive summary. These two represent technical support for the creation of the press release, document used for dissemination of official results.

The data analysis is carried out in chronological order, by comparing information at the level of variable, month by month and taking as reference both the trends of years compared and seasonal variations ,according to the activity these establishments perform . This process is carried out by correlating the independent variables (such as production and sales) with the rest of dependent variables, in order to make a hypothesis about the consistency of the reported information in the months analyzed and cover all variables of the establishments under study in all Territorial Branches. In this way, the information can be corrected whenever that is necessary or the reported information can be justified with the notes provided by the establishments themselves.

Usually, small enterprises have accounting ledgers and develop the reports manually, frequently committing mistakes; meanwhile, the biggest ones increase the process sophistication levels and the manner they develop the reports for DANE, committing mistakes less frequently.

Production and sales set the establishments` behavior, since these variables show the real status of the market in which the manufactured products are involved, therefore, these also set the trends of the rest of variables. Production and sales have external constraints typical for the sector`s circumstantial aspects, which must be taken into account and analyzed, because it is important to know the point of view of the manufacturers and their observations on the results that are being obtained in its productive process, without ignoring the influence of other variables not requested such as the manufacturer`s costs, which normally explain the production trends.

4.2 ANALYSIS OF THE MMM CONFIDENCE LEVEL

The reliability of the information derived from the MMM is measured in terms of:

- Coverage
- Opportunity
- Number of inconsistencies registered
- Quality of the processes carried out.

There are local and central indexes for measuring the reliability of the data supplied by the MMM.

Response rate of the statistical unit (TRF by its acronym in Spanish): it is the ratio between the observed responses in relation to the expected responses of the statistical units.

$$TRF = [(FI + FE) / TD] * 100\%$$

Where:

FI = Number of statistical units responding to the data request.

FE = Number of statistical units not responding to the data request.

TD = Number of questionnaires sent for data collection.

TD is monthly adjusted according to the reports from the previous survey.

Non-imputation Index or central estimate (INIC by its acronym in Spanish): this index states the rate of complete or partially complete data collected in the survey. It is stated as follows:

$$INIC = (FES - FNC) / FES * 100\%$$

Where:

FES: expected statistical units responding the questionnaires.

FNC: observed statistical units with missing data

Local quality index (IDCL by its acronym in Spanish): this index quantifies the quality of the capture and critic processes carried out in both the Territorial branches and auxiliary offices.

DANE calculates the index through the following formula:

$$IDCL = (ICC + ICCA) / 2 * 100\%$$

Where:

IDCL = Local quality index

ICC = Critique quality index

ICCA = Capture quality index

DANE does not use a collection quality index because the data is actually delivered to the office by the statistical units.

Central Quality Index (IDCC by its acronym in Spanish): percentage which expresses the quality of the information sent by territorial branches. It is defined as the sum of the errors and omissions identified in the processes carried out at the regional and national level. This index is calculated at DANE Central following the formula:

$$IDCC = [(FES - TPNC) / FES] * 100\%$$

Where:

TPNC = Sum of errors and omissions detected in the central production process
FES = Expected questionnaires

Reliability index (ICFA by its acronym in Spanish): percentage which indicates the quality level reached during the survey productive process. The index is an average of all the quality indicators of the chain process, which enable the survey performance.

$$ICFA = (TRF + INIC + IDCL + IDCC) / 4$$

5. DISSEMINATION

5.1 DATA REPOSITORY MANAGEMENT

The Economic Thematic Division produces the figures and indexes, which are disseminated according to the established format, after the General and Deputy Directorates of DANE, have approved its publication. The Diffusion, Marketing and Statistical Culture Division publishes the results of the MMM in the monthly bulletin and on the web page, making them available for the users.

5.2 PUBLICATIONS

The Diffusion, Marketing and Statistical Culture Division is in charge of the dissemination process of the MMM.

These publications report the MMM findings in descriptive tables integrating the entire set of economic variables analyzed and the 48 manufacturing classes at the 3 digit level (CIIU rev 3). They are constructed by the Economic Thematic Division.

5.3 Statistics Users

The regular users of the MMM publications are:

DANE's internal users:

Marketing and Editions
Systems
Data Bank
Press Office
National Accounts

External users:

Government
Guilds and Productive sector
Researchers
Media
International Organizations

6. RELATED DOCUMENTS

Monthly Manufacturing Survey Fill out Manual: This Manual sets the procedures for filling out the questionnaire, for both the written and the electronic form.

Ruta/ Documentación básica/Manuales/Diligenciamiento/TE-MMM-MDI-01.doc

Monthly Manufacturing Survey Critique Manual: This manual sets the procedures for every data processing action involved in the survey.

Ruta/Documentación Básica/Manuales/Crítica/TE-MMM-MCR-01.doc

Sampling Design Methodology: This publication contains all definitions and statistical procedures of the MMM.

Ruta/DocumentaciónBásica/Metodologías/DiseñoMuestral/Metodologíadediseño Muestral/DM-MMM-DIM-01.doc

Estimation Specifications: This document contains additional topics on estimation procedures, particularly data consolidation and error estimation procedures.

Ruta/DocumentaciónBásica/Metodologías/DiseñoMuestral/Especificacionesde Estimación/DM-MMM-EES-01.doc

Information consistency specifications for the MMM Capture software: This publication explains the basic economic relations among the economic variables captured by the MMM.

Ruta/DocumentaciónBásica/Metodologías/DiseñoTemático/EspecificacionesdeConsistencia/TE-MMM-ECO-01.doc

Functional Model: It presents the flow chart of the research processes.

Ruta/ Documentación Básica/Modelo Funcional/Modelo Funcional/ MMM-MFU-02.doc

Process Management for the Monthly Manufacturing Survey: This Manual aims to

provide a description of all processes and threads needed in order to carry out the execution of the activities involved in this research, using the methodology of context diagram and levels. Ruta/ Documentación Básica/Modelo Funcional/Levantamiento de Procesos/GC-MMM-MFU-01.doc

MMM Control Plan: This Manual defines the control procedures and the personnel in charge of the quality of each action taking place in the MMM.

Ruta/ Documentación Básica/Tablas de control y de información/Plan de control/ GC-MMM-PDC-01.xls

Support System for the Institutional Planning and Management (SPGI by its acronym in Spanish): This document presents the schedule for the operative and MMM technical activities.

Ruta/systema57/systema57/SPGI/Prog_Tec_2008/Prog_Recursos_2008/PR_PCS_IM MMM_08.xls

7. GLOSSARY⁴

(The translation of definitions is for reference purposes only)

⁴ *The translation of definitions is for reference purposes only.*

Apprenticeship contract: Special type of contract considered in labour rights as a way in which a natural person (apprentice- student) is trained in a legal entity, supported by an enterprise (Natural or legal employer).

Classification: The grouping of objects in homogenous sets according to the established criteria and the classification purpose. The comprised groups are exhaustive; cover the whole elements of the universe, are mutually exclusive and each object corresponds to only one same level category.

Coding: The assignation of alphanumeric codes to identify different categories in a classification. For Annual Manufacturing Survey, information is presented as four digits codes, where each one of them corresponds to: Section, division, group and class.

Directory: Electronic file containing the data of all variables that DANE registered through different media: Confecámaras, surveys, mini-surveys, data collection by telephone, guilds directories, and magazines. This information concerns: ID (NIT "Tax Identification Number", trade name, corporate name), geographical location (department, municipality, address, telephone number, e-mail), other additional variables (economic activity, sales, employed personnel) and economic establishments (industrial, commercial or services).

Enterprise: Economic unit which under a legal constitution, in one or more locations, develop, control and manage directly or indirectly the set of activities and resources of its property; required for the development of its economic or corporate function.

Imputation: Statistical process used to assign any value to the variables of records that have incomplete information in the applied surveys and was not possible to obtain it directly from respondent sources. This procedure is applied in few cases, inferior to 2% and taking into account the specific methodologies for each case.

Integral salary⁵: "When the employee's salary is equal to or higher than 10 minimum monthly legal wages (MMLW), the parties may agree (in writing) that the employee receives an integral salary which, besides remunerating the nominal salary, compensates every month the fringe benefits such as severance payments and its interests, overtime, legal and extralegal service bonuses, and in general any amount that the employee could be entitled to receive under the nominal salary regime, except for vacation payments, social security and family compensation contributions, which in any case must be paid regardless of the method of remuneration".

ISIC Rev.3 A.C. Activity: Kind of classification aimed to establish a structure where the statistics from economic activities developed by different nationwide production sectors must be presented. The term activity used in this context is defined as a production process or a set of actions which make up a group of goods and services.

Local commercial unit: For statistical purposes, local commercial unit corresponds to the sum of establishments of a same enterprise, which develop its economic activity in

⁵ Campbell C. *Legal Aspects of Doing Business in Latin America. Volume 1, par 151, 2007. Yorkhill Law Publishing.*

a same city.

It is important to take into account that offices or establishments exclusively devoted to the sales of products manufactured by them are considered ancillary units; however, if those offices or establishments in addition of selling their products, re sell (sell and purchase) other goods in such proportion higher than 60% of their total income; they must be considered as commercial units. Therefore they must be counted as components of trade local units.

Local services unit: Corresponds to the sum of establishments belonging to a same enterprise, which are exclusively devoted to the service providing to third parties, in a same geographical location.

Location/ Emplacement: Physical place or a group of non-adjacent places that belong to an enterprise, in a geographical area.

Novelties: Novelties are known as possible states or conditions of economic units in data collection time which can affect the survey results.

Principal Activity: The activity of an enterprise is the one that contributes the most to the entity's value added, or the activity whose value added exceeds that of any activities carried out in the establishment. The final products resulting from the principal activity are known as: Principal products or associated products.

Reference year: A *reference* year is the time period for which statistical results are collected or calculated It comprises the year surveyed.

Respondent unit: From 1992, the Annual Manufacturing Survey takes into account enterprise as respondent unit, which in statistical terms are defined as the proper or administrative economic unit that under a legal denomination develop, control and manage directly or indirectly the set of activities and resources of its property; required for the development of its economic or corporate function.

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