



**GLOBAL STRATEGY TO IMPROVE AGRICULTURAL AND
RURAL STATISTICS**

**AGRICULTURAL STATISTICS TRAINING
(Exercise booklet)**

Abbreviations

✓ **Qn:** Question number n

Contents

ACKNOWLEDGEMENTS.....	III
MODULE 0. STATISTICS RECAP	1
Exercice 1: Definition of population.....	1
Exercice 2: Sampled population vs target population	1
MODULE 1. OVERVIEW OF THE GENERAL FRAMEWORK OF AGRICULTURAL STATISTICS .3	
Exercice 3: Domains covered by agricultural statistics	3
Exercice 4: Conceptual framework of agricultural statistics and its four dimensions	3
Exercice 5: Agricultural activities and rural activities.....	3
Exercice 6: Economic, social and environmental aspects	4
Exercice 7: Agricultural holder / agricultural holding	4
Exercice 8: Agricultural holder / agricultural holding	5
Exercice 9: Users and uses of agricultural statistics.....	5
MODULE 2. MAIN SOURCES OF DATA AND METHODS.....	7
Exercice 10: Data producers and main sources of agricultural data.....	7
Exercice 11: General Population and Housing Census (GPHC) and National Agriculture Census (NAC)	7
Exercice 12: Structural and cyclical variables.....	7
Exercice 13: Population, statistical unit and sample frame	8
Exercice 14: Sampling frame	9
Exercice 15: Primary sampling unit: EAs vs villages	9
Exercice 16: Population, statistical unit and sampling frame	10
Exercice 17: Electronic data collection versus paper and pencil	10
Exercice 18: Data collection and agricultural calendar	11
MODULE 3. DATA PROCESSING, ANALYSIS AND DISSEMINATION.....	12
Exercice 19: Crop cutting experiment	12
Exercice 20: Estimation of yield	12
Exercice 21: Land area / yield / density	13
Exercice 22: Density and area under crop.....	13
Exercice 23: Land area.....	14
Exercice 24: Production and yield: case study of plantain.....	15
MODULE 4. ANALYTICAL FRAMEWORK AND DERIVED STATISTICS	15
Exercice 25: Costs of production statistics.....	15
Exercice 26: Post-harvest losses.....	16
Exercice 27: Collection of agricultural prices with non-conventional units.....	18
Exercice 28: Collection method for farm-gate prices.....	18
Exercice 29: Agricultural price indexes (API).....	18
Exercice 30: Food balance sheet	20
Bibliography	21
Webography.....	24

Acknowledgements

This collection of exercises is one of the support documents accompanying the Training Handbook on Agricultural Statistics. The collection has been drafted by Mr. Ankouvi Nayo and coordinated by Valérie Bizier, who also made significant contributions at the reviewing stage. Valérie Bizier is Technical Assistance and Training Coordinator at the Global Office of the Global Strategy to improve agricultural and rural statistics (GSARS), while Ankouvi Nayo is a one of the institution's agricultural statistics consultants. Mr. Franck Cachia and Mr. Aliou Mballo, Agricultural Statistical Consultants from the same office, have also contributed to the content of this document.

In addition, some exercises were taken from the collection used for agricultural statistics training at the National School of Statistics and Applied Economics (ENSEA) of Abidjan, as well as from the training handbook on agricultural statistics produced by the statistician Mr. Tiral Sidi (exercises 3 and 4).

All of the work carried out was coordinated, overseen and guided by Mr. Christophe Duhamel, Global Office Coordinator.

This handbook was drafted with support from the Global Strategy trust fund financed by the Bill & Melinda Gates Foundation and the United Kingdom Department for International Development (DFID).

Module 0. Statistics recap

Exercice 1: Definition of population

Defining the concept of population when calculating the average	Exercice N° 1	Handbook section: 0.1
--	---------------	-----------------------

An agricultural survey is carried out in a specific country. For each farmer within a household, the variables of interest are as follows:

- (i) Income from agricultural activities;
- (ii) Income from selling food crops;
- (iii) Income from selling cash crops;
- (iv) Income from selling cocoa beans.

Farmers are members of households, with the latter being located in the sample villages. It is possible to list more than one holder per household. Throughout the survey, all of the agricultural holders (members of selected households) in the sample are interviewed (even if they are members of the same household).

A statistician is asked to produce the following indicators:

- a. Average income (of farmers) from selling food crops;
- b. Average income (of agricultural households) from selling agricultural production;
- c. Average income (of agricultural households) from selling cash production.

The statistician proceeds as follows to calculate the indicators:

- Indicator a: add up all the income from selling food crops and divide that by the total number of holders.
- Indicator b: add up all income from selling agricultural production and divide by the number of farmers.
- Indicator c: add up all income from selling cocoa production and divide by the number of households.

Questions:

- Q1.** Have these averages been correctly calculated?
- Q2.** If not, explain your answer. What is the source of the problem?

Exercice 2: Sampled population vs target population

Distinction between target population and sample population	Exercice N° 2	Handbook section: 0.1
--	---------------	-----------------------

In the framework of the National Agricultural Development Strategy, the Ministry of Agriculture devised a planned subsidy (credit and purchase of inputs) and provision of materials (agricultural, plants and so forth) for farmers.

For effective implementation of the component relating to provision of agricultural materials and equipment, the leading statistician suggested introducing a data collection operation with the following specific objectives:

- a. Making an inventory of the agricultural material and equipment available and used in traditional holding;
- b. Assessing holdings' needs in terms of materials and equipment.

Questions:

Q3. For each of the specific objectives (a and b), what are the:

- 3.1. Sample population?
- 3.2. Target population and the corresponding statistical unit?

Q4. For the first specific objective (a):

- 4.1. Is the sample population the same as the target population? Explain your answer.
- 4.2. Does access to the sample population give access to the target population without exception (coverage problems)? Explain your answer.

Module 1. Overview of the general framework of agricultural statistics

Exercise 3: Domains covered by agricultural statistics

Scope of agricultural statistics	Exercise N° 3	Handbook section: 1.1
----------------------------------	---------------	-----------------------

Question:

- Q5. What are the scope and the domains covered by agricultural statistics?

Exercise 4: Conceptual framework of agricultural statistics and its four dimensions

Conceptual framework for the Global Strategy	Exercise N° 4	Handbook section: 1.2
--	---------------	-----------------------

Questions:

- Q6. What are the pillars of the Global Strategy to improve agricultural and rural statistics (GSARS)?
- Q7. What does the conceptual framework of the Global Strategy to improve agricultural and rural statistics (GSARS) emphasize and what are the dimensions covered by agriculture?

Exercise 5: Agricultural activities and rural activities

Agricultural activities and rural activities	Exercise N° 5	Handbook sections: 1.1 and 1.2
--	---------------	--------------------------------

To update the map of agricultural activities and crops, your country's directorate of agricultural statistics has decided to carry out a data collection operation to identify the various crops grown at the national level. The directorate is carrying out a one-stage stratified sample survey. Enumerators are asked to list all the households within selected geographical areas (village, Enumeration Area (EA) and so on). Once the list has been made, they are then instructed to interview all eligible households (involved in carrying out agricultural activities).

During the field work, several heads of household complained to a survey team leader because they were not called for interview after the listing stage. Two cases are described below.

- Mr. Albert buys trees in a forest. He has them chopped down and then transforms the wood into charcoal for domestic use. Ms. Rachele purchased a primary forest from a landlord and she is now the owner. She also cuts down trees to make charcoal for

domestic use. Both complain that they were not selected for interview unlike their neighbour, Mr. Johnson. Mr. Johnson carries out forestry and transforms wood produced in his forest into charcoal.

- Mr. Kourouma catches fish. He goes out on the lake and catches fish with his net for his household to eat. Mr. Jollah also fishes, but he has made a space in the lake where he feeds fish, fattens them and then catches them to sell. Mr. Kourouma was called for interview but Mr. Jollah was not. The latter wants to know why his household was not included for interview.

Questions:

- Q8.** Did the surveyors take the right decision not to interview Mr. Albert and Ms. Rachele? Please answer yes or no and explain your answer.
- Q9.** What about Mr. Kourouma and Mr. Jollah?

Exercise 6: Economic, social and environmental aspects

Economic, social and environmental aspects	Exercise N° 6	Handbook section: 1.2
--	---------------	-----------------------

An agroindustrial unit in the central region has purchased large areas of land to produce cash tree crops exclusively for export than cannot be used locally. The manager of the agroindustrial unit has often reprimanded and punished workers for sowing food crops as intercrops. Furthermore, the agroindustrial unit usually paid workers the lowest wages. The practices used gave the best yields. However, the manager was not very concerned with the quality of the fertilisers and crop protection products used as long as they helped to achieve the target yields. In addition, he had issued a non-negotiable refusal to recruit female workers.

Questions:

- Q10.** Describe the aspects to which the manager of the agroindustrial unit attached the most importance.
- Q11.** Which aspects are neglected?
- Q12.** What could the eventual consequences be of such a production system?

Exercise 7: Agricultural holder / agricultural holding

Agricultural holder / agricultural holding	Exercise N° 7	Handbook section: Module 1
--	---------------	----------------------------

Mr. Sawadogo Hamadou is a permanent employee for a holding. However, he is not a member of his employer's household. His household is in another part of the village, where he also has his own agricultural production.

Questions:

Mr. Hamadou's village is part of a sample for an agricultural survey

Q13. During the listing phase of agricultural households in the village, how will Mr. Hamadou be recorded?

Q14. In the holding questionnaire, how will Mr. Hamadou be recorded?

Exercise 8: Agricultural holder / agricultural holding

Agricultural holder / agricultural holding	Exercise N° 8	Handbook section: Module 1
--	---------------	----------------------------

A large-scale producer lives in a town that is the main town of the department and owns a hamlet in his village of origin. Four kilometres from the town, he farms a rubber tree plot of 15 hectares. He also has 25 hectares of cocoa in his hamlet at home in the village. That plot is maintained by three workers including a head. The workers live in the hamlet.

His wife lives in town with him and regularly grows garden vegetables. His daughter lives in his dwelling in the village and regularly grows rice there. His wife and daughter therefore use the production assets (infrastructure, equipment and land) made available by the main holder. The women also have decision-making autonomy over managing production and the income from their own production.

Question:

Q15. As part of an agricultural survey, how many holdings will be listed? Specify the holder for each of those holdings.

Exercise 9: Users and uses of agricultural statistics

Users and uses of agricultural statistics	Exercise N° 9	Handbook section: 1.4
---	---------------	-----------------------

Various national institutions have decided to make public the following information at varying intervals:

- a. Consumer price index:
 - i. Relating to the basket of agricultural commodity prices
 - ii. For agricultural sector stakeholders;
- b. Agricultural commodity prices on various markets (village, regional and so forth);
- c. Production of various agricultural products and the production areas;

- d. Operating account from a specific agricultural activity;
- e. Cocoa yield;
- f. Credit interest rate;
- g. Typology and mapping of soil structure at the national level;
- h. Production of fish products by product;
- i. Mapping of waterways and level of pollution.

Questions:

Q16. Who might be the potential users of such information?

Q17. For each kind of user identified, what would the information be used for?

Module 2. Main sources of data and methods

Exercise 10: Data producers and main sources of agricultural data

Data producers and main agricultural data sources	Exercise N° 10	Handbook section: 2.2 and 2.3
---	----------------	-------------------------------

Let us consider Exercise 9: For each of the aforementioned indicators, what are the main sources from which information could be available (for each type of information)?

Questions:

Q18. List the actors (possible producers of information).

Q19. List possible sources to derive such information.

Exercise 11: General Population and Housing Census (GPHC) and National Agriculture Census (NAC)

Exercise 11: General Population and Housing Census (GPHC) and National Agriculture Census (NAC)	Exercise N° 11	Handbook section: 2.3.1
---	----------------	-------------------------

Your country wishes to carry out a Population and Housing Census and a Census of Agriculture.

Questions:

Q20. What is the link between a population and housing census and a census of Agriculture?

Q21. Which one should come first? Explain your answer.

Exercise 12: Structural and cyclical variables

Structural and cyclical variables	Exercise N° 12	Handbook section: 2.3.1
-----------------------------------	----------------	-------------------------

Two managers from a Technical Committee for the National Agriculture Census have just received the following firm instructions from the Minister for Agriculture:

For the NAC, we will need the following information:

- Agricultural materials used by farmers
- Financing of family farming
- Farmgate price of agricultural commodities
- Yields of the country's major food crops

- Situation of agricultural workforce

Questions:

- Q22.** Will all these variables be considered in the NAC? Explain your answer.
- Q23.** Which collection methods would you suggest for those that will not be taken into account?

Exercice 13: Population, statistical unit and sample frame

Population, statistical unit and sample frame	Exercice N° 13	Handbook sections: 2.3 and 2.4
---	----------------	--------------------------------

In order to respond to specific information requirements, the following surveys are being implemented:

- Survey on the agricultural production systems of cashew producers;
- Survey on the sustainability of cocoa production, production system and workforce availability;
- Analysis of the cassava value chain in West Africa;
- Survey on the determining factors of the availability of agricultural workforce;
- Survey on the impact on agricultural commodity prices of corruption on roads;
- Surveys on the determining factors of food crop prices.

Specify for each survey:

Questions:

- Q24.** Target populations and the corresponding statistical units;
- Q25.** The relevant sources of the sample frames.

Exercice 14: Sampling frame

Sampling frame	Exercice N° 14	Handbook section: 2.3.2
----------------	----------------	-------------------------

In order to obtain information on production and yield, the Ministry of Agriculture is recruiting a statistician to produce a technical protocol of survey methodology. Two types of crops are involved: tubers (cassava, yams and so forth) and rubber trees.

Tuber crops are fairly common at the national level, whereas rubber tree is quite a rare crop. Rubber tree production is supervised and the production of rubber is entirely sold to three main industrial units that carry out processing for export.

The statistician decides to carry out a two-stage survey. The first stage involves sampling the EAs and the second stage is an exhaustive listing of the sampled EAs to identify eligible households. According to the statistician, the approach will provide a sample frame of tuber producing households while also identifying rubber tree producers. The statistician will then select a set number of households to interview.

Questions:

Q26. Will this sample frame provide both populations?

- If yes, explain your answer
- If not, explain your answer

What do you think would be the recommended approach to form a sample frame for rubber trees?

Exercice 15: Primary sampling unit: EAs vs villages

Primary sampling unit: EAs vs villages	Exercice N° 15	Handbook section: 2.3.2
--	----------------	-------------------------

When selecting primary sampling units in a sample frame the statistician can choose between (i) villages, or (ii) Enumeration Areas (EAs) to form a first-stage sample.

The primary unit is the village or EA

Questions:

Q27. What are the pros and cons of using villages instead of EAs as primary sampling unit (and vice versa)?

Q28. Which option do you recommend? Explain your answer.

Exercise 16: Population, statistical unit and sampling frame

Population, statistical unit and sampling frame	Exercise N° 16	Handbook section: 2.4
---	----------------	-----------------------

Let us consider the following subjects:

- a. Parasite status of palm tree (date palm, oil palm, borassus palm and so on);
- b. Parasite status of cattle;
- c. Support and extension services;
- d. Production of fish products;
- e. Amount in agricultural loans and credit allocation.

Questions:

Q29. Specify the statistical units corresponding to these subjects and any relevant response units.

Exercise 17: Electronic data collection versus paper and pencil

Electronic data collection versus paper and pencil	Exercise N° 17	Handbook section: 2.5
--	----------------	-----------------------

The National Council for Agricultural Research and Consultation is responsible for coordinating, implementing and monitoring the agricultural productivity project over five years with seven phases. To carry out this activity, seven data collection activities have been budgeted for and planned for the end of each phase.

For the midway assessment of phase 1 of the project, the Council had not planned a data collection operation. However, in order to reorient the project implementation activities if necessary and ensure that the project is still on track to achieve its objectives, a decision has been taken to collect the data needed to calculate the indicators defined in the results framework (phase 1 midway point). As this activity was not initially planned, the Council is faced with budgetary and time constraints. The Council recruits two consultancy firms to design survey methodologies to reduce the two types of constraint.

- The first firm decides to organize Computer-assisted personal interviewing (CAPI) to save time.
- The second firm suggests Paper-and-Pencil Interviewing (PAPI) PAPI to save money.

The Council is confused because CAPI saves time but can be relatively more expensive due to initial investment. Nevertheless, the time line involved in the PAPI approach is past the deadline, even if the proposed budget is lower than sum initially set aside by the Council.

Question:

Q30. On the basis of course elements and your personal research, you are asked to help the Council make the most rational decision.

Exercice 18: Data collection and agricultural calendar

Data collection and agricultural calendar	Exercice N° 18	Handbook section: 2.5
---	----------------	-----------------------

To assess the impact of racketeering (road corruption¹) on road on agricultural commodity prices, the Ministry of Agriculture (in conjunction with the Ministry of Security) has decided to organize a survey on the main stretches of road servicing regional markets.

To implement the activity, the Ministry decides on the following:

Data collection methodology:

Data are collected by enumerators at three points along the stretch: departure, midway at a checkpoint and at the unloading bay.

Time line: given the busy schedule of both Ministers, the data will be collected over four weeks (during February).

Questions:

- Q31.** Is the calendar for the collection operation appropriate? Yes / No. Explain your answer.
- Q32.** What period would you propose?
- Q33.** What factors should be considered to set the implementation schedule for the field work?
- Q34.** What would you choose out of a one-pass or repeated-pass survey?

¹ Road corruption is when an official or unofficial person coerces the user into paying a sum of money to be authorized to continue enjoying freedom of movement or freedom to carry out an activity.

Module 3. Data processing, analysis and dissemination

Exercice 19: Crop cutting experiment

Crop cutting experiment	Exercice N° 19	Handbook section: 3.2
-------------------------	----------------	-----------------------

Questions:

Q35. In the procedure to lay down a density or yield grid, which element guarantees the random nature of the place to lay down the grid on the plot?

Q36. When laying down the grid, you notice that:

- The selected point of the yield grid lands on a termite mound – what do you do?
- One of the corners of the yield grid falls outside the plot – what do you do?

Exercice 20: Estimation of yield

Estimation of yield	Exercice N° 20	Handbook sections: 3.2, 3.3 and 3.4
---------------------	----------------	-------------------------------------

To assess the yield of food crops, crop cutting experiments have been carried out for various food crops. See below:

Case 1: One of the plots selected for the crop cutting experiment is sown with plantains and cassava evenly spread.

Case 2: Another plot is sown with rice

Case 3: Another plot is sown with yam

Question:

Q37. What factors may influence the choice of yield grid size to be used in the various cases?

Exercice 21: Land area / yield / density

Land area / yield / density	Exercice N° 21	Handbook sections: 3.2, 3.3 and 3.4
-----------------------------	----------------	-------------------------------------

To assess the yield of robusta coffee, enumerators were asked to lay down yield grids with the dimensions 10m X 10m=100m². The recommended density for robusta coffee in West Africa is 1333 trees/hectare or 1960 trees/hectare.

Once the yield grids were laid down, the enumerators found the following:

- Case 1: At least 13 coffee plants counted in the grids;
- Case 2: Between 10 and 12 coffee plants counted in the grids;
- Case 3: 7 coffee plants and 4 palm plants counted in the grids;
- Case 4: Fewer than 10 coffee plants counted in the grids.

Questions:

Q38. Which cases should be taken into account when assessing yield? Explain your answer

Q39. Describe which bias there is a risk of introducing if case 4 is considered (for instance).

Exercice 22: Density and area under crop

Density and area under crop	Exercice N° 22	Handbook sections: 3.2, 3.3 and 3.4
-----------------------------	----------------	-------------------------------------

As for density grids, agents are meant to count the number of cocoa seedlings in a 300m² patch. The following cases may present themselves in the field:

- A uniform plot with plants in lines
- A uniform plot but with unaligned plants
- An uneven plot with plants sown freely

Three enumerators are involved.

Filippo: one enumerator takes his notebook and counts the cocoa seedlings in the patch

Abdala: takes a paint pot and counts the trees by marking the cocoa seedlings

Yang: arrives in the collection area and has a quick look at the place. He identifies long-leaf trees (oil palm and borassus palm). He cuts the leaves and makes tufts with around 100 of them. Once his density patch is set up, he marks the trees by attaching leaves to their trunks.

Questions:

Q40. What is the point of laying down a density grid in this case?

- Q41.** What is the potential mistake if the methodological approach is used to decide to only measure land area and yields without considering density?
- Q42.** Now for reflections: please comment on the three methods applied by each enumerator by stating the pros and cons of each method. Which methods would you recommend?

Exercise 23: Land area

Land area	Exercise N° 23	Handbook sections: 3.2, 3.3 and 3.4
-----------	----------------	-------------------------------------

In order to obtain a real estimate of cocoa production, the Ministry of Agriculture decides to carry out a data collection operation for one specific year at the national level. The information required relates to the land area covered by cocoa plants and the yield by agroecological area. The enumerators are asked to measure the area of cocoa plots and lay down yield and density grids.

The enumerator in the field finds the following situations:

- Case 1: A new plot planted with cocoa (1333 seedlings per hectare, which is the optimum density for this type of plant). On the same plantation, plantain trees have been used to provide shade to the cocoa.
- Case 2: A cocoa plantation in production has a density of 1333 seedlings per hectare. Yam bulbs have been planted between the rows (intercropping).
- Case 3: A yam plot in which cocoa plants have been dispersed.
- Case 4: A plot of cocoa alongside cashews. The plot's total surface area is 2.5 ha. Cocoa accounts for 33% of the area, with cashews representing the rest.
- Case 5: An oil palm plot with a few cocoa plants spread around. The cocoa is estimated to take up less than 10% of the surface area.
- Case 6: One cocoa plot that is over 30 years old.

Questions:

- Q43.** Which cases should be taken into account to assess area under crop?
- Q44.** Which cases should be taken into account to assess production?
- Q45.** For each case above, explain how the area under crop should be distributed.

Exercice 24: Production and yield: case study of plantain

Area / yield / density	Exercice N° 24	Handbook sections: 3.2, 3.3 and 3.4
------------------------	----------------	-------------------------------------

In your country, you notice that there are no pure stand plantain plantations. Plantain trees are sown or grown scattered on plots. The government wants to introduce a special programme for the crop, but wants to find out annual production and yield.

Questions:

Q46. What methodology do you suggest for calculating yield?

Q47. Once the yield is known, what surface area will be used to calculate production? How would this be done?

Module 4. Analytical framework and derived statistics

Exercice 25: Costs of production statistics

Costs of production statistics	Exercice N° 25	Handbook section: 4.2
--------------------------------	----------------	-----------------------

The Economic Analysis Unit of the Ministry of Agriculture has been asked to draw up operating accounts for the country's priority sectors. The statistician in charge of the Unit therefore took the data from the previous annual agricultural survey on production. There is a special section for field creation and installation expenses and operating costs – which are needed to draw up the operating account. Having examined the data, the statistician noticed the following:

The data on operation expenses have not all been recorded. The following situations have thus arisen:

- Case 1: Some producers who own their plots have not replied to the question on the cost of land use. Only farmers involved in crop-sharing or renting have answered the question.
- Case 2: As for the labour costs, some farmers have not answered about workforce costs during harvest. They justify this on the basis that harvesting is done by the community of farmers helping each other in turn to harvest each other's fields. In exchange, the farmer benefitting is meant to encourage those helping by providing food during the harvest period. That being the case, the farmers assumed that there was no labour cost for that activity.
- Case 3: For certain crops, such as permanent crops, certain expenses relating to land clearance, felling, burning, seeding, planting, suckering, pruning and harvest have not been recorded because the responding farmers had not carried out some of these activities during the reference period for the survey.

Questions:

Q48. For each of the above cases, did enumerators make the right decision to leave the information unanswered?

Q49. In each of the aforementioned cases, what approach would have been recommended to assess the operating expenses associated with each heading?

Faced with all of these scenarios outlined above, the statistician decides to use the following methodology:

- **First stage:** Only use the expenses for which there are at least 30 non-zero observations;
- **Second stage:** Assess average expenses per hectare;
- **Third stage:** Assess production per hectare in monetary terms.

Q50. What are the pros and cons of that methodology?

Q51. Which profitability indicators can be calculated from the information available?

Exercice 26: Post-harvest losses

Post-harvest losses	Exercise N° 26	Handbook section: 4.3
----------------------------	----------------	-----------------------

Two enumerators visiting a rural market (first market) to carry out routine price collection operations for agricultural products witnessed a series of events along the route to the market and on the market square. The events were as follows:

- Event 1: On an untarmacked road leading to market, a truck transporting agricultural product leaving for town (to supply the regional market) had a burst tyre. During the incident, two bags full of fonio fell off and the bag's contents spilled onto the sand. There are also plantains on the ground with the fruit squashed.
- Event 2: A few minutes later, they saw a rice field with a group of children playing instead of watching over the field. Swallows and other birds took advantage by filling up on paddy rice on fully mature plants.
- Event 3: They also saw an oil palm plantation with harvested oil palm plants. They noticed the following:
 - 3.1 The harvest was carried out when the fruit of the oil palm were extremely ripe, with several grains becoming separated from bunches when picked. Not all the grains were able to be recovered.
 - 3.2 Following the harvest, the bunches were piled up on the plantation. Furthermore, transport availability problems resulted in the harvest not being taken away in time for the agroindustrial unit where processing happens. Some bunches were affected by mildew and rot.

When they arrived at the market, they observed the following.

- Event 4: Loading of another truck at the market:

- 4.1 Wholesalers came to buy agricultural products from farmers on the rural market. The products bought were loaded onto the truck. In the chaos, turmoil and confusion of the negotiations between the buyers (wholesalers) and the sellers (farmers), some products (tomatoes, oranges, mangos and tubers) fell and were then trampled.
- 4.2 Workers loading the purchased products onto the truck felt hungry. Some of them took some cassava from the bought products and peeled them to eat. They ate a few pieces but soon realized they had peeled more than they needed to satisfy their hunger. They therefore threw the rest away to feed the pigs in a pigsty next to the marketplace.
- Event 5: Children were playing in the market by throwing around oranges and tomatoes that were stacked up for sale.
- Event 6: A farmer was drying his maize close to the marketplace. He was distracted by a conversation he was having with another farmer. Chickens took advantage by filling up on a few grains.

Question:

- Q52.** Which of these events count as post-harvest losses and which count as waste?
- Q53.** For each of the post-harvest losses, at what stage of the production and distribution chain did the loss occur?
- Q54.** In each case of post-harvest losses, suggest a method for estimating the quantity lost.

Exercise 27: Collection of agricultural prices with non-conventional units

Collection of agricultural prices with non-conventional units	Exercise N° 27	Handbook section: 4.4
--	----------------	-----------------------

Ongoing surveys are often carried out under difficult conditions in Africa as a result of a lack of financial resources.

As for agricultural commodity price surveys in rural markets, enumerators often do not have measuring equipment in conventional units. The farmers and merchants sell their agricultural products in local measurements units: cup, pile, bowl, bunch and so on.

Question:

Q55. Under these working conditions, what should a statistician do?

Exercise 28: Collection method for farm-gate prices

Collection method for farm-gate prices	Exercise N° 28	Handbook section: 4.4
---	----------------	-----------------------

A manager from the National Institute for Statistics tells his head of department that "it is difficult to collect the agricultural commodity prices at the farm gate (to obtain farm-gate prices)".

Questions:

Q56. What solution would you suggest?

Q57. Provide a collection methodology.

Exercise 29: Agricultural price indexes (API)

Agricultural price indexes (API)	Exercise N° 29	Handbook section: 4.4
---	----------------	-----------------------

You are working on a data set taken from the Directorate for Agricultural Statistics. Following recent public discontent about rising milk prices, the Minister for the Economy and Finances reassures the population. He argues that his increase was followed by a reduction in yam prices and that, as a result, the purchasing power of households will not have been affected. To make sure this is the case, the Minister of Agriculture asks you to respond to the following concerns.

You have the following three double series to work on:

Table of sales (thousands of units) and average sales observed during the year (€) 1997 - 2000						
	Maize		Yam		Milk	
Year	Price	Sales	Price	Sales	Price	Sales
1997	1,22	3256	2,45	597	0,56	5698
1998	1,27	4567	2,80	612	0,65	5893
1999	1,19	3972	3,06	624	0,48	5364
2000	1,35	3587	3,02	658	0,69	6971

Source: Fictional data.

Questions:

- Q58.** Calculate the Laspeyres and Paasche indices (base 1997 = 100) of the price of the three products sold on the capital's market in 1999.
- Q59.** The value index of sales of the above products (base 1997 = 100) was 131.27 in 1999. Using this value and the calculation in question 1, calculate the aggregate Laspeyres and Paasche indices for quantities (base 1997 = 100) in the year 1999.
- Q60.** What can be said about changes in the value of sales of the products concerned (overall growth rate, source of variation and so on)?
- Q61.** Calculate the average growth rate of the value of sales of yam from 1997 to 2000.

Exercice 30: Food balance sheet

Food balance sheet	Exercice N° 30	Handbook section: 4.5
--------------------	----------------	-----------------------

Product code	Heading	Production (P)	Imports (I)	Exports (X)	Stock change (dSt)	Food (Fo)	Food processing (Pr)	Animal feed (Fe)	Seed (Se)	Net tourist food (T)	Industrial use (IU)	Losses (Lo)	Residues and other uses (R)
	Wheat	54,390,000	4,550,000	870,000	-230,600	0	23,607,595	29,182,950	1,922	0	0	2,175,600	0
	Wheat flour	18,650,000	341,500	1,742,315	0	17,280,685	0	0	0	-31,500	0	0	0
	Wheat bran	4,249,367	0	0	0	0	0	4,249,367	0	0	0	0	0
	Wheat germ	472,152	0	0	0	0	0	472,152	0	0	0	0	0
	Wheat starch	0	624,900	224,500	0	0	0	0	0	0	400,400	0	0
	Wheat breakfast cereal	0	312,500	217,300	1,200	94,170	0	0	0	-170	0	0	0

Questions:

Q62. Reminders:

- Briefly describe the information in the table above.
- Specify potential data sources for this information.

Q63. Is the supply and utilization balance in equivalence to the product always verified? If so, explain

- If not, what could be the sources of error?
 - How could the error be corrected if the account is not balanced (supply \neq utilization)?

Q64. Based on the supply and utilization account (SUA), what are the main stages needed to draw up a food balance sheet (FBS)?

BIBLIOGRAPHY

Canada. Statistics Canada. 2003. *Survey Methods and Practices*. Statistics Canada Catalogue no. 12-587-XPE. Available at: <http://www.statcan.gc.ca/pub/12-587-x/12-587-x2003001-eng.pdf>. Accessed on September 2017.

Food and Agriculture Organization of the United Nations (FAO). 2017. *World programme for the census of agriculture 2020*. FAO Publication: Rome. Available at: <http://www.fao.org/3/a-i4913f.pdf>. Accessed on September 2017.

2010. *FAO/WFP crop and food supply assessment mission to Lesotho*. FAO special Report: Rome. Available at: <ftp://ftp.fao.org/docrep/fao/010/ah865e/ah865e00.pdf>. Accessed on September 2017.

2005. *World programme for the census of agriculture 2010*. Publication FAO: Rome. Available at: <http://www.fao.org/3/a-a0135e.pdf>. Accessed on September 2017.

1996. *Conducting agricultural censuses and surveys*. Publication FAO: Rome. Available at : http://www.fao.org/fileadmin/templates/ess/documents/publications_studies/publications/SDS_6_Conducting_agricultural_censuses_and_surveys.pdf. Accessed on September 2017.

1995. *World programme for the census of agriculture 2000*. FAO Publication: Rome. Available at : http://www.fao.org/fileadmin/templates/ess/ess_test_folder/Publications/SDS/5_Programme_for_the_world_Census_of_Agriculture_2000.pdf. Accessed on September 2017.

1986. *World Programme for the Census of Agriculture 1990*. FAO Publication: Rome. Available at: <http://www.fao.org/3/a-s8900e.pdf>. Accessed on October 2017

1982. *Estimation of crop areas and yields in agricultural statistics*. FAO Publication: Rome. Available at http://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Publications/FAO_ESDP/ESDP_22_Engv2.pdf. Accessed on October 2017.

1976. *World programme for the census of agriculture 1980*. Publication FAO: Rome. Available at: <https://unstats.un.org/unsd/progwork/pwabout.asp>. Accessed on October 2017.

1967. *Report on the 1970 world census of agriculture*. FAO Publication: Rome. Available at: <https://www.cabdirect.org/cabdirect/abstract/19786723217>. Accessed on September 2017.

Global Strategy to improve Agricultural and Rural Statistics (GSARS). 2017. *Handbook on the Agricultural Integrated Survey (AGRIS)*. GSARS Guidelines: Rome.

2017a. *Guidelines for the compilation of Food Balance Sheets*. GSARS Guidelines:

Rome.

2017b. *Improving Methods for Estimating Livestock Production and Productivity Methodological Report*. GSARS Technical Report Series n. GO-23-2017. Rapport GSARS: Rome. Available at : <http://gsars.org/wp-content/uploads/2017/05/TR-04.05.2017-Improving-Methods-for-Estimating-Livestock-Production-and-Productivity.pdf>. Accessed on September 2017.

2017c. *Methodology for Estimation of Crop Area and Crop Yield under Mixed and Continuous Cropping*. GSARS Technical Report Series n. GO-21-2017: Rome. Available at : <http://gsars.org/wp-content/uploads/2017/03/TR-15.03.2017-Methodology-for-Estimation-of-Crop-Area-and-Crop-Yield-under-Mixed-and-Continuous-Cropping.pdf>

2016a. *Crop1&2: measuring crop area and yield under pure stand, mixed, and continuous cropping. Findings from the field tests conducted in three countries: Indonesia (Asia/pacific), Rwanda (Africa) and Jamaica (Caribbean region)*. Working paper GSARS n. 16. Rome. Available at: <http://gsars.org/wp-content/uploads/2017/01/WP-16.01.2017-Findings-from-the-Field-Tests-Conducted-in-Three-Countries.pdf>

2016b. *Guidelines for the Enumeration of Nomadic and Semi-Nomadic (Transhumant) Livestock*. GSARS Guidelines: Rome. Available at: <http://gsars.org/wp-content/uploads/2016/08/Guidelines-for-the-Enumeration-of-Nomadic-and-Semi-Nomadic-Livestock-06.pdf>. Accessed on September 2017.

2016c. *Improving Methods for Estimating Livestock Production and Productivity Test Stage: Fieldwork Report and Summary Data Analysis*. Working paper GSARS no. 13: Rome. Available at: http://gsars.org/wp-content/uploads/2016/12/WP_Improving-Methods-for-Estimating-Livestock-Production-Productivity_Test-Stage-081216.pdf. Accessed on September 2017

2016d. *Improving Methods for Estimating Livestock Production and Productivity Gap Analysis Report*. Working paper GSARS n. 12. Rome. Available at: <http://gsars.org/wp-content/uploads/2016/11/Improving-Methods-for-Estimating-Livestock-Production-and-Productivity1.pdf>. Accessed on September 2017.

2016e. *Improving Methods for Estimating Livestock Production and Productivity: Literature Review*. GSARS Technical Report Series n. GO-11-2016. A literature review GSARS: Rome. Available at : http://gsars.org/wp-content/uploads/2016/04/LR_Improving-Methods-for-Estimating-Livestock-Production-and-Productivity-220416.pdf. Accessed on September 2017.

2016f. *Handbook on agricultural Cost of Production Statistics*. GSARS publication: Rome. Available at: <http://gsars.org/wp-content/uploads/2016/07/ACPS-WEBFILE-310516.pdf>. Accessed on September 2017.

2015a. *Gap analysis and proposed methodologies for estimation of crop area and crop yield under mixed and continuous cropping: Research on Improving Methods for Estimating Crop Area, Yield and Production under Mixed, Repeated and Continuous Cropping*. GSARS Working paper n. 4. Rome. Available at : <http://gsars.org/wp-content/uploads/2015/04/WP-04.04.2015-Gap-analysis-and-proposed-methodologies-for-estimation-of-crop-area-and-crop-yield-under-mixed-and-continuous-cropping.pdf>

[content/uploads/2015/12/WP-2-on-Improving-Methods-for-Estimation-of-Crop-Area-and-Crop-yield-under-Mixed-and-Continuous-Cropping-141215.pdf](#). Accessed on September 2017.

2015b. *Handbook on master sampling frames for agricultural statistics*. GSARS publication: Rome. Available at: <http://gsars.org/wp-content/uploads/2016/06/Handbook-on-MSF-FR-WEBFILE-280616.pdf>. Accessed on November 2016.

2015c. *Technical Report on Linking Area and List Frames in Agricultural Surveys*. GSARS Technical Report Series n. GO-08-2015. GSARS technical Report: Rome. Available at: <http://gsars.org/wp-content/uploads/2015/10/TR-on-Linking-Area-and-List-Frames-in-Agricultural-Surveys-191015.pdf>. Accessed on September 2017.

2015d. *Spatial Disaggregation and Small-Area Estimation Methods for Agricultural Surveys: Solutions and Perspectives*. GSARS Technical Report Series n. GO-07-2015. Rome. Available at: <http://gsars.org/wp-content/uploads/2015/09/TR-Spatial-Disaggregation-and-Small-Area-Estimation-210915.pdf>. Accessed on September 2017.

2015e. *Technical Report on Improving the Use of GPS, GIS and Remote Sensing in setting up Master Sampling Frames*. GSARS Technical Report Series n. GO-06-2015. GSARS technical Report: Rome. Available at: http://gsars.org/wp-content/uploads/2015/01/Technical-Report-GPS_GIS_RS-for-MSF-finalv2.pdf. Accessed on September 2017.

2014. *Guidelines for the Integrated Survey Framework*. GSARS Guidelines Publication: Rome. Available at: http://gsars.org/wp-content/uploads/2015/05/ISF-Guidelines_12_05_2015-WEB.pdf. Accessed on September 2017.

2014b. *PSSAR – Strategic Plans for Agricultural and Rural Statistics*. GSARS publication: Rome. Available at: <http://www.gsars.org/wp-content/uploads/2014/07/SPARS-final-3007.pdf>. Accessed on September 2017.

United Nation Economic And Social Council (ECOSOC). 2013. generic statistical business process model v5. ecosoc technical report series n. ece/ces/2014/1. publication ecosoc: paris. available at: <https://statswiki.unece.org/display/gsbpm/gsbpm+v5.0>. accessed on september 2017.

International Monetary Funds (IMF). 2007. *Republic of Mozambique: Poverty Reduction Strategy Paper*. IMF Country Report No. 07/37. IMF Publication: Washington, D.C. Available at: www.imf.org/external/pubs/ft/scr/2007/cr0737.pdf. Accessed on September 2017.

United Nations – Department of Economic and Social Affairs (ONU-DESA). 2016. *A Framework for the Development of Environment Statistics*. UN Publication: New York, United-States. Available at: <https://unstats.un.org/unsd/environment/FDES/FDES-2015-supporting-tools/FDES.pdf>. Accessed on September 2017.

2012. *International Recommendations for Water Statistics*. ONU-DESA Statistical

Papers Series M No. 91. New York. Available at:
<https://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf>. Accessed on September 2017.

World Bank, FAO & UN. 2010. *Global Strategy to Improve Agricultural and Rural Statistics*. Report No. 56719-GLB. Publication de la Banque Mondiale : Washington, D.C. Available at :
http://www.fao.org/fileadmin/templates/ess/documents/meetings_and_workshops/ICAS5/Ag_Statistics_Strategy_Final.pdf. Accessed on September 2017.

United Nations Educational, Scientific and Cultural Organization (UNESCO). 2006. *International Standard Classification of Education (ISCED, 1997)*, republishing May 2006. Available at: <http://unesdoc.unesco.org/images/0014/001470/147001f.pdf>. UNESCO publication: Genève, Suisse. Accessed on September 2017.

WEBOGRAPHY

Food and Agriculture Organization of the United Nations (FAO). 2017. *Food and Agriculture Organization of the United Nations*. Rome. Accessed on September 2017.
<http://www.fao.org/>

2017a. FAOSTAT: *The world's largest database of food and agriculture statistics*. on: Food and Agriculture Organization of the United Nations. Rome. Accessed on September 2017. <http://www.fao.org/ES/ess/census/default.asp>.

Global Strategy to improve Agricultural and Rural Statistics (GSARS). 2017. *Global Strategy to improve Agricultural and Rural Statistics*. Rome. Accessed on September 2017.
<http://gsars.org/en/>.

MDG Monitor. *Fact sheet on current MDG progress of Belize (Latin America and the Caribbean)*. On: *MDG Monitor: Tracking the Millennium Development Goals*. Accessed on September 2017. http://www.mdgmonitor.org/factsheets_00.cfm?c=MOZ.

United Nations (UN). 2017. *SDG Indicators: Global database*. On: *Sustainable Development Goals*. Accessed on September 2017.
<http://unstats.un.org/sdgs/indicators/database/>.

United Nations (UN). 2016. *The Sustainable Development Goals Report 2016*. On: *Sustainable Development Goals*. Accessed on September 2017.
<http://unstats.un.org/sdgs/report/2016/>.

United Nations Development Programme (UNDP). 2017. *Sustainable Development Goals*. On: *United Nations Development Programme*. Accessed on September 2017.
<http://www.undp.org/mdg/>.

University of Warwick. Introduction to the International Standard Classification of Occupations (ISCO-88). On: [Social Sciences /Institute for Employment Research Warwick Institute for Employment Research](http://www.ilo.org/public/english/bureau/stat/isco/isco88/index.htm) Accessed on September 2017
<http://www.ilo.org/public/english/bureau/stat/isco/isco88/index.htm>

Statistics Canada. 2014. Defining quality. On: *Statistics Canada*. Accessed on September 2017. <http://www.statcan.gc.ca/pub/12-539-x/4147797-eng.htm>.