



**Food and Agriculture Organization
of the United Nations**

FAO Statistics Working Paper Series / 21-21

**OPERATIONAL GUIDELINES ON LISTING AND SURVEY
PREPARATION FOR HOUSEHOLD AND NON-HOUSEHOLD
AGRICULTURAL HOLDINGS AND SPECIAL FARMS**

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Required citation:

Bako, D., Cara, O., Paré, L., Missiroli, S., Mugabe, S. and Koudelka, K. 2021. *Operational guidelines on listing and survey preparation for household and non-household agricultural holdings and special farms*. FAO Statistics Working Paper 21-21. Rome, FAO. <https://doi.org/10.4060/cb4065en>

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ISBN 978-92-5-134190-2

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Contents

Acronyms	v
Preface	v
Acknowledgements	vi
1 Rationale and objectives	1
2. Definitions of agricultural holdings	4
A. Definition of holdings.....	4
B. Types of holdings	4
C. Conclusions and recommendations for defining agricultural holdings for survey implementation	9
3. Operational listing procedures	12
A. Listing agricultural holdings in the household sector in enumeration areas.....	12
B. Listing tracts/plots in segments when using area frame	24
C. Listing non-household holdings and special farms	28
4. Interview strategies for non-household holding and special farms	35
A. Data collection methods	35
B. Country examples	36
C. Some recommendations	38
5. Estimation procedures for covering agricultural holdings and special farms with a dual frame approach	39
A. Operational strategy for covering special farms (large farms, commercial farms...) in agricultural surveys	39
B. Overview of dual frame survey	40
C. Screening approach	41
D. Dual frame estimators	42
References	45
Annex	48

Preface

As the organization recognized by the United Nations Statistics Division as responsible for international statistical standards for the agriculture sector, the Food and Agriculture Organization of the United Nations (FAO) has been supporting countries since its founding in 1945, providing assistance to implement their national agricultural censuses through the World Programme for the Census of Agriculture (WCA) promoting the use of standard international concepts, definitions and methodology.

The census of agriculture is generally aimed to be carried out every ten years while more frequent agricultural data are required for effective planning, financing, and implementation of agricultural development policies, especially in developing countries. Agricultural surveys are naturally a cost effective solution for more detailed and updated agricultural statistics in countries to fulfil both national and international data needs.

Recently in the framework of the Global Strategy to improve Agricultural and Rural Statistics (2012-2018), hosted by FAO Statistics Division, methodological works and field experiments were implemented to provide cost effective international guidance to countries for the implementation of sample surveys in the agriculture sector. Since 2018, FAO Statistics Division established a Survey Team with the ultimate goal to support effectively countries in the implementation of agricultural sample surveys.

This note is part of the series of operational guidelines of FAO Survey Team providing practical cost effective orientations to countries on agricultural surveys from the conception and implementation to data dissemination. The present document is focused on operational clarifications on the definitions of agricultural holdings and operational guidance for establishing lists of agricultural holdings for agricultural surveys.

This document is result of a collaborative work of experienced experts of FAO Survey Team and national consultants working in statistical offices in countries where agricultural surveys cover agricultural holdings in both household and non-household sectors and special farms.

Acknowledgements

This document is part of the methodological works of the Survey Team of FAO Statistics Division to provide operational guidance on selected areas of agricultural survey methodology with an overall objective to promote cost effective practices in agricultural surveys implementation. The methodological works are conducted under the overall coordination of Christophe Duhamel and the technical supervision of Flavio Bolliger and Neli Georgieva.

This publication was prepared by Dramane Bako, Oleg Cara, Lassina Paré, Silvia Missiroli, Stephane Mugabe and Karla Koudelka. The document benefited from valuable comments and inputs from Flavio Bolliger, Neli Georgieva, Christophe Duhamel and Chiara Brunelli.

The authors thank the following external reviewers for their valuable technical contributions: Naman Keita, Seghir Bouzaffour and Miguel Galmés.

Acronyms

AAS	Annual Agricultural Survey
AC	Agricultural census
CAPI	Computer Assisted Personal Interviewing
CASI	Computer-assisted self-interviewing
CATI	Computer-assisted telephone interviewing
CAWI	Computer-assisted web interviewing
CIAS	Cambodia Inter-Censal Agricultural Survey
DAPSA	Direction de l'Analyse, de la Prévision et des Statistiques Agricoles
DO-MB	Drop-off/mail-back
DO-PKI	Drop-off/ pick-up by interviewer
EA	Enumeration Area
EC	European Commission
EPA	Enquête Permanente Agricole
FAO	Food and Agriculture Organization of the United Nations
Geostat	National Statistics Office of Georgia
GPS	Global positioning system
IBGE	Instituto Brasileiro de Geografia e Estatística
IMF	International Monetary Fund
LAO	Large Agricultural Operations
LSU	Livestock Size Units
NIS	Cambodia National Institute of Statistics
NPI	Non-profit institutions
NSO	National Statistical Office
OECD	Organisation for Economic Cooperation and Development
PAPI	Paper and Pen Interviewing
PATI	Paper-based (or assisted) telephone interviewing
PHC	Population and Housing Census
PSU	Primary Sampling Unit
RGPHAE	Recensement Général de la Population et de l'Habitat, de l'Agriculture et de l'Elevage
SAS	Seasonal Agricultural Survey
SNA	System of National Accounts
SSU	Secondary Sampling Unit
TLU	Tropical Livestock Unit
UN	United Nations
WB	World Bank
WCA	World Programme for the Census of Agriculture

1. Rationale and objectives

The population of interest in the agricultural surveys is composed by agricultural holdings. The FAO World Programme for the Census of Agriculture (WCA) 2020 distinguishes two types of agricultural holdings: (i) holdings in the household sector and (ii) holdings in the non-household sector (FAO, 2015a). Agricultural holdings in the household sector are operated by households engaged in own-account agricultural production (either for sale or for own use) while those in the non-household sector are operated by other economic entities like corporations, cooperatives, government institutions, etc.

For agricultural surveys, FAO strongly recommends countries to ensure the coverage of all types of agricultural holdings using a suitable master sampling frame that is a frame enabling the selection of different samples (including from different sampling designs) for specific purposes (FAO, 2015b). Accordingly, FAO (2017) recommends two types of master sampling frames: on one hand, a multiple frame consisting of two list frames of agricultural holdings (i) in the household sector and (ii) in the non-household sector, and on the other hand, for countries using an area frame for their agricultural surveys, it is recommended to complement the area frame with two list frames of (i) landless holdings raising livestock and (ii) large agricultural holdings. However, developing a sampling frame for a sector as complex as the agriculture sector is difficult and expensive for many countries. For holdings in the non-household sector, another issue for countries is to adopt a clear operational definition that facilitates the development of a quality sampling frame.

This document aims at fulfilling the following interlinked goals related to the two categories of agricultural holdings:

(1) Provide recommendations on operational definitions of agricultural holdings for data collection purposes

The generic international definitions of agricultural holdings need to be customized in countries specific contexts for data collection. The document will review and discuss definitions used in a number of countries and provide operational recommendations on the classification of agricultural holdings for data collection purposes.

(2) Provide guidance and recommendations on operational procedures to develop lists of agricultural holdings within primary sampling units (PSUs) for agricultural surveys in the household sector with a multi-stage sampling

For agricultural surveys, stratified two-stage sampling designs are recommended as cost effective when using list frame of holdings in the household sector or an area frame (FAO, 2017). Many developing countries are familiar with this design, which consists of selecting a first sample of PSU (enumeration areas (EA), villages, counties, group of segments etc.) and then selecting in a second stage a sample of agricultural holdings in each of the selected PSU.

For list frames of holdings in the household sector, direct listings of agricultural holdings are practically problematic in most contexts as holdings may operate many parcels in different locations. A recommended alternative commonly used is building the list of holdings indirectly through a list of households engaged in own-account agricultural production, as a household holding is generally operated by one household. This operation is fundamental to build an updated frame of the statistical units of interest, i.e. the agricultural holdings. Identifying the agricultural holdings in the household sector requires

an updated list of households in the PSU with relevant information about their engagement in agriculture activities. This could be obtained from data of a recent population census or agricultural census or any updated register with the required information. However, it often happens that such updated sampling frame does not exist. In that case, a common practice is to perform field visits to undertake a listing of the households in the sampled primary units or, particularly in the case of agricultural censuses, in all PSU. Alternatively, the list of households can be established using experts consultations, registers or other administrative data where relevant.

In addition, when an area frame is used in a two-stage sampling scheme, lists of all agricultural holdings operating land located in the sampled segments are often required. Developing such lists would be straightforward if there is an updated cadastral register or other administrative source. Otherwise, it would be necessary to conduct a listing operation in all sampled segments.

(3) Provide methodological guidance to countries on surveys of non-household holdings and special farms

According to FAO (2014)¹, more than 90 percent of farms in the World are family farms and they produce more than 80 percent of the world's food in value terms. Thus, in many countries agricultural surveys are primarily focused on agricultural holdings managed by households. However, it often appears that, beside of household holdings, countries are interested in other specific types of holdings managed by households or not. Rationales of such interest include:

- **Full coverage of agricultural holdings by the survey:** although family farms are dominant in most countries, farms managed by non-households' entities (institutions, corporations...) may have a significant contribution to agricultural production at national or sub-national level. For some specific types of commodities (e.g. cash crops: cocoa, cotton, coffee, sugar can...), this contribution may be particularly high. It is therefore important to consider this category of farms in agricultural surveys, especially in countries where administrative data does not include detailed required information on them. In addition, for countries using area frame, it is recommended to complement it with a list of landless livestock holdings as they are not covered by that type of frame.
- **Reporting needs:** agricultural surveys may be expected by the government to produce reliable statistics on some specific type of agricultural holdings for various reasons including the monitoring of agricultural programs supporting particularly those holdings and as fundamental information for national accounts computation. Another reasons can be the need of information for making decisions related to specific types of holdings ("modern farms", as called in some countries, large farms, organic farms, farms producing specific crops...).
- **Other reasons:** for instance when area frame is used, a complementary list of large holdings is advised to improve estimations as they usually appear as outliers.
- This note will provide methodological guidance on surveys of non-household holdings and "special farms" ("modern farms", large farms, organic farms, farms producing specific crops...). While countries are familiar with surveys of agricultural households, only few of them are surveying non-households holdings. Based on experiences of countries that conducted surveys on

¹ The State of Food and Agriculture 2014. Innovation in family farming (also available at: <http://www.fao.org/3/a-i4040e.pdf>)

this category of holdings, the document will provide guidance on listing strategy to develop a sampling frame for sampling surveys on these holdings and discuss effective interview strategies.

(4) Discuss sampling strategy and estimation procedures when using overlapping sampling frames for different types of agricultural holdings

To achieve a complete coverage of agricultural holdings, countries often use many lists of different types of holdings. Sampling and estimation procedures can be complex if the lists are overlapping. That is usually the case when special farms are of interest. This work discusses cost effective sampling strategy in such cases and provides recommendations on estimation procedures.

Structure of the document

After this introductory chapter, the chapter II discusses the definitions of agricultural holdings considering the main types of holdings adopted by countries and provides operational recommendations specifically on defining holdings in the non-household sector and special farms for statistical purposes. The chapter III provides guidance on the operational procedures for developing lists of agricultural holdings. Then, effective strategies for interviewing non-household holdings and special farms are discussed in chapter IV followed by a chapter V on estimation strategy and procedures with a dual frame.

2. Definitions of agricultural holdings

For statistical, analytical and other purposes, countries use different approaches to distinguish the types of agricultural holdings. This document is interested in operational definitions of agricultural holdings for survey implementation. Definitions for analytical and other purposes are already fully discussed in FAO (2018b). According to the WCA 2020 and country experiences, different approaches and criteria could be used to define **the types of holdings** for data collection purposes, such as:

- 1) According to the household or non-household sector to which the holding belongs to;
- 2) According to the legal personality of the holding or legal status of agricultural holder;
- 3) Using other approaches and criteria (such as market orientation, size or technology).

Countries may use one or several approaches and criteria to define the holdings for agricultural surveys (i.e. censuses and sample surveys). That would depend on what the countries consider to be the most relevant for them, as well as the available data sources. However, to ensure soundness of methods used and international comparability of data, countries are advised to comply with the relevant recommendations provided by FAO and other relevant international organizations.

A. Definition of holdings

The main statistical unit used in the national agricultural census and survey programmes is the agricultural holding. As defined in the World Programme for the Census of Agriculture (WCA) 2020, an agricultural holding *“is an economic unit of agricultural production under single management comprising all livestock kept and all land used wholly or partly for agricultural production purposes, without regard to title, legal form or size. Single management may be exercised by an individual or household, jointly by two or more individuals or households, by a clan or tribe, or by a juridical person such as a corporation, cooperative or government agency. The holding’s land may consist of one or more parcels, located in one or more separate areas or in one or more territorial or administrative divisions, providing the parcels share the same production means, such as labour, farm buildings, machinery or draught animals”* (FAO, 2015a). In some countries, a threshold (minimum size limit) is adopted for defining the holdings (such as area of holding, area of arable land, area of temporary crops, number of livestock raised by main types, quantity of output produced, value of agricultural production, quantity of labour used, etc.).

B. Types of holdings

Agricultural holdings can be classified according to different criteria, as, for instance, the sector to which they belong and/or according to the legal status of the holder. Details are given below.

1. **Types of holdings according to the sector to which the holding belongs (holdings in the household and non-household sector)**

The sector to which the holding belongs may be classified as “household sector” or “non-household sector”. Accordingly, two types of agricultural holdings could be distinguished (FAO, 2015a):

- (i) *holdings in the household sector; and*
- (ii) *holdings in the non-household sector.*

a) Holdings in the household sector

As defined in the System of National Accounts (SNA), “the household sector consists of all resident households”. Accordingly, as specified in the WCA 2020, agricultural holdings in the household sector are holdings that are operated by household members. Usually there is only one holding in a household (single-holding household). However, there can be exceptions (for more details please refer to the FAO (2015a), Chapter 6)). In most developing countries, the majority of agricultural production is in the household sector. The concept of “agricultural holding” in the household sector is therefore closely related to the concept of “household”, in particular to “household engaged in own-account agricultural production” (called in some countries “agricultural household”).

b) Holdings in the non-household sector

According to the WCA 2020, non-household holdings are those in sectors other than the household sector. These could include the holdings operated by corporations, cooperatives, which are defined within the context of national laws and customs; tribes, clans, private schools; religious institutions, as well as government institutions.

A clear definition of non-household holdings and distinction between this type of holdings and the holdings in the household sector is essential in order to avoid duplications or omissions. In some cases, confusions may arise in differentiating the holdings in the household and the non-household sectors, especially with respect to households that operate large or commercial farms that could be classified as quasi-corporations in the System of National Accounts.²

For operational purposes, provided that business registers (or other administrative registers used by countries for the registration of businesses, etc.) are among the primary sources for establishing the sampling frame for non-households holdings, the use of such registration could be applied as a criterion for classifying the quasi-corporations in the non-household sector. If the registered quasi-corporation owned by household meets all the criteria established in the SNA in the country for quasi-corporations, the unit is included in the list of holdings in the non-household sector.³

Therefore, holdings in the non-household sector could be considered the agricultural holdings operated by:

- Legally constituted corporations;⁴
- Cooperatives and limited liability partnerships;

² According to the SNA, quasi-corporation are unincorporated enterprises (including unincorporated partnerships) owned by households that are sufficiently self-contained, independent and operated as if they were privately owned corporations. It must be possible to identify and record any flows of income and capital that are deemed to take place between the quasi-corporation and its owner (EC, IMF, OECD, UN and WB, 2009).

³ A quasi-corporation is treated as a separate institutional unit from its owner. It must keep complete sets of accounts (EC, IMF, OECD, UN and WB, 2009).

⁴ A corporation is an entity created by process of law whose existence is recognized independently of the other institutional units that may own shares in its equity. (EC, IMF, OECD, UN and WB, 2009).

- Government institutions: agricultural production entities operated by a central or local government directly or through a special body;
- Non-profit institutions (NPIs);⁵
- Tribes, clans;
- Registered quasi-corporations.

Registered quasi-corporations are household-owned units (unincorporated enterprises) with large or specific agricultural operations in which income and expenditure flows from agricultural activities can be separated from the other household activities, and the operations are registered in the nation's business register (or another similar administrative register used in the country).

A corporation is an entity created by process of law whose existence is recognized independently of the other institutional units that may own shares in its equity. The laws governing the creation, management and operations of legally constituted corporations may vary from country to country. They may be described by different names: *corporations, incorporated enterprises, public limited companies, public corporations, private companies, joint-stock companies, limited liability companies, etc.* (EC, IMF, OECD, UN and WB, 2009).

The agricultural holding as an establishment

The WCA advises using the SNA concept of establishment when defining the agricultural holdings, whereby an establishment is an economic unit engaged in one main productive activity, operating in a single location (FAO, 2015a). The agricultural holding is treated as equivalent to an establishment unit under the SNA framework.

The use of the establishment concept might be difficult to implement when defining the agricultural holdings in the non-household sector. Corporations and government institutions may have complex structures, in which different activities are undertaken by different parts of the organization. Thus, these may consist of different establishments engaged in agricultural production that would constitute different agricultural holdings. For instance, a corporation may consist of two distinct agricultural establishments operating in different districts, which would be actually different agricultural holdings.

When designing their agricultural sample surveys, a number of countries consider agricultural holdings in the "household sector" including: Botswana, Burkina Faso, Cambodia, Mauritius, Senegal, Suriname and Seychelles. However, the coverage of holdings in the "non-household sector" in such agricultural surveys is not yet a common practice particularly in developing countries. This is mostly due to their relative numbers and low contribution to agricultural production. In some of these countries, the non-household sector is usually covered in the census of agriculture as part of "special farms" of interest for them (modern, commercial farms..., see related section below). Countries where non-household holdings are

⁵ NPIs are legal or social entities, created for the purpose of producing goods and services, whose status does not permit them to be a source of income, profit or other financial gain for the units that establish, control or finance them. They may be created by households, corporations, or government but the motives leading to their creation are varied. NPIs could be religious institutions, schools, colleges, clinics, hospitals, etc. (EC, IMF, OECD, UN and WB, 2009).

relatively important and those who consider the support to national accounts computing in their survey design (e.g. Georgia and Costa Rica) cover this sector in their regular agricultural surveys. More country examples are presented in Annex 1.

2. Types of holdings according to the legal status of agricultural holder

The holdings could be distinguished based on the following legal status of the holder:

- (i) a civil person (or “a natural person” in some countries)*
- (ii) a group of civil (or natural) persons or*
- (iii) a juridical (or legal) person*

From the juridical point of view, a holding may be operated by civil persons or juridical (legal) persons. In the former case, the holdings may be operated, either by a single individual, or jointly by several individuals (group of civil persons) belonging to the same or to different households, with or without contractual agreement. The juridical (legal) persons can be public or private, inter alia: a corporation, a cooperative, a governmental institution, a church, etc.

Holdings where the holder is a legal person usually are non-household holdings and vice versa, those where the holder is a civil person (or holders are civil persons) mainly refer to the household sector. However, as the legal responsibility for the holding is defined according to country’s legislation, the correspondence between legal status of the holder (type of holder) and the sector to which the holding belongs is not automatic and depends on the country legal system and context. For instance, a holding can be registered as a legal entity, but function as a household holding. Such a holding is usually considered to be part of the household sector but some countries may classify it in the non-household sector.⁶ On the contrary, a quasi-corporation owned by a household, which is sufficiently self-contained and keeps complete sets of accounts would refer to the non-household sector. A legal or institutional criterion helps to define units that are recognizable and identifiable in the economy.

The legal status of agricultural holder is used to define the holdings in many countries such as: Armenia, Cabo Verde, Chile, Costa Rica, Egypt, Georgia, Peru, the Congo, Uruguay, EU member countries, etc. More country examples are presented in Section II - C below.

3. Other approaches and criteria used to define the specific types of holdings for the purposes of data collection

Some countries use other criteria to classify agricultural holdings for data collection purposes, such as:

- *The main purpose of production of the holding (market orientation)*
- *Size of the holding, etc.*

These criteria are discussed below.

⁶ FAO, 2015.

a) *Types of holdings related to the purpose of production*

Depending on the main purpose (or destination) of production, the holdings could be divided into:

- (i) *Producing mainly for sale;*
- (ii) *Producing mainly for own consumption (or “for own final use”).⁷*

Or:

- (i) *Commercial enterprises (producing mainly for sale);*
- (ii) *Other holdings, which use all or some of the production for own consumption. In its turn, “other holdings” could be further divided into producing:*
 - *mainly for sale with some own consumption,*
 - *mainly for own consumption with some sales,*
 - *only for own consumption.*

Purpose of production is a useful measure for analyzing holdings (especially those in the household sector) according to their market orientation. In cases where a holding sells some production and uses the rest for own consumption, the main purpose should be which of the two – sale or own consumption– represents the larger value of agricultural production of the holding.⁸

Despite the fact that the holdings *producing mainly for own consumption* are mainly part of the household sector, and those *producing mainly for sale* - of the non-household sector, the main purpose of production should not be used as a criterion to define the sector to which the holding belongs, thus the terms ‘non-household holdings’ and ‘commercial farms’ shall not be used as synonyms.

b) *Use of size criteria*

Countries use various criteria to establish minimum size limits for holdings covered in the agricultural surveys or for those covered by complete enumeration (or with an increased fraction) in agricultural surveys, such as:

- Area of operated land (e.g. total area of holding or agricultural area);
- number of tree crops;
- number of livestock raised (e.g. total number of livestock by main types and/or over a certain age, use of conventional Livestock Size Units (LSU) or Tropical Livestock Unit (TLU)⁹ to define the size of a livestock unit);
- output/income (e.g. value of agricultural production, value of agricultural products sold, net cash farm income);
- hired farm labour;

⁷ According to the Resolution concerning statistics of work, employment and labour underutilization (ILO, 2013), adopted by the 19th ICLS in 2013, “for own final use” is interpreted as production for which the intended destination of the output is mainly for final use by the producer in the form of capital formation or final consumption by household members, or by family members living in other households.

⁸ Sale includes selling self-produced agricultural products, processed or not, for cash or in exchange for other produce (barter).

⁹ LSU are used in the EU member countries and other countries. See also <http://www.fao.org/3/i2294e/i2294e00.pdf>

- other inputs (e.g. farm production expenses, agricultural machinery used, use of irrigation), etc.

One or a combination of the criteria could be used to set minimum size limits and/or holdings' types classes.

For setting the thresholds, there is a need for reliable information about agricultural producers. The sources of such information could be agricultural censuses, farm registers and other relevant statistical and administrative data sources. Despite the fact that the holdings in the *household sector* are commonly of a small-size, the size criteria should not be used to define the sector to which the holding belongs to (household or non-household sector).

Size criteria to define the types of holdings are used by countries such as Georgia, Mauritius and Saint Lucia (see the examples in Section II - C below).

c) Other criteria

Countries use also other criteria to define the types of holdings, such as the availability of accounting (bookkeeping records) in the holding, Business Registration, Tax registration.

There is a specific group of agricultural holdings for which the criteria mentioned above are not applied. Those holdings, due to their specific characteristics such as high commodity specialization, use of particular farms practice (organic farming holdings), particular commodity (usually rare) like flowers farms or a precise localization, are called here "specialized holdings".

The list of those holdings can be easily updated because usually they are well known, visible and provide statistical returns. Often, those holdings are included in administrative and statistical registers, such as business or farm registers.

C. Conclusions and recommendations for defining agricultural holdings for survey implementation

Countries' practices (presented with details in annex) show that countries use different criteria to classify the agricultural holdings before survey implementation. Most of the analyzed countries (such as Burkina Faso, Cambodia, Congo, Georgia, Mauritius and Senegal) use the sectoral approach to distinguish the households' holdings and either non-household holdings or special farms of interest (commercial, modern, large farms...). Other countries use definitions based on the legal status of the holdings. A summary is presented in the table 1 below.

Table 1. Distribution of countries according to approaches and criteria used to define agricultural holdings

Country	Household sector/ Non-household sector	Legal status	Other criteria (special farms)
Brazil	✓		✓
Burkina Faso	✓		✓
Cambodia	✓		✓
The Congo	✓		✓
El Salvador		✓	✓
Georgia	✓	✓	
Kazakhstan		✓	✓
Mauritius	✓	✓	
Nepal	✓		✓
Saint Lucia			✓
Senegal	✓		✓

Source: FAO (2019) and direct contacts with countries, 2020.

The definitions and classification criteria are well established in most countries with a developed national statistical system. However, the criteria used in a number of other countries are not always well defined, preventing from a clear distinction of the types of holdings, and/or are not mutually exclusive, causing overlap or exclusion of holdings.

For example, in some countries, the holdings in the household sector are defined using the size criteria (for instance, holdings below “x” ha are considered household holdings). This approach presents some major problems as a household holding is not determined by the size of the holding but depends on whether it is operated by a household or not. Thus, the relatively large holdings above “x” ha of area (in a country using the size criteria to define the holdings in the household sector) are included in the “non-household” sector, while they are operated by households and are not registered in the business register.¹⁰ However, according to WCA 2020, the household sector should include all households engaged in the agricultural production regardless of the size (e.g. the area of land or number of livestock raised) and purpose of production (for own final use or for sale). On the other hand, the holdings in the non-household sector should include all other holdings, which are not operated by the households.

In order to avoid this type of problems, a clear definition of the agricultural holdings in the household sector should be developed by countries, based on international recommendations, such as WCA 2020 and SNA 2008. In order to ensure the coherence with the SNA when defining the holdings in non-household sector, the criteria used to define the household sector should be developed and applied in practice in close collaboration with the units responsible for the development of national accounts in the country.

¹⁰ or in a similar national administrative register of business units.

In case the country is interested in special holdings (large, commercial, modern, specialized holdings...), clear criteria should be used considering potential operational constraints to apply them and allowing a clear distinction of the overlap with the household and the non-household sectors.

In general, it is crucial to ensure that the types of holdings considered for the survey cover all agricultural holdings of the country. It is recommended to carefully assess the available data sources when considering the approaches and criteria to be used to define the types of holdings.

3. Operational listing procedures

This section discusses operational procedures of building the list of each type of holdings considering the use of existing lists from both statistical and administrative data sources, the implementation of special ad-hoc listing operations to develop the list and the integration of lists from multiple sources. Good practices from country cases are also discussed.

A. Listing agricultural holdings in the household sector in enumeration areas

The recommended sampling design for agricultural holdings in the household sector is a stratified multi-stage design. Many countries already used that design in their household surveys. The primary sampling units are generally enumeration areas (EA) designed for Population and Housing Censuses (PHC) and defined as the smallest geographical unit usually allocated to a single enumerator during census or survey enumeration. A common cost-effective sampling procedure with such design consists in selecting a sample of EAs from the PHC data and then perform listing procedures in those sampled EAs in order to select inside them the sample of eligible households. This section discusses such listing procedures in the framework of agricultural surveys considering the availability or not of updated lists from existing sources.

1. Developing preliminary lists without visits

Before opting for fieldwork with in-person visits, it would be cost-effective to explore the availability of existing data that could be used to develop a reliable list of agricultural holdings. Main requirements are that such data should be recent and include the basic information to identify holdings as discussed in Section 3. Although it can be difficult to find an updated list of households with the relevant specific information, the most suitable solution would be lists from a recent agricultural census or recent lists of agricultural holdings established in the framework of a previous agricultural survey.

Other suitable data could be lists from a recent population and housing census. FAO (2015b) advises on how to identify agricultural households from the population census data using information on the economic activity status of the household's members. Agricultural holdings in the household sector are operated by households engaged in own account agricultural production (agricultural production households, or just "agricultural households" as called in some countries).

In addition, any recent lists of households established for a previous household survey could also be used if the required information on households that will be discussed in Section 3 was included.

Another possibility to create a frame of agricultural households or agricultural holdings in a selected PSU is to examine available lists from administrative sources. For instance, updated registers from local institutions (municipalities, villages, communes etc.) covering administratively the sampled EAs could be explored. The use of any other register having a good coverage of households/agricultural holdings in the country could potentially be investigated.

In any case, all lists of agricultural holdings developed without visits should be carefully checked to ensure the level of coverage of all holdings in the selected PSUs. This checking could be performed with local leaders, officials, members of the local administration, important agricultural holders. The activity could be undertaken by regional statistical experts or experienced enumerators who send the list of each village/commune to the regional office for validation and quality checks. The final version is then submitted to the statistical office in charge of the agricultural survey.

2. Listing procedures with visits

In case there is no suitable existing data to develop the lists of holdings without visits, a fieldwork for listing all households is required. Each household of the selected primary sampling units (PSUs) should be visited and administered a listing questionnaire. This operation is time consuming and costly but it allows to collect at one time information at the household level that can be also used to build frames for other surveys. It is important that the questionnaire includes sections that allow determining whether the household belongs to the target population (agricultural households) or not. The listing questionnaire content will be discussed in Section 3.

a) Advantages and timing

The listing operation allows reducing the non-sampling errors using an updated list of households in the sampled PSUs. Indeed, the collected information are useful to update any existing frame of households, deleting the ones that do not exist anymore and adding the recent ones, ensuring a better coverage of the target population.

Moreover, the households listing allows performing a probability sampling procedure and it provides basic information for stratification purpose. It also facilitates the field supervision during the main survey thanks to the geo-localisation of the dwellings.

It is advised to avoid having a long time between the listing and the actual survey to facilitate the identification of the sampled households for the survey. In addition, it would be good to target periods in which most households can be found in their dwellings. In many countries, market days and period with high intensity agricultural activities should be avoided.

When the country has relatively poor road infrastructure or big distances between households, it can happen that the listing operation phase occurs at the same time of the survey/census. If a sample of the eligible households has to be drawn in the sampled enumeration area, the main survey can be done immediately after the end of the listing operation, before the enumerators leave the enumeration area. If a CAPI questionnaire is used and it's possible to use internet connection, appropriate quality checks should be conducted simultaneously by the central office and the HQ team can provide immediately the sample and the households can start to be interviewed for the main questionnaire. In case a paper questionnaire is used for the listing, the list of eligible households can be established after the listing operation and the sample can be selected systematically or using a table of random numbers ideally with the support of the supervisor. In case the survey is conducted with a cluster sampling scheme (quite rare in practice), if the enumerator during the listing sees that the household satisfies the eligibility criteria for the survey/census, she/he continues with the main interview.

b) Operational steps

As a fieldwork, the listing operation is generally carried out by teams of enumerators and supervisors recruited and trained by the Central Office (national statistical office or agricultural statistics department in the ministry in charge of agriculture). The number of teams established depends on the number of sampled EAs and on the number of households within each EA. Enumeration areas are generally designed in a way that facilitates the survey operation. The average size of the EA is usually the number of households that an enumerator can list in one day. The Central Office controls the overall workload. It is

recommended to list all the households in the selected EAs and then to identify the agricultural households, based on the identifying variables in the listing questionnaire form (see Section 3) before selecting a sample for the survey. Listing all the households in the EAs allows the comparability with the population census' data, with populations' projection data or other auxiliary sources for quality control of the listing.

Before the field operation

One of the important prerequisites for a good listing is to have recent maps of the selected EAs. These maps usually come from the previous population census and contain the list of the dwellings inside the EAs. They might be adjusted and updated according to the survey type. For instance, contiguous EAs used in a population census can be grouped in agricultural surveys in order to maintain an equal workload (agricultural holdings in the household sector are usually less than the households interviewed for a population census). If good EAs maps are not available, sketch maps should be prepared. The maps could be physically printed or electronically uploaded in case of the use of a CAPI platform. That should be complement with a description of the EA reference points and boundaries and any other helpful information to locate the EA.

Before going to the field the enumerators and the Central Office have to be sure that all materials are available. For instance, in case of using physical maps to identify the EAs, those must be printed in a desired format or uploaded to the tablets if a CAPI platform is provided. A listing questionnaire form must be drawn and printed or uploaded to the CAPI platform. The teams should be well trained for the use of maps as well as CAPI and/or GPS if they are used.

Another important thing is to sensitize the target population since the listing will collect personal data on households. This activity should be done earlier by the Central Office in close collaboration with the extension workers of the Ministry of Agriculture and the local leaders. Preliminary meetings with the officials and community leaders may be required in some countries. A short publicity campaign can be also useful if resources are available.

On the field

In order to conduct the listing operation of all the households in a selected EA the team of enumerators has to:

1. Review the map of the selected EA and locate it in the field. Approach the EA and try to identify its physical or artificial boundaries. This important step may require the support of cartographic experts of the department that elaborated the EA map or the help of resource persons from the localities (village chief, administrative and municipal officer, other notables, etc.), particularly if the borders are not clear and/or the map is complex. If available, the maps must show some practical information (localization of the public/community infrastructures such as schools, health centres, markets, etc., as well as natural resources such as water points, forests, etc.) in order to ease the identification of the EA's boundaries. In some cases, co-ordinates for some special points in the EA are available (landmarks, roads, schools, hospitals, police stations, etc.). If that is the case, they should be used for a better identification. On the other hand, if a recent census is available, check if GPS was used to identify EA boundaries or dwellings.

2. Make a first exploratory tour to determine an efficient route of travel for the household's visits. The EA should be divided into parts if possible. A part can be a block of structures. The subdivision in blocks is easier in urban areas where dwellings are usually well organized in regular areas. The enumerator should complete the listing of one block before moving to the adjacent block.
3. Visit all the dwellings and record their geographical coordinates (usually the GPS coordinates of the door of the house/dwelling) using a hand GPS or the GPS of the tablet if provided, and list sequentially all the households inside each of them. If the dwellings are reported on the maps or a list of reference persons of the dwellings is provided together with the EAs maps, this step could be easily carried out. Otherwise, if the EAs correspond to villages for instance, one could associate to each dwelling a sequential number usually starting from north-west and proceeding to south east in a serpentine way, and number all the households in each dwelling sequentially. At this stage, it is important to update the map by adding the new dwellings as well as excluding the empty/non-existing ones.

If PSU are villages or big EAs, this step could be carried out by two phases: the first one consists in listing all the dwellings, as described above, and marking them visibly, either with chalk or with a special marker at their entrance point; and then at the second phase implement a full screening of the households in each dwelling, following the sequential order.

4. Verify whether each dwelling is occupied. An occupied dwelling is a dwelling occupied at the time of the listing even if the occupants refuse to cooperate or a dwelling is without occupant, but with neighbours confirming the potential occupants would not be absent for a long period and would be at home at the time of the survey. The enumerators have to be sure of the occupants' absence. They should come back to the dwellings without occupant more times (usually three times) before declaring them unoccupied and/or asking confirmation to reliable neighbours.
5. Interview the head of the household or his/her substitute and fill in the listing form that contains brief questions about the general characteristics of the household, the demographic data of the head (name, surname, age, nickname for some countries, etc.), the main agricultural activities if any. These questions will allow to identify which household is also an agricultural holding.
6. Perform quality checks before sending the collected data to the Central Office: the supervisors should re-do the listing operation for a small subsample of houses/dwellings. If they find important errors, the whole EA has to be relisted.
7. Send the complete list of households and the collected information to the Central Office. In case of use of a CAPI platform, this step could be cost effective, as it could be done automatically. In this case, even the sampling process could be implemented on field to allow the enumerators start the survey immediately if the initial plan is to combine the two operations.

The Central Office then proceeds with the analysis of the data collected through the listing operation and selects the sample of agricultural holdings inside each selected EA. At this stage, the quality of the listing can be assessed by analysing the gaps between the list we got and the one coming from the nearest census.

Box 3.1. Cambodia - Listing operation conducted for the 2019 Inter-Censal Agriculture Survey

In Cambodia, the 2019 Inter-Censal Agriculture Survey (CIAS 2019) could not rely on an updated frame of agricultural holdings since the last agricultural data collection was performed in 2013. Hence, a listing operation was necessary to identify the households engaged in agriculture and their main characteristics. The CIAS 2019 is a two-stage stratified sampling design, with the Enumeration Areas (parts of villages) as PSUs and agricultural households as SSUs. The first step was to select a sample of 1350 EAs distributed among the 25 Provinces of Cambodia. They were selected through a systematic sampling with probability proportional to size that coincides with the number of households in the EA.

A listing procedure was then carried out in each of the 1350 selected EAs, based on a CAPI listing questionnaire. The screening form is given in Annex 1. The main aim of the listing was to identify the agricultural holdings in the household sector. Hence, the questionnaire contained sections on the agricultural activities of the household if any, as the cultivation of crops and the agricultural land size, the livestock breeding with the number of big/small livestock and poultry raised. The answers to these questions, together with those related to fishing and aquaculture activities, allowed to achieve the second goal of the listing procedure: the stratification of the secondary units (agricultural households) for a better coverage of specific holdings of interest in the sample (e.g. large holdings and those practicing fishing and aquaculture).

The staff for the listing procedure – the same employed for the main survey data collection - included 422 operators: 40 data supervisors, 44 field supervisors and 338 enumerators. The Cambodia National Institute of Statistics (NIS) supervised the field work and assigned to each team the EAs they had to list. Screening all the 1350 EAs took 7 full days. Each team was composed of one data supervisor, one or two field supervisors and around eight enumerators. For the areas with more dense assignments, the teams included more than eight enumerators. Around 190 EAs were listed per day by these 40 teams and around five EAs were covered per day on average by each team.

The teams were provided with the same paper maps of the assigned EAs used for the previous Cambodia Population Census. The borders of each EA were clearly identified in the maps that contained also the households present in the area. Each EA was assigned to one or two enumerators who had to move in a serpentine way starting from the north-west and assign to each household a serial number first on the map and then on CAPI. Some new households were not present on the map: the enumerators were asked to add them. If a dwelling of a household was not occupied, the rule was to come back three times during the week and ask the neighbours before declaring it unoccupied.

Before SSU stratification and the calculation of the weights, some members of NIS checked the data collected from the listing procedure. The use of *Survey Solution* CAPI application allowed performing some checks automatically.

Box 3.2. Burkina Faso - Listing operation conducted for the 2014 Permanent Agricultural Survey

In 2014, a listing operation was carried out with the aim of updating the panel sample used for the permanent agricultural survey (*Enquête Permanente Agricole, EPA*) in Burkina Faso. This annual survey is based on a two-stage stratified sampling design, with the villages as PSUs and agricultural households (considered as household holdings) as SSUs. The stratification was done at PSU level, using stratification variables from the latest survey.

The listing consisted in a complete screening of all households in each of the 886 sampled villages at national level, based on a paper listing questionnaire. The questionnaire included both variables to identify agricultural households and variables to reconstitute the strata (see Annex 1). An *ad-hoc* questionnaire to screen the dwellings was administered prior to the main questionnaire on the households listing.

At the operational level, the enumerators were the same as those used for the annual survey, and each of them was responsible for one village. The Central Office was coordinating and supervising the fieldwork together with the decentralised staff of the Ministry of Agriculture. Before the data collection, an advocating activity towards the local leaders and resources persons about the importance of the operation was done by the Central Office with the assistance of the decentralised staff.

The data was conveyed at Central Office for data entry and editing before identifying the agricultural households and sampling the SSUs. During this process, data was cleaned for more coherence and accuracy.

The main challenges encountered during this field operation were due to the administrative changes occurred in some villages since the last Population and Housing Census (PHC 2006) and the partial refusal in other villages. For the first case where the villages were subdivided in 2 or 3 villages, the solution was to do the screening in the new villages in order to reconstitute the original village as it was during the last PHC.

Box 3.3. Senegal - Listing operation conducted for the 2019 annual agricultural survey (AAS)

In 2019, DAPSA (Direction de l'Analyse, de la Prévision et des Statistiques Agricoles) which is the main Department in charge of agricultural statistics within the Ministry of agriculture in Senegal, started the process for renewing of the sampling plan of the annual agricultural survey (AAS). The objectives were first to address the obsolescence of the sample being used since 2014 and secondly to enlarge the survey's coverage by including holdings operating non-rain-fed activities such as livestock and horticulture crops that contribute significantly to the agricultural output but were not sufficiently taken into account in the previous sampling process.

The new plan was designed as a two-stages stratified sampling plan, with the first stage consisting of selecting a sample of PSUs (EAs in the case of Senegal) using a PPS selection process while the second stage consisted of a selection of SSUs (Agricultural households) through a simple random process. The sample of EAs were selected using the frame from the last population and agricultural census (RGPHAE) carried out in 2013 and the final sample of SSUs was done within the selected EAs after a complete enumeration of each of them. The data collection was carried out using a CAPI questionnaire including questions to identify the agricultural households (see the paper version in annex). A few questions were also included to identify agricultural households operating formal agricultural enterprises according to the country's definition to exclude them before sample selection.

Prior to the data collection, the enumerators were trained, and the questionnaire tested. The listing operation was performed by the enumerators using maps of the EAs provided by the National Statistical Office (NSO) to facilitate the identification of the dwellings for households' screening. The NSO also made available a team of cartographers to help the enumerators in identifying the dwellings from the maps. The enumerators were moving from one area to another area using motorcycles. The overall process was coordinated and supervised by the central team of DAPSA and extension workers.

After the data collection, the central team of DAPSA proceeded with the cleaning and selecting the sample of SSUs.

The most challenges encountered were linked to the obsolescence of some of the maps due to some changes in the field: dwellings no longer occupied or disappeared, new dwellings, fusion or dislocation of dwellings, etc. Consequent updates of the maps were made with the help of the cartographers.

c) Cost

The households listing operation may generate a significant field cost, but as explained above, it is essential for the correct implementation of the sampling plan and survey. The cost obviously depends on the size of the PSU i.e. the number of households located in each PSU. For a given EA size indeed, the number of households is usually higher in the urban context respect to the rural one. According to USAID (2008-2013), a general rule would be to have about 100 dwellings per EA. The cost depends also on the distance between dwellings, usually higher in the rural areas.

If travelling costs are high, it is possible to combine the listing procedure with the main survey into a single field operation. In this case, the survey interviews occur immediately after the listing operation and they are managed by the same team of enumerators and supervisors. Since the two working activities are substantially different, a good training to the staff is strongly recommended. Moreover, it is important to deliver the samples of households in a timely and efficient way to avoid wasting too much time in the field. A CAPI application would facilitate a quick selection of the sample from the Central Office to be assigned to the enumerators after the listing, but this requires a suitable internet connection in the field.

Box 3.4. Cambodia - Costs for the listing operation conducted for the CIAS 2019

The listing procedure for the CIAS 2019 was conducted by the same enumerators and supervisors that did the main survey data collection. Hence, they were selected and trained for both operations at the same time. The cost of the recruitment and training was around 300,000 USD. Other major costs were the wages of enumerators and supervisors, their DSA and their travel costs that amount to a total of 207,000 USD. This is actually 47 percent of the amount spent for the staff (wages, DSA and travel costs) to conduct the main survey. There were also some minor costs related to enumerators' phone cards (13,500 USD), energy for the tablet's battery, costs for specialists providing some technical services (1,960 USD), costs for the maps (3,375 USD) and for the supply of communication services (53,252 USD).

Box 3.5. Burkina Faso - Costs for the listing operation conducted for the EPA.

As stated above, the cost of a listing operation could be significant and proportional to the size of the PSU. In the case of Burkina Faso, the most part of the cost (47.9 percent) was dedicated to the field enumerators who were at the same time the personnel involved in survey data collection for the survey. That was done for practical reasons since these persons are living in or nearby the village in which they work, thus they know very well the boundaries. Another practical reason is that they could contribute to sensitize the sampled households, as they will be performing soon the survey activities. The second highest part of the cost is dedicated to training (20.7 percent) both enumerators and the supervisors. At the end, the cost related to the data editing and processing represents the third highest portion of the total cost (12.5 percent). Table 1 shows the repartition of the total cost by activities.

Table 2. Repartition of the total cost by activities for the listing procedure of the 2014 Annual Agricultural Survey in Burkina Faso

Type of activity	% of the total cost
Questionnaires printing	1.7
Communication and publicity	1.9
Enumerators recruitment	2.8
Trainings (Enumerators and supervisors)	20.7
Salaries for field workers	47.9
Field supervision by the Central Office	7.3
Coordination and management by the Central Office	3.2
Data capturing	1.5
Data editing and processing	12.5
Materials	0.5

Source: the authors from exchanges with the country, 2020.

Box 3.6. Senegal - Costs of the listing operation conducted for the 2019 annual agricultural survey (AAS)

The table below shows the distribution of the total budget of the listing operation (about USD 150 000) into different costs categories.

Table 3. Budget distribution by cost categories for the listing operation conducted for the 2019 AAS in Senegal

Cost categories	% of the total cost
Maps printing	10%
Communication	1%
Trainings (Enumerators and supervisors)	26%
Remuneration of field workers	54%
Fees for motorcycles	8%
Materials	1%
Total	100%

Source: the authors from exchanges with the country, 2020.

3. Content of the households' listing questionnaire

The questionnaire for the household listing procedure should not be too long. Questions to be considered in the listing can be classified in two categories:

- **Basic items:** these are basic questions about the location of the dwelling, the characteristics and main activities of the household, the name/surname of its head and some of his/her demographic information. These items are required to identify the agricultural households and to be able to locate after the listing the sampled ones for the main survey.
- **Optional items for stratification and quality control:** these are questions generally on agricultural assets used for quality control and/or an implicit stratification.

The respondent should be the head of the household. If he/she is absent, another member who knows the needed information may respond. The following paragraphs describe generic contents of a typical households listing questionnaire designed for an agricultural survey.

Some country example of households listing questionnaires for agricultural surveys are given in Annex 1.

a) Basic items

▪ **Questions on geographic information of the household.**

This section should contain all the questions regarding the needed information to localize the households, such as:

1. The Municipality/Province (Full name or code)
2. The District (Full name or code)
3. The Commune (Full name or code)
4. The Village (Full name or code)
5. The Enumeration Area (Full name or code)

These points can vary according to the administrative geography of the country; they should allow localizing univocally the household. The questionnaire can also include a part where the enumerator has to draw a sketch map of the household (crops, natural/artificial borders, neighbours) or has to record the geographical coordinates if a GPS system is provided.

▪ **General questions about the household, the head of the household and the holder.**

This section includes general questions about the household, the head of the household and the holder if he/she is different from the head. In agricultural households, the holder (civil person, group of civil persons or juridical person) is the person economically responsible for the agricultural production, whereas the head of the household is the person acknowledged as such by members of the household and who is usually responsible for the upkeep and maintenance of the household. The questions cover:

1. General characteristics of the household:
 - Serial Number (associated usually by the Central Office or by CAPI tool),
 - address of the household (house number and street name),
 - number of members of the household (not away from the households for more than 6 months).
2. Head of the household:
 - family name and first name,
 - age (years),
 - sex,
 - mobile phone number and e-mail address,
 - primary occupation (farmer, farm hand, fishing, agro-processing, trader, artisan, student, none, other).
3. Holder of the holding (if different from the head):
 - family name and first name,
 - age (years),
 - sex,

- mobile phone number and e-mail address,
- primary occupation (farmer, farm hand, fishing, agro-processing, trader, artisan, student, none, other).

The household dwelling where the holder resides allows to link each holding with one and only one PSU and with the associated probability of inclusion. Hence, in order to list all the agricultural holdings inside the selected PSU, interviewing the households allows linking the geographical area with the holdings. Indeed, if the holder does not live in his holding, it is easier to find him by way of his housing unit than by way of his holding. This means that in the sampled PSU there can be holdings that are not listed if the holder lives in another PSU. They would be included in the sampling frame for the PSU in which the holder lives. Thus, they will have their proper probability of inclusion in the sample.

- **Questions to identify agricultural holdings in the household sector.**

The aim of the listing operation is to build a frame of agricultural holdings in the household sector. In this sector, the agricultural holdings are operated by one or more households engaged in own-account agricultural production. They are called in some countries “agricultural households”.

In some countries, a threshold (minimum size limit) is adopted for defining the holdings (such as the area of agricultural land operated and number of livestock raised, by main types). If the country is using a threshold in the holdings’ definition, this should be taken into account.

The following two basic questions could help for the identification of agricultural households:

- Does any member of the household grow any crop of any kind for own account in the [reference period]?
- Does any member of the household keep any livestock (including poultry) for own account in the [reference period]?

If there is any threshold in the definition of agricultural holding, information on land size and/or livestock number are required:

- How much agricultural area does the household operate in the [reference period]? Or: what is the area of land (or number of plots) used for agricultural production purposes in the [reference period]?
- How many [livestock type] does the household currently keep?

The latter question should be asked for each livestock type.

Example of threshold: Nepal National Sample Census of Agriculture 2011/2012

- having area under crops greater than or equal to a quarter of a ropani (or four anna) in the hill or mountain district (0.01272 hectares), or greater than or equal to eight dhur (0.01355 hectares) in the Terai; or
- keeping one or more head of cattle or buffaloes; or
- keeping five or more head of sheep or goats; or
- keeping 20 or more poultry.

In addition, if the definition of holdings of the non-household sector in the country suggests that some of these holdings may be operated by households, relevant questions could be added to listing questionnaire for their identification.

Example of Senegal

In Senegal, some additional questions were included in this section to delimit the listing coverage to only informal households' sector. This delimitation is done to avoid including in the agricultural households frame some holdings which are managed by households but ruled as "modern farms". For this purpose, the two following criteria, referring to the general definition of modern firms in Senegal, are used (see Annex 1 for more details):

- the formal registration of the activity;
- the existence of a modern system of accounting.

As mentioned in the WCA 2020, there is usually a one-to-one correspondence between an agricultural household and an agricultural holding. In other words, all the own-account agricultural production activities managed by members of a given agricultural household are usually undertaken under single management. It is unusual that different household members operate agricultural land or livestock completely independently, rather they pool together the income derived from these activities. It is also unusual for household members to operate land or livestock as a single unit, but to have independent household budgets out of the control of the head of the household. If this happens, there are broadly two cases where the agricultural holding and agricultural household concepts may diverge: (i) a household may operate land or keep livestock jointly with another household or group of households and (ii) the members of the same household are operating different holdings. The former case is very rare in practice and when it happens it is advisable to consider all holdings managed by household members as a single holdings to avoid critical confusions in the field.

If in the country it is common for households to operate farms in partnership, these questions could help to identify uniquely the agricultural holdings in the EA:

- Does the household operate land or keep livestock:
 - a) independently
 - b) jointly with another household or group of households?
- If the answer is b, how many households?
- Please provide the name of the heads of these households as other ID info to clearly identify all joint holders (address, etc.).

The name of the head of household is just indicative. The aim of this question is to collect information that will allow identifying these households in the frame after the listing. The name of the head of household may not be enough in some contexts.

b) Optional items

Few optional items could be added in the listing form for some purposes including quality control and implicit stratification (i.e. ordering the statistical units by some criteria and performing a systematic sampling).

- **Basic questions about the agricultural activities of the household.**

This section focuses on the agricultural activities of the households and includes basic questions about cultivated crops and livestock, if any. Key aspects to investigate are:

1. The main purpose of agricultural production (mainly for own final use or for sale).
2. The cultivation by the household of temporary crops (cereals, vegetable, root/tubers, leguminous crops, etc.) in the last 12 months (or any other reference period).
3. The cultivation by the household of permanent crops (cocoa, coffee, cashew, fruits, etc.) in the last 12 months (or any other reference period).
4. The number of parcels or their planted area in hectares (inside and outside the selected PSU). It is important to specify if the number or the area of parcels refer only to crop land or to general land used for agricultural purposes including livestock.
5. The number of bovine animals, sheep and goats or number of large livestock (buffalo, horses, cattle), small livestock (goats, pigs, etc.), poultry (chicken, ducks etc.) raised.

- **Basic questions on other activities managed by the household.**

It can be helpful to know if some households also practice aquaculture, capture fisheries, forestry or other activities. A good example of a questions to be included in this section are the numbers Q10 and Q11 of the Cambodia listing questionnaire presented in Annex 1:

Q10. In the last 12 months, did you or any members of your household engage in capture fishing on their own account?

- Yes
- No

Q11. In the last 12 months, did you or any members of your household engage in aquaculture on their own account?

- Yes
- No

This section can be useful to add layers for stratification in case we are interested in a stratified random sampling for the household selection. Layers for stratification can be the household size in terms of members and/or agricultural extension, the type of crops cultivated, the number and the type of livestock, the presence of related activities as fishing and aquaculture.

The structure of the questionnaire is not fixed, some sections can be mixed, some questions may be deleted and other added, as we can see from the examples included in Annex 1. The structure and the content of the questionnaire depends on the aim of the survey and on the aim of the listing operation that can be conducted even to update or create frames for multiple surveys. In this case, the questionnaire should be more complete and varied, keeping in mind that the interview has to be limited in time.

Table 4. Generic structure of the screening questionnaire for the listing operation of agricultural holdings in the household sector

BASIC QUESTIONS								OPTIONAL QUESTIONS						
Household Identification variables	Household head	Holding identification questions					Holder (if different from household head)	Additional questions on agricultural activities of the household				Questions on other activities managed by the household		
region, province, ..., household serial number	Socio-demographic questions (name, age, sex, primary occupation etc.)	Grown any crop of any kind in the last year?	Keeping any livestock or poultry?	land size (if required)	number of livestock by type (if required)	Partnership with other households/number of holdings (if required)	Socio-demographic questions (name, age, sex, primary occupation etc.)	temporary crops?	permanent crops?	number of parcels?	number of livestock?	Fishery?	Aquaculture?	Forestry?

Source: Author's own elaboration, 2020.

B. Listing tracts/plots in segments when using area frame

1. Overview of area frame survey

The survey approach with an area frame is different from that used with a list frame as the units of an area frame are directly bound to a geographical area. With an area frame, units can be pieces of territory, which are often named segments. Segments can be either delimited by natural or physical elements, such as roads, rivers or permanent field boundaries or defined with reference to a regular grid (which is often square) in the selected cartographic projection (FAO, 2015b).

To prepare an area frame, the first requirement is the availability of up-to-date cartographic material (maps, satellite images, aerial photos) covering *all* the land to be included in the frame. The resolution or detail of the material must be sufficient to allow a stratification according to the proportion of land cultivated, the predominance of certain crops or other uses of land, etc., and the subsequent subdivision of these land-use *strata* into primary sampling units (PSUs) – if a two stage sampling is used - which should have also recognizable permanent physical boundaries. Six to ten land-use strata is the normal range constructed by using satellite images (if available), aerial/ortho photographs and maps. PSUs are usually constructed on photography and/or satellite images that show the boundaries of the strata. They are transferred to maps for measurement. Each PSU must be measured and assigned a target number of segments. The number of segments assigned to each PSU are summed to provide the total number of segments in each stratum and summed again to provide the total of segments in the frame. Then a two-stage probability sample of segments is selected from each stratum using for example a replicated selection procedure. Each sample segment is constructed on small mosaics of aerial photography on

which the boundary of the corresponding PSU have been transferred. Finally, the selected sample segments are located on aerial photo enlargements used to control field data collection.

Area sample surveys usually involve a single-stage or a two-stage sampling design. With a two-stage sampling scheme, a complete list of plots or tracts¹¹ in the selected segments is required for sampling purposes. An update cadastral register with geo-references of plots could be used but such register is not available in most countries especially in rural areas. A listing operation is therefore required. Each segment receives a probability of selection according to the chosen sampling scheme. The values of the variables that are to be estimated have to be known/collected in each sampled segment. In order to collect the information at segment level, there are two different methods depending on the units of observation that can be the tracts or the agricultural holdings within each segment (FAO, 1996). Details are given below.

i. Data Collection for the Tract as Reporting Unit

The information relative to the segment is collected through all the tracts it contains. The tract, or better, the operator of the tract, is the reporting unit. In this case, the closed segment estimation method is usually adopted. According to this method, the value of a variable in a segment is simply the sum of its values in each of the tracts inside the segment. If part of the tract is located outside the segment, the entire tract is excluded from data collection and calculation.

In order to identify the tracts and their operators within each segment, a listing operation can be necessary. Details are given in Paragraph Section 2 and an example of listing operation conducted in Rwanda for the Seasonal Agricultural Survey (SAS) is shown in Section 3.

The closed segment is the common method to estimate planted crop areas. With regard to information on livestock, the closed segment method is only appropriate for those livestock controlled in pastures and/or corrals within the boundaries of the segment at the time of the enumeration. For estimating livestock that can roam outside the segment, the closed segment method should not be used.

ii. Data Collection for the Holding as Reporting Unit

A common practice is to collect the information at segment level through the agricultural holdings located inside the segment. Establishing the criteria to identify and localize the agricultural holdings is a fundamental step in agricultural surveys. When the holding is the reporting unit, the open segment estimation method and the weighted segment estimation method are usually adopted.

According to the weighted segment method, data is collected for the entire holding associated with any land area in the sample segment. The data collected from each holding is then weighted by the proportion derived by dividing the area of the holding that is within the segment by the entire area of the holding (both inside and outside the segment).

The effect of this method is that data for each holding is prorated among the segments in which it is located. For instance, if ten percent of a holding's area is in the segment, ten percent of the total holding data recorded on the questionnaire will be assigned to the segment and thus to the

¹¹ A Tract is the total land operated by one operator in the segment. It can be composed of one or more fields or plots adjacent to each other or located in different places across the segment.

summarization process. The weighted segment estimator can be used for all survey variables, since the holding is the reporting unit required.

Open segment estimators were the first type of estimators utilized in area sampling, and are still used in some countries. The open segment method (or holding headquarters method) associates a segment to all holdings with headquarters included in the segment. For this purpose, clear rules have to be established to define a unique reference point for each holding, called the headquarters. There are several ways to do this, but the most common procedure is to define the headquarters as the dwelling (residence) of the holder. Details are given in Section 2 that shows the procedure to identify and list the holdings in a segment. An example is given in Section 3.

2. Operational procedures for listing agricultural holdings or tracts in a segment

The aim of a listing operation when using an area frame is to localize and identify all the agricultural holdings or tracts inside each sampled segment. It often happens that once the agricultural holding or tract is identified, the enumerator proceeds directly with the main interview. In this case the listing operation and the main data collection are not two separated operations, but they occur simultaneously. Indeed, an area sampling scheme usually implies that the information on the sampled segments is collected through all the observational units located inside them. The need to provide a list of observational units before the main data collection arises when a sample of reporting units has to be selected in each segment or when a recent frame of agricultural holdings or tracts does not exist and, consequently, it is not possible to evaluate some properties of the segments like the portion of cultivated land or the number of reporting units. These pieces of information are fundamental to stratify the segments before the sample selection and to equally split the fieldwork. Indeed, before starting the data collection, the fieldwork is organized in such a way that each team of enumerators receive the same amount of work in terms of reporting units to interview and distance to cover. Several teams of enumerators and supervisors are responsible of the listing operation and the main data collection. A listing procedure can also facilitate the main data collection where the enumerators can directly receive the list of the interviewees and their address. The operational procedures for the listing operation in area frame are described below.

Before the field operation

Before starting the fieldwork the supervisors or the coordinators of each geographical zone split the work among enumerators. It is possible that one sample segment is divided in more parts according to the number of observational units it contains (if this information is known). In this way, each part is equivalent in terms of workload and can be associated to an equal group of enumerators (usually two enumerators per group). The cartographic material may be already ready at this stage because it could be used for the selection of the sampled segments. Particularly, it's important to have a map of the geographical zone where the segment is located and a map of the segment where the main points of reference (schools, hospitals, big roads, churches etc.) and the boundaries are highlighted. In addition, it is recommended to have tracts on the segment map, in case of a follow up visit (second, or third visit). Before going to the field, this material has to be given to the enumerators if PAPI is used or uploaded on the tablet if CAPI is

used. Several applications can be used to handle the cartographic material on the tablet, like, for instance, the Oruxmaps or ArcGIS applications (see example in Paragraphs 2.2.1.1. and 2.2.1.2.).

Before going to the field the enumerators have to be sure that they have all the necessary material (e.g. tablet if provided, applications and maps uploaded on the tablet, supplementary charged battery, paper maps if the cartographic material is not digital, manual for instructions, a GPS receiver etc.) and that they have carefully understood the instructions given during the training.

On the field

When the enumerators are on the field they have first to identify the segment assigned to each of them. This can be done through a paper map of the geographical zone where the segment is located or through a digital map and a GPS if provided.

Once the enumerator has identified and reached the segment, he/she usually conducts an exploratory tour of the segment in order to find the most efficient route to cover all tracts in the segment.

We can distinguish two cases according to the level of information that has been provided at segment level. If a recent census has been conducted and the cartographic material is updated, the enumerator can have access to names and locations of all the reporting units of the segment. So, he/she knows exactly where to go to collect the information of each observational unit, which can be an agricultural holding or a tract. He/she has to communicate to the supervisor and update the list only if he/she finds tracts or agricultural holdings that are not on the list provided or if he/she does not find a structure mentioned in the list. In this case, the listing operation is easier and can be conducted simultaneously with the main survey. The enumerator can be asked to measure the perimeters of the new tract or the parcels of the new holdings, computing also the portion that is outside the segment. This can be done directly on the photomap using for instance the ArcGIS or Oruxmaps applications and a GPS receiver. If an agricultural holding has parcels far from the segment or located in another part of the segment, it should be noted.

However, it can happen that not precise information has been provided on the reporting units within the segment, so the enumerator has to list all the agricultural holdings or tracts starting from north-west and proceeding with the closest structure, as follows:

1. Localize the tract and try to find the operator of the tract or the holder (if the agricultural holding is the reporting unit). A local officer can support the enumerator in this phase. Ask to the holder/operator of the on-going interview where to find the holders/operators of the three neighbouring holdings/tracts. If the agricultural holding is the observational units and the holder is impossible to find, the manager can be interviewed. Before interviewing a family member or a neighbour, try to find out when the holder or the manager will come back. In general, if nobody at the holding/tract is present and the neighbours are not present or don't know anything, come back at least three times before declaring the tract/holding without operator, holder, manager.
2. Assign a consecutive number to the tract (and/or to the holding) and write down its GPS coordinates. In case the holding is the observational unit it is important to localize the headquarters of the holding that can be the residence of the holder, the entrance gate or the location of the main offices if it is a commercial farm. Indeed, the enumerator should be asked to track all the agricultural holdings, both in the household and in the non-household sector. Sometimes a list of the commercial farms or big farms is given to the enumerator who has to locate them on the field and ask the main information.

3. Measure the perimeter of the tract or of the holding. This can be done directly on the photomap, using special applications as Oruxmap and a GPS receiver.
4. Ask to the tract's operator or to the holder the questions of the screening form and/or start directly with the main interview. The screening form can contain questions about the socio/demographic status of the holder/operator and the main characteristics of the agricultural holding (total agricultural size, number of plots, crop types, presence of fishery, aquaculture and forestry activities, etc.) or the main characteristics of the tract (total size, land use, size of each plot in the tract, types of crop cultivated, etc.). An example of the content of a screening questionnaire is given in Paragraph 2.2.1.1.
5. If a holder/ tract's operator has another agricultural holding or tract (even out of the segment) assign to it the consecutive number, write down the location on the screening form and start another questionnaire.
6. If an area of the segment is particularly difficult to access ask to a local person if there are agricultural holdings or tracts there. Usually it's possible to visualize them also on the map.
7. Complete the identification and the list of all the observational units in the segment before passing to the next segment.
8. Send to the supervisor the data collected in the segment. A CAPI system facilitates this passage. The supervisor should perform quality checks before sending everything to the central office. The central office and the cartographic experts also perform quality checks and can send the enumerators back to the segment if they find errors and inconsistencies in the measures and in the collected data.

Examples of listing in area sampling are given in the Paragraphs 2.2.1.1. and 2.2.1.2. The former is an example of listing of tracts, the latter is an example of listing of tracts and agricultural holdings.

C. Listing non-household holdings and special farms

One recommended strategy to build a master sampling frame on agricultural holdings is to combine two list frames: one from the household holdings and another one from the non-household holdings. While the first frame can be easily built from agricultural or population census, the second one is usually developed from administrative sources and/or a comprehensive listing procedure in case the agricultural census does not cover this scope.

As previously discussed, countries are often interested in special farms (large, commercial, specialized...). These farms can be in both household sector and non-household sector. The coverage of special farms in the agricultural surveys requires a complete list of these farms. The strategy for building a list of special farms is similar to the one for non-household holdings. In many cases, most of the non-household households would be eligible in the list of special farms given the criteria used for their definition (land size, sales, specialization...).

The most cost-effective way to develop a complete list of non-household holdings and special farms is to consider carefully these holdings in the census of agriculture. Methodological approaches for listing agricultural holdings in a census of agricultural are fully covered by FAO (2015a) and are not in the scope this document.

This section aims at describing the milestones of operational procedures for developing lists of non-household and special farms in the case they are not already included in a recent agricultural census. Even

if a country conducts regular agricultural censuses (that according to the WCA are recommended to be carried out every ten years), the list of the holdings in the non-household sector (as well as of special farms) should be updated regularly, based on administrative data sources and current statistical surveys. Two activities are usually undertaken: (i) constitution of a preliminary list from identified administrative data sources and (ii) carrying out of a complementary data collection from the primary list to build the frame.

1. Building a preliminary list from various administrative data sources

The first step after the units of interest are well defined is to identify the potential sources from which the primary list will build on. The following administrative sources could be considered:

- Registers hold by the central Government and its agencies (such as administrative registers of the ministry in charge of agriculture, national business register or ad-hoc administrative registers of corporations operating agricultural holdings (business registration/licensing registers), Tax register, land registration/cadastral records, farm registers if any etc.);
- Registers hold by local governments;¹²
- Registers from farmers' associations or special commodity boards (for coffee, cocoa, tea etc.), agricultural cooperatives, , other non-governmental data sources like the chambers of agriculture in some countries;
- Farm registers (the statistical farm registers are updated regularly based on the available data sources);
- Local knowledge and information from extension agents and local authorities about large specialty-type farms.

Once these sources are identified and basic lists are gathered from them, a desk review should be carried out to end up with a unique list that is as most coherent, exhaustive and exclusive as possible. It is common that the different lists do not have a common key for deterministic linkage. When combining lists from separate sources, caution must be taken, to avoid adding duplicates to the subsequent combined list. Depending on the size of the lists, the deduplication can be done "manually" in artisanal way comparing records. If the list are large, statistical record linkage technics should be applied. More operational information on linking administrative data can be found in FAO (2018c).

However, because data bases from the administrative sources are not usually built for statistical purposes, they may not provide a full coverage of all holdings of interest. Therefore, it is important to carry out a more detailed listing operation based on the primary list obtained from these sources, to end up with a statistical frame.

2. Building a sampling frame

This second step consists of administering a light questionnaire to the units identified from the first step with the aim at collecting more information on statistical variables for further frame building. This field activity is generally an in-situ interview with the respondents, or a self-interview in case a face-to-face appointment is difficult to obtain.

¹² Depending on national legislation, some tasks related to the registration of some businesses/ institutional units could be delegated to local governments, etc.

a) *Content of the light listing questionnaire*

While there is no need of a specific data collection tool for the first step described above, a light questionnaire, together with a user's manual, should be drawn to carry out the second step that implies a collection of more specific data on the agricultural activities of the unit.

To meet the objective of building a sampling frame, it is important to include in the questionnaire some questions that could be used for stratification purposes. Furthermore, some relevant questions (for ex. legal status) are required to identify the overlapping units with a frame of agricultural holdings in the household-sector. At the end, to facilitate the linkage of the two frames, the identification variables in the questionnaire must be as possible the same as ones used in the household frame.

The proposed light questionnaire, broadly based on AGRIS Core module, is structured as follows.

Table 5. Structure of the light questionnaire

Section	Content	Comment
Identification of the holding	ID code	<i>To be set up during the constitution of the preliminary list</i>
	Name/Surname of the holder/Business name of the holding	
	Legal status	
	Number of establishments	<i>if applicable according to the recommendation of WCA</i>
	Geographic identification: region, district, town, enumeration area, legal address, phone number, type of address (plot, house, agricultural building)	
	GPS Coordinates	
	Name, sex and type of respondent (holder, co-holder, manager, employee, other)	
	Official identification number of the holding in the national business register (<i>if any</i>)	
Agricultural activities of the holding	Holding's main agricultural focus for the reference period, from an economic perspective <ul style="list-style-type: none"> • Mainly crop production • Mainly livestock production • A mix of crop and livestock production 	
	Holding's main intended destination of its agricultural production? <ul style="list-style-type: none"> • Producing primarily for sale (selling 90% or more) • Producing mainly for sale, with some own consumption (selling more than 50% and up to 90%) • Producing mainly for own consumption, with some sales (selling more than 10% and up to 50%) • Producing primarily for own consumption (selling 10% or less) 	
Crop productions	Number of parcels used for agricultural production (for crops and livestock) during the reference period	
	List of temporary crops produced on the holding during the reference period	<i>to be customized to the context of the country</i>
	List of permanent crops produced on the holding during the reference period	<i>to be customized to the context of the country</i>
	Total area planted for the temporary crops during the reference period	<i>All types of temporary crops</i>
	Total area planted for the permanent crops during the reference period	<i>All types of permanent crops</i>
Livestock	Number of large ruminants (raised on the holding as of today)	<i>Bovine and cattle (cows, buffalo, zebu, etc.)</i>

Section	Content	Comment
	Number of small ruminants (raised on the holding as of today)	<i>Ovines and caprines (sheep, goats, etc)</i>
	Number of pigs raised on the holding as of today	
	Number of poultry raised on the holding as of today	
	Number of other animals raised on the holding as of today	

Source: Author's own elaboration, 2020.

Some countries may have a strong interest in some special farms (e.g. farms implementing specialized agricultural activities). In such cases, additional questions may be required depending on the criteria adopted for the definition of these farms. For instance the following questions on special agricultural activities may be considered.

Table 6. Additional items for the light questionnaire for special farms

Agricultural activities of the holding	Holding's main cropping activity, from an economic perspective <ul style="list-style-type: none"> • Production of annual field crops (cereals, oilseeds, protein crops, root crops, tobacco, cotton, etc.) • Production of vegetables, mushrooms, flowers, ornamental plants, etc. • Production of grapes for wine • Production of fruits • Production of other perennial crops (cacao, coffee, etc.) Mixed cropping (no real prevalence of a specific crop activity)
	Holding's main livestock activity, from an economic perspective <ul style="list-style-type: none"> • Raising ruminant livestock for meat (cattle, sheep, goats, etc.) • Raising non-ruminant livestock for meat (pigs, poultry, etc.) • Production of eggs • Production of milk Mixed livestock (no real prevalence of a specific livestock activity)

Source: Author's own elaboration, 2020.

b) Organization of the field work

Before going to the field, the questionnaire should be designed, discussed and endorsed by the institution in charge of the survey operation. Depending on the country's strategy for the field work, a training of trainers and/or a training of enumerators will be carried out. One interesting option, if feasible, is to use the extension workers as enumerators. Advantages of that option include the fact that extension officers have generally a good knowledge of the non-household holdings and special farms in their local administrative areas and given their position they can easily get in touch with holders of those farms. This approach was successfully experimented in Senegal.

A work plan should be established to ease the follow-up of the field work and to get feedback from the field on a regular basis.

c) Data processing

This step is as important as it should end up with a most comprehensive as possible and a coherent frame of non-households and special farms to complement the household sector. Hence, the data processing should be carried out keeping in mind the possibility of overlapping with the frame of household holdings if any. It is therefore crucial to use as possible the same identification variables in the two frames in order to identify overlapping units to be considered in the estimation phase (see Section V).

A special attention should be also paid to the cleaning of the variables that could be potentially used for further stratification (types of agricultural activities, area cultivated by type of crops, number of animals raised, etc.).

3. Countries examples

Experiences of some countries having developed a list of non-household/special holdings are described in the box below.

Brazil

The 2017 Agricultural Census of Brazil adopted a special survey operation of special farms (see annex 1 for more details). A preliminary list of special farms was developed from the register of the 2006 Agricultural Census. That list was updated with data from the following administrative data sources:

- RAIS - Annual List of Social Information (formal enterprises), from Ministry of Labour
- CEMPRE - Central Register of Companies, maintained by IBGE
- CNEFE - National Address Register for Statistical Purposes, maintained by IBGE

The records from these registers were merged through record linkage techniques and units that declared agricultural activities were selected. Later the list of those selected units was merged with preliminary list to develop a final that was processed and validated before data collection.

Burkina Faso

During the 2016 census of agriculture in Burkina Faso, a special listing operation was implemented to develop a list of all “modern farms” in the country. The definition of “modern farms” combines size criteria, hiring of permanent employees and purpose of production (see annex 1 for more details).

Preliminary lists were developed from registers of the regional departments of the ministry in charge of agriculture. These registers already contain basic information on the farms including agricultural area, production, speculations produced and place of sale, varieties produced by arboriculture farms, the turnover for those who agree to give information and telephone contact. The lists were provided to enumerators to get in touch with the farms in the field and collect additional information. Other modern farms non-registered were identified with the support of the extension officers and covered by the listing operation.

The main difficulties encountered in the field were: (i) the reluctance of the farm managers to provide information in absence of the owner and (ii) the ambiguity of some criteria of the definition of modern farms that made that complicated the identification of some of them in the field.

Cambodia

The National Institute of Statistics (NIS) of the Ministry of Planning of Cambodia conducted the Cambodia Inter-Censal Agricultural Survey (CIAS) in 2019. To improve the coverage of agricultural production in Cambodia, the CIAS 2019 consisted of a survey of households and a survey of Large Agricultural Operations that are special farms with specific characteristics (see annex 1 for more details).

The list of large agricultural operations in the country for developed from five administrative sources from the Ministry of Agriculture, Forestry and Fisheries (farms with more than 100 ha land, large livestock farms, large aquaculture operations, Council for Development of Cambodia (large-scale plantations) and the Cambodia National Institute of Statistics (Juridical Agricultural Holdings).

Georgia

The National Statistics Office of Georgia (Geostat) consider two types of agricultural holdings: family holdings (household sector) and agricultural enterprises (non-household sector).

The frame of non- agricultural enterprises relies on a unique administrative source which is namely the Statistical Business Register (SBR), obtained from National Agency of Public register and Tax office. Therefore, there is no specific listing strategy but regular updates are made to keep this database up-to-date.

Nepal

In Nepal, the 2019 Pilot Agricultural Integrated Survey (AGRISurvey) covered both households' holdings and commercial farms which include registered farms in the national business register and informal business from registers of farmers' organizations. To develop the list of commercial farms, a preliminary of farms officially listed in the 2018 Nepal Economic Census was considered. This list was complemented by lists from registers of farmers' organization and lists from previous *ad-hoc* commercial surveys conducted by the Central bureau of statistics: Commercial poultry survey, 2015; Commercial floriculture survey, 2016; Commercial tea survey, 2017; Commercial coffee survey 2018.

The final list was updated using secondary data obtained from government entity like agriculture development offices at local levels, key informant's observations, published reports etc. through a field operation with the support of extension officers.

Senegal

In Senegal, in the framework of the renewal of the sample of the 2019 annual agricultural survey (AAS), it was decided to cover some special farms that include farms officially registered in national business register, informal business farms from various registers (farmers organizations, cooperatives...), "modern farms" characterized by modern facilities and large farms (more than ten ha) owned by religious leaders (marabouts). A preliminary list was established from the administrative sources and a field work is organized to update and developed a final list of special farms in the country.

4. Main challenges and recommendations

According to countries examples described above, the main challenge is the proper identification of borders between household and non-household sectors. This issue is largely discussed in the Section I and the recommendations made at the end of this section could help countries to better deal with this though matter.

As for the operational aspects of the listing strategy to build the frame for non-household sector, the challenge in conducting such a listing operation is to establish as much as possible a comprehensive and coherent primary list of holdings, coming from multiple sources. Then during the field work the constraint of localization of these units due to the obsolescence of some of the registers used also requires special attention.

Furthermore, another challenge could be the low response rate as linked to the difficulty to conduct a face-to-face interview with the respondents.

Both these challenges could lead to an under-coverage of the scope of the frame.

Some field recommendations are as follows:

- Establish a simple and easy approach to understand/practical definition of the units of interest, based on the registration or legal status criteria;
- Use as much as possible alternative ways to localize the units: google search, neighborhood, etc...;
- Plan enough time and explore suitable strategies to get an appointment before going to the field;
- Use self-interview, telephone or email where feasible.

4. Interview strategies for non-household holding and special farms

In many developing countries face-to-face interviewing is still used to collect survey data from both the non-household and household holdings, i.e.: Computer-assisted Personal Interviewing (CAPI) and Paper and Pen Interviewing (PAPI). However, the traditional PAPI method is increasingly being replaced by the use of electronic data collection. For instance, in Nepal and Cambodia, CAPI questionnaires were used in 2019 for face-to-face interviews of non-household holdings and special farms. However, for this category of holdings, alternative emerging data collection approaches can be explored. This section discusses data collection methods and special arrangements for agricultural surveys interviews non-household, large and other special holdings.

A. Data collection methods

Legal units, as well as other non-household, large and other special holdings commonly:

- Keep records (bookkeeping) of production and sells of commodities, income, expenditures, etc., as required by the national legislation. Many such kind of holdings have dedicated personnel for bookkeeping purposes. This facilitates reporting the data required by tax, statistical and other state agencies;
- Are used to provide financial and statistical returns on a regular basis;
- Are increasingly using new technology to keep records and provide the statistical and financial returns.

As a result, this yields more accurate and comprehensive statistical data from such holdings. Often these are covered in the surveys using remote data collection, which does not require interviewers to meet respondents in person when conducting a survey especially, such as:

- Self-interviewing using paper-based questionnaires;
- Computer-assisted self-interviewing (CASI) or computer-assisted web interviewing (CAWI) with online electronic questionnaire;
- Telephone interviewing.

These methods are discussed in detail in the WCA 2020 and are briefly presented below.¹³

Self-interviewing using paper-based questionnaires includes:

1) Drop-off/mail-back (DO-MB) or pick-up by interviewer (DO-PKI)

In the case of DO-MB, the interviewers receive from the National Statistical Office (NSO) or other institution conducting the survey (such as the Ministry of Agriculture, MoA) the paper questionnaires and instructions. The interviewers deliver the questionnaire to the respondent's residence with instructions on how to complete the questionnaire and how to mail it back once completed (e.g. in an enclosed postage-paid envelope). In case of DO-PKI, the questionnaire filled in by the respondents will be collected by the interviewer at a later date.

¹³ For more details see WCA 2020, vol. 2 (FAO, 2018).

The interviewers follow up with respondents who have not returned their questionnaire after the collection deadline (in case of **DO-MB**) and verify the filled in questionnaires (in case of DO-PKI). They can also assist respondents in completing the questionnaire.

2) Mail-out/mail-back (MO-MB)

In this case the NSO or other institution conducting the survey (such as the MoA) mails paper-based questionnaires directly to respondents with instructions on how to complete the questionnaire and how to mail it back once it is filled out (usually in an enclosed postage-paid envelope). The completed questionnaires are mailed back to the NSO/MoA.

CASI/CAWI (online electronic questionnaire)

In case of CASI/CAWI, respondents receive a letter from the NSO/MoA with instructions on how to access the Web (online) questionnaires with their secure access code, how to complete it and with an online phone number to call for help if needed. A wave methodology can be developed to mail reminders to respondents to complete the Web questionnaire before the established deadlines. CASI/CAWI is increasingly used by many countries, contributing to the improvement of the data quality (as the verification of questionnaires for completeness and editing errors are built into the electronic questionnaires) and reduction of costs for data collection and processing as to the decrease of the response burden.

Telephone interviewing includes:

- Paper-based (or assisted) telephone interviewing (PATI)
- Computer-assisted telephone interviewing (CATI).

Prior to the PATI/PAPI interview, respondents receive a notice letter and paper-based questionnaire with instructions on how to complete the questionnaire. This will help respondents to prepare prior to the phone interview. The time of the interview should be agreed with the respondent in advance. During phone interviews, interviewers write the data on paper-based questionnaires or capture the information directly into an electronic questionnaire.

In a number of countries, a combination of self-interviewing methods are used, such as CASI/CAWI, MO-MB and/or CAPI/PATI. In addition, respondents might be contacted by phone to collect data from the units that did not provide the reports on time, or to clarify the quality issues related to the questionnaires submitted by respondents.

B. Country examples

Some country examples on the methods of remote data collection from the holdings operated by legal entities and special holdings used in agricultural surveys are presented below.

Brazil

In Brazil, during the 2017 Agricultural Census, a mix mode of data collection was adopted for special farms (see their definition in annex2): face to face and web survey. The option of completing the questionnaire via internet was of great value for establishments where it is necessary to consult several documents in order to provide the required information.

If a respondent chooses to fill the questionnaire via the internet, he will receive an access code, by email, and will have a predetermined deadline to answer the questionnaire. If he does not respond within the scheduled deadline or responds in an incomplete manner, the enumerator must get in touch with him for a face to face interview to administer the full questionnaire or to complete it.

Georgia

In the case of legal entities, the survey of agricultural holdings is conducted using web-based data collection (CAWI). National Statistics Office of Georgia (Geostat) started using CAWI in 2012. The Implementation of CAWI method significantly improved the accuracy and timeliness of survey data, as well as reduced the cost of data collection and processing.

Two days before the start of a new round of data collection, the legal entities selected in the sample are informed via e-mail about their participation in the survey. A statistician (supervisor) from Geostat is assigned to supervise the data collection from the agricultural enterprises. Supervisor's function is to consult agricultural enterprises on methodological and technical issues related to the survey. The staff from the head office of Geostat exercise control and monitor the filling in the questionnaires online and, if necessary give instructions to supervisors and enterprises.

Survey data from other agricultural holdings (non- legal entities) are collected through face-to-face interview using the CAPI method.

Kazakhstan

The data collection from agricultural enterprises (legal entities) and large farms (with more than 100 employees) is conducted using complete enumeration and self-interviewing methods: paper questionnaires and CAWI, according to respondent's preference. CAWI method is increasingly used in the data collection by the Committee of Statistics (CS) of Kazakhstan, that is in charge of agricultural statistics surveys. Currently, the share of legal entities and large farms providing data using CAWI for some surveys is 60 percent.

The personnel from the territorial offices of the NSI/MoA is responsible for data collection, as well as for checking and editing the data. In case of any questions, respondents are contacted by telephone for clarification.

PAPI method is applied for the data collection from other agricultural holdings, using sample surveys.

C. Some recommendations

Special arrangements need to be made for collection of data from the holdings in the non-household sector and special holdings, such as:

- When face-to-face interviewing, DO-MB/ DO-PKI or PATI/CATI is used, the personnel responsible for data collection from non-household holdings and special farms should be selected among the best interviewers. When MO-MB and CAWI/CASI methods are used, the personnel from the central or territorial offices of the NSO/MoA are assigned to supervise the data collection from a specific farm. The supervisors follow up with respondents who have not returned their questionnaire after the collection deadline and assist respondents asking for help to complete the questionnaires.
- Prior to a new round of survey data collection or when a special farm is included in the survey for the first time, it is important that the NSO/MoA in charge of the survey to notify the respondents about the survey in which the holding should participate (including the purpose of the survey, the legal provisions, the obligation of the statistical agency to protect the data confidentiality when and how the data will be collected, as well as how to contact the NSO/MoA for any questions. Such a notification letter could be provided by the interviewer directly, when face-to-face interviewing or DO-MB/DO-PKE are used, or otherwise, by post, e-mail, etc.
- Self-interviewing methods to collect the data from holdings in the non-household sector or special holdings, especially CAWI/CASI and CATI should be used if practical.

Some additional recommendations when self-interviewing methods are used, are listed below:

- Special attention should be paid to the design of the questionnaire and instruction manual to assure its suitability for self-reporting. It is a good practice to collect in the questionnaire the contact information of the person that filled in the form (i.e. name, telephone number, e-mail) in order to contact the person in case of any question.
- In multilingual countries the questionnaires and instructions should be available in most widely spoken languages in the country to facilitate the understanding and the quality of responses.
- A combination of reporting methods could be used, depending on the respondent's preferences.
- A wave methodology can be developed to mail reminders to respondents to complete the Web questionnaire before the deadlines.

5. Estimation procedures for covering agricultural holdings and special farms with a dual frame approach

From the sections above, broadly three types of populations of interest are usually considered by countries in agricultural surveys: agricultural holdings in the household sector (households' holdings), agricultural holdings in the non-household sector (non-households' holdings) and special farms (modern farms, large farms, organic farms, farms producing specific crops...) that could be in both households and non-household sectors. In principle there should not be overlapping units between the households and non-households farms if the definition and identification procedures are clearly set as recommended in this note. However, by definition, the population of special farms could overlap with both households and non-households farms. This section will discuss various approaches for survey implementation and estimations with a dual frame.

A. Operational strategy for covering special farms (large farms, commercial farms...) in agricultural surveys

The FAO Handbook on Agricultural Integrated Surveys (FAO, 2017) provides guidance on the development of sampling frames and sampling designs for agricultural surveys:

- For households' holdings, a stratified two-stage sampling design is recommended.
- For agricultural holdings in the non-household sector, a stratified one-stage sampling design is recommended.
- Where special farms are covered (e.g. list of large farms when an area frame is used), a stratified one-stage sampling design is recommended as well.

FAO (2017) advised dual frame estimation after survey implementation when non-households' holdings are selected in the sample of households' holdings because of frame error (e.g. misclassification).

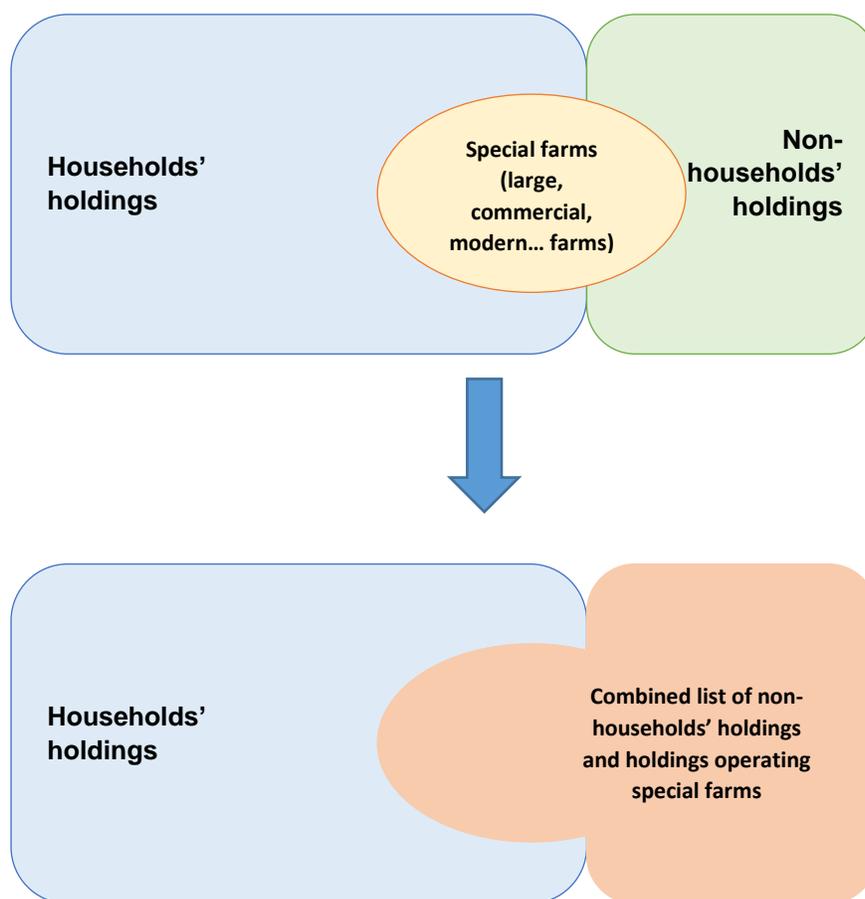
When a country has an interest in special farms (large farms, commercial farms...), as discussed in the previous sections, a clear definition of these farms should be elaborated and a list of special farms should be established through administrative data and/or listing operations as a sampling frame. This list will overlap with either the frame of household holdings or the frame of non-household holdings or both leading inevitably to a dual frame survey.

Regarding the coverage of special farms, it can be observed that some countries opt for the creation of an explicit stratum of agricultural households operating special farms after listing operations in the sample of primary sampling units used for the selection of household holdings. However this approach presents some weaknesses affecting the efficiency of the sample especially when the proportion of households operating special farms is low and/or the geographical distribution of these farms is asymmetric. This does not guarantee reliable estimations on the population of special farms as the explicit stratification is performed in a sample and may lead to an under-sampling of households' holdings affecting the precision of estimates on them.

In practice, when special farms are of interest, a single list can be developed for both populations of holdings operating special farms and non-households' holdings as the same sampling design is recommended for both (stratified one-stage), and listing strategies are quite similar for both. Thus in the

end, that late list and the list of households' holdings will constitute an overlapping dual frame that will represent the sampling frame covering all holdings and allowing the production of reliable statistics on the special farms. The overlapping units are simply households' holdings operating special farms.

Figure 1. Illustration of the strategy for special farms in agricultural surveys



Source: Author's own elaboration, 2020.

B. Overview of dual frame survey

Broadly speaking, multiple-frame survey refers to surveys where two or more frames (dual or multiple-frame) are used and independent samples are selected from each frame. In the literature, the use of many frames in a survey is motivated by various reasons including:

- **Absence of a frame with a complete coverage of the population of interest:** there are situations where it is difficult (or sometimes impossible for some populations) to get a frame with a complete coverage. A solution is to use many frames on the same populations for improved coverage, exploiting the strengths and offsetting the weaknesses of each type of frame.
- **Production of reliable statistics on subpopulation, rare and hard to reach populations** depending on the country's interest.

Advantages associated with the use of multiple frames include (i) saving cost in under sampling expensive frame and over sampling cheaper frames (e.g. area and list frames) and (ii) having more flexibility in the survey design to better control survey costs, coverage, response rates, accuracy (use of different sampling designs for different frames, use of different modes of data collection: face-to-face, phone, web interviews). In the framework of agricultural survey, this approach facilitates (i) the coverage of all agricultural holdings in both household and non-household sector, (ii) the use of the suitable sampling design recommended for each type of holdings, (iii) the production of reliable statistics on special farms whom countries are interested in. However, estimations procedures can be quite complex in particular when the number of frames becomes high (typically more than three).

There are basically two important requirements for the use of multiple frame:

- **Completeness:** the union of all frames should provide full coverage for the target population. In this way, every element should be listed in at least one of the frames.
- **Identifiability:** for any sampled unit, it should be possible to understand to which frame it belongs.

When there is no overlap, estimations procedures are straightforward as independent samples are selected from each of them for survey implementation. In presence of overlap, methods proposed in the literature for dual-frame estimations are discussed below.

C. Screening approach

The screening estimator approach consists in removing the overlapping units either from one frame before sample selection or from one sample before data collection. It can be considered as a special case of stratified sampling and accordingly estimations are straightforward. Common drawbacks of the screening approaches are that they can be resource-consuming, error-prone and amount to missed opportunity to collect data from a willing participant.

1. Frame level screening

This screening approach consists in removing the overlap between frames (de-duplicating the frames) before the sample selection. For instance, in the case of dual frame of household's holdings and special farms, the screening will consist in removing households operating special farms from the complete lists of agricultural households in EAs before selecting the sample of agricultural households. Before such removals, it is important to ensure that the special farms screened in the EAs are included in the frame of special farms. This may increase the listing time in EAs when the identification of special farms required many additional questions in the listing form.

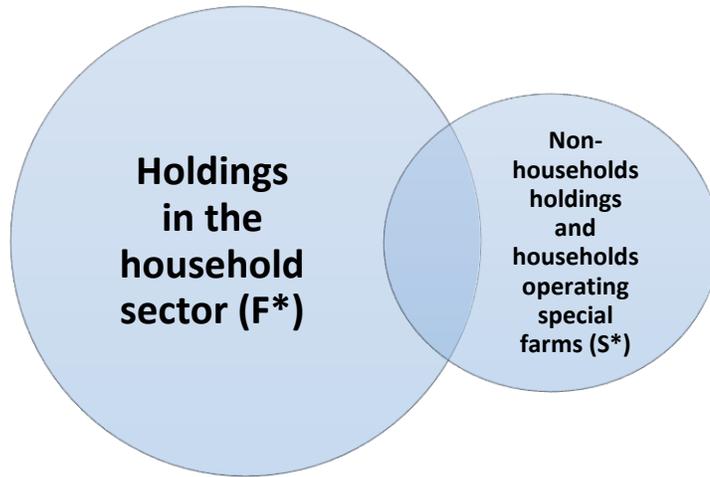
2. Sample level screening

In this screening approach, the overlap between one frame and the sample selected from the other frame (usually the most expensive frame) is removed. Example: when a dual frame of area and list frame is used, agricultural holdings identified in the area sample (e.g. sample of segments) are removed from the list frame before selecting the sample from the list. The sample level screening is considered acceptable when the overlap is relatively small. A specific drawback of this approach is that it may increase non-response errors.

D. Dual frame estimators

Consider a typical situation when a country is interested in special farms (commercial, large farms...) and is using a dual-frame consisting in a list of holdings in the household sector and a combined list of non-households holdings and households operating special farms (described in section 5.1.).

Figure 2. Illustration of a dual-frame for agricultural surveys



Source: Author's own elaboration, 2020.

Estimators

Let N be the total number of agricultural holdings in the estimation domain (or domain of inference), F^* the population of holdings in the household sector and S^* the population of non-households holdings and households operating special farms. The population of agricultural holdings from these two frames ($F^* \cup S^*$) can be divided into three mutually exclusive subpopulations:

F : the population of households' holdings non operating special farms, with a size N_f

FS : the overlapping population of households' holdings operating special farms, with a size N_{fS}

S : the population of non-households holdings with a size N_s

Therefore $N = N_f + N_{fS} + N_s$

Let Y be a variable of interest (e.g. agricultural planted area) in the population of agricultural holdings and let y_k be its value on unit k , for $k = 1, \dots, N$.

The objective is to estimate from the data of two independent samples surveys (households and registered farms) the population total $Y = \sum_{k=1}^N y_k$ that can be written as:

$$Y = Y_f + Y_{fS} + Y_s = \sum_{k=1}^{N_f} y_k + \sum_{k=1}^{N_{fS}} y_k + \sum_{k=1}^{N_s} y_k$$

The simple summation of the two totals of Y estimated from the two samples is obviously biased because of the overlap between the two sampling frames used to select the samples. Different methods are proposed in the literature for estimations from dual-frame surveys. The most famous were proposed by Hartley (1962; 1974), Fuller and Burmeister (1972), Bankier (1986), Kalton and Anderson (1986), Skinner (1991), Skinner and Rao (1996), Singh and Wu (1996; 2003), Lohr and Rao (2006), Mecatti (2007) and Singh and Mecatti (2011).

Estimations in general and variance estimations in particular are not always straightforward in dual-frame survey. Arcos *et al.*, (2015) note that standard software packages for complex surveys cannot be used directly when the sample is obtained from a dual frame survey because the classical design-based estimators are severely biased and there is an underestimation of standard errors. The authors developed the R package Frames2 that can be used for dual-frame estimations using most of the methods mentioned above.

The dual frame estimation method proposed by Hartley (1962) consists basically in weighting the two estimates of Y for the overlapping domain (here FS the overlapping population) to avoid the overestimation bias. The Hartley's general class of dual frame estimators is given by:

$$\hat{Y}_H = \hat{Y}_f + \theta \hat{Y}_{fs}^f + (1 - \theta) \hat{Y}_{fs}^s + \hat{Y}_s$$

Where

- \hat{Y}_{fs}^f is the estimator on the domain FS based only on the data of the sample of households' farms
- \hat{Y}_{fs}^s is the estimator on the domain FS based only on the data of the sample of non-households or special farms
- θ is an arbitrary constant, such that $0 \leq \theta \leq 1$

It can be easily noted that using $\theta = 0$ or $\theta = 1$ is equivalent to a sample level screening approach (see section 5.3.2.). Hartley (1974) proposed an optimal value for θ minimising the variance of \hat{Y}_H :

$$\theta_{opt} = \frac{V(\hat{Y}_{fs}^s) + Cov(\hat{Y}_s, \hat{Y}_{fs}^s) - Cov(\hat{Y}_f, \hat{Y}_{fs}^f)}{V(\hat{Y}_{fs}^f) + V(\hat{Y}_{fs}^s)}$$

This optimal value can be estimated using the R package Frames2 (Arcos *et al.*, 2015). The main drawback is that it is variable-specific i.e. shall be estimated for each indicator.

The Hartley's estimator with $\theta = 1/2$ (also called average estimator) is equivalent to the multiplicity estimator proposed by Mecatti (2007) for multiple-frame surveys and presents interesting features that could interest countries. Lohr (2011) mentioned that and the value of $\theta = 1/2$ is frequently recommended with the Hartley's estimator. The average estimator may not be the most efficient one in many contexts compare to other dual-frame estimators but it can be recommended to countries because it offers operational advantages. First, it is straightforward to compute and implement because the value of θ does not depend on the quantity of interest (Baffour *et al.*, 2016) and its variance is quite easy to estimate. In addition, it provided good results in a number of experiences in the literature including Brick *et al.* (2006) dual frame survey of landline and cell phone numbers and Ferraz *et al.* (2017) with a dual frame of area

and list frames in agricultural survey. Ferraz *et al.* (2017) notes that the average estimator is more efficient than the screening estimator. Chauvet and Tandeau de Marsac (2014) performed simulations comparing the performance of several dual-frame estimators in two-stage sampling designs and conclude that a simple estimator is sometimes preferable, even if it uses only part of the information collected.

Below is described how estimations are straightforward with the average (or multiplicity) estimator that can be presented as follows:

$$\hat{Y} = \hat{Y}_f + \frac{1}{2}\hat{Y}_{fs}^f + \frac{1}{2}\hat{Y}_{fs}^s + \hat{Y}_s$$

Let's consider:

S^f and S^s the samples selected from the populations F^* and S^* respectively

w_i^f : sampling weight of unit i selected in S^f

w_i^s : sampling weight of unit i selected in S^s

The use of the average estimator will consist simply in calculating adjusted weight as follow:

$$w_i^{*f} = \begin{cases} w_i^f & \text{if } i \in F \\ \frac{1}{2}w_i^f & \text{if } i \in FS \end{cases}$$

$$w_i^{*s} = \begin{cases} w_i^s & \text{if } i \in S \\ \frac{1}{2}w_i^s & \text{if } i \in FS \end{cases}$$

The adjusted weights should be used for estimations on the population of agricultural holdings (e.g. area, production...) using the standard Horvitz-Thompson estimator. However, the initial weights w_i^f and w_i^s are kept in the two samples to be used for estimations specific for population F and S respectively. For instance, the estimation of the production of special farms would be performed using the sample S^s and the initial weights w_i^s .

Given that samples were selected independently from the two frames, the variance estimations are straightforward using any standard statistical software: $V(\hat{Y}) = V(\hat{Y}_{hf} + \frac{1}{2}\hat{Y}_{hfr}^f) + V(\frac{1}{2}\hat{Y}_{hfr}^s + \hat{Y}_r)$.

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Annex

Annex 1: Country examples on types of holdings used for agricultural surveys

Brazil

In Brazil, large farms and corporation have high importance in agricultural activities and concentrate most of the agricultural land and pastures. The data collection on such agricultural holdings is challenging because the enterprises often have complex structure; the holder or the company's headquarters, that can provide the survey information, could be far from the farm or even in other provinces.

The Brazilian 2017 Agricultural Census adopted special procedures for performing the data collection of those large farms and farms belonging to corporations. During the survey preparation, a list of farms for the special collection was built. Cases for special collection could be also identified during the regular collection.

The special farms were identified in the register of the 2006 Agricultural Census. The criteria for inclusion in the list are the following:

- Decentralized Collection = Yes
- Total Area \geq 1,000 ha
- Crop land > 500 ha
- Number of Cattle number > 500
- Number of Birds > 20,000
- Number of Swine > 1000 e Area
- Value of production > R\$ 500,000

A farm is considered in the list of special farms if it has at least one of these characteristics.

Burkina Faso¹⁴

For the Agricultural census (AC) 2006-2010, two types of holdings have been defined, according to the sector these belong to: (i) Household (traditional) sector and (ii) modern farms that could be in both household and non-household sector as defined by FAO. The coverage of modern farms was driven by a specific interest of country on statistics on this category of farms in order to monitor agricultural policies aiming at "modernizing" the agricultural sector. The definition of "modern farms" combines size criteria and purpose of production. Thus, "modern farms" are those "with a certain level of investment (infrastructure, equipment) and hired labour (employees), where high efficiency production techniques are applied. In addition, there is a unique decision-making process, and more than fifty percent (50 percent) of the production is for sale".

Only the household sector is covered through the annual agricultural surveys. The holdings in the non-household sector are not only very few, but also they have a marginal contribution to the agricultural

¹⁴ FAO 2019. Country Note.

cultivated land at national level (less than 1 percent of the total cultivated area in 2019),¹⁵ so that it will be not cost-effective to carry out a regular survey for these units.

Cambodia

Two types of agricultural holdings are distinguished: agricultural holdings in:

- (i) the household sector (household agricultural holdings) and
- (ii) Large Agricultural Operations.

Two surveys were implemented in Cambodia to collect data on agricultural holdings: Survey of Agricultural Households and the Survey of Large Agricultural Operations (LAO)¹⁶. For the survey of LAO the holdings meeting at least one of the following criteria were eligible¹⁷:

- Large crop production operations (with 100 hectares or more).
- Large livestock operations (criteria are provided below).
- Operations with fishponds.
- The list of operations which received land under the Economic Land Concession (ELC) program in Cambodia.¹⁸
- Juridical agricultural holdings included in the 2013 Agricultural Census.¹⁹

The following minimum size limits were established for “large livestock operations” (head):

- Cattle: 1 000
- Chicken: 50 000
- Ducks: 50 000
- Pigs: 5 000

“Juridical holdings” are agricultural enterprises operated by corporations, cooperatives, government and private institutions and are a part of the non-household sector.

Congo²⁰

For the General Agricultural Census (GAC) in the Congo 2014–2015, two types of agricultural holdings were distinguished: (i) holdings in the household sector (“agricultural households”²¹) and (ii) modern holdings.

¹⁵ FAO, 2019. Country Note.

¹⁶ The Survey of LAO was a survey of 447 operations.

¹⁷ The first three list sources were provided by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Cambodia.

¹⁸ The list was provided by the Council for Development of Cambodia (CDC). ELC is a program that provides a long term lease of land that allows a concessionaire to clear land in order to develop industrial-scale agriculture for various activities including large-scale plantations, and raising animals. After checking for duplication, 163 holdings from the CDC list were included in the survey of Large Agricultural Operations.

¹⁹ The list of “juridical holdings” included in the 2013 Agricultural Census was checked for duplication with other list sources, and included 58 of the 96 holdings in the survey of Large Agricultural Operations.

²⁰ FAO, 2019.

²¹ An “agricultural household” was defined as “a household with at least one member operating one or more agricultural fields or rearing animals, or practicing aquaculture and/or fishery or forestry activities for their own account or for the account of the household”.

A “modern holding” is characterized by all the following criteria:

- bookkeeping (keeping records);
- existence and use of equipment; use of hired/paid employees;
- cultivation of large surfaces; and
- the purpose of production is mainly for sale.

Georgia²²

The country uses different approaches to define the types of holdings.

Two types of holdings have been defined, according to the sector these belong to:

- (i) Family holding, which is a holding operated by household;
- (ii) Agricultural enterprise, which is a holding operated by a legal entity, such as: “limited liability company, general partnership, limited partnership, joint stock company, cooperative, etc.”.

A calculation using agricultural indexes (ACI) is applied to define the size of the agricultural holding:

- (i). Small
- (ii). Medium
- (iii). Large
- (iv). Extra Large

The size of an agricultural holding is defined using ACI applied to holding’s area of crops and number of livestock by type (see Table 1 in the Annex). The ranges used to define the size of the holding depend on the region the holding is located. The size of the holding is used for stratification purposes.

Kazakhstan

Three main types of holdings are distinguished for statistical data collection in Kazakhstan:²³

- (i) Legal entities (agricultural enterprises).
- (ii) Large individual entrepreneurs and farms (large farms) – holdings with more than 100 employees.
- (iii) Small holdings – the individual entrepreneurs and farms with less than 100 employees (“small farms”) and the agricultural production households.

The first two types of units are covered mainly with complete data collection - statistical surveys with monthly (two surveys), quarterly (three) and annual periodicity (eight). In addition, there is a survey on machinery and equipment conducted every three years. There is only one sample survey used to collect data from such units - for estimation of the yield of cereals (wheat and rice) before harvesting (see also Table 1).

The small holdings are surveyed using two sample surveys on agricultural production: one monthly survey – on livestock production and one annual survey – on crop production. In addition, there is an annual

²² FAO. 2019. Country Note.

²³ The total number of agricultural enterprises is about 12 thousand units; the total number of individual entrepreneurs and farms is about 188 thousand and the number of agricultural production households is about 2 million.

survey on agricultural production, expenditures and sales, which covers small farms based on sampling (along with the agricultural enterprises and large farms with a complete coverage).

Mauritius²⁴

For the Agricultural Census 2014, the following types of holdings were distinguished:

- (i) Holdings in the household sector, and
- (ii) Holdings in the non-household sector or “agricultural businesses” (namely corporations, NGOs, government institutions etc.);²⁵

In its turn, in the household sector, a distinction was made between “household farms” and “private households”. The following thresholds were established for a “household farm” (included in Phase II of the census):

- any household cultivating a piece of land, on own account, and for commercial production (at least five perches);²⁶
- any housing unit having a kitchen garden (at least five perches); and
- any housing unit having fruit trees on the premises with a certain cut-off: breadfruit, lychee, mango (at least five trees), lemon, mandarin, coconut, guava, other citrus, mixed fruit trees (at least ten trees), banana, pawpaw (at least 20 trees), pineapple, lychee, vegetables, fruits-other, crops-other (at least five perches);
- all honey producers and all deer farms; and
- all units raising livestock (including poultry).

The agricultural production households below the above thresholds refer to “private households”.

The frame for the holdings in the non-household sector consisted of a list of agricultural establishments obtained from:

- the Ministry of Agro Industry and Food Security (MAIFS);
- the Food and Agricultural Research and Extension Institute (FAREI);
- other administrative sources.

The sampling frame for the holdings in the household sector was built based on:

- administrative data sources (from the FAREI databases and the list of small farmers registered with the Small Farmer’s Welfare Fund (SFWF) who are engaged in crop and livestock production);
- the information collected in the 2011 Housing and Population Census.

²⁴ FAO, 2019.

²⁵ According to the methodology followed for the AC 2014, “usually there is only one farm in a household (single-holding household), but there can be also two or more farms in a household (multiple-holding household)”.

²⁶ 100 perches are equivalent to approximately 0.42 ha.

Nepal²⁷

The agricultural holding is defined as an economic unit of agricultural production under single management comprising all livestock (including poultry) kept, and all land used wholly or partly for agricultural production purposes, and with a physical size satisfying specific threshold criteria (see below).

Agriculture farming in Nepal can be broadly divided in to two parts:

- (i) “subsistence farming” and
- (ii) “commercial farming”.

“Subsistence farming” is a farming practice where crops growing and livestock rearing is to fulfill the needs of farmer and his family. The subsistence farms correspond by definition to the holdings in the household-sector.

The definition of “Commercial agricultural holdings” is still being discussed but will include large/big households farms registered in various registers including the ones of farmers’ organizations and holdings operated by institutions and other entities in the non-household sector.

The Agricultural Census 2011/2012 covered only agricultural holdings in the household sector satisfying any of the following conditions:

- (i) agriculture land at least four Anna (0.01272 ha) in the Hill and mountain, or eight Dhur (0.01355 ha) in Terai;
- (ii) *livestock raising - at least*: one head of cattle or buffaloes (“big head”); five head of sheep or goats (“small head”); or (iv) 20 poultry (chicken, duck etc.).

Saint Lucia

The following thresholds were established to distinguish small holdings from other holdings in the 2007 Saint Lucia Census of Agriculture (CA):

- one eighth of an acre (1 acre, or 0.4 ha) of any temporary crop;
- ten bearing trees of any tree crop;
- 100 mats of banana and/or plantain;
- one head of cattle;
- two pigs or goats or sheep or one head of any two of these; or
- 12 poultry, 12 rabbit, or 12 head of poultry and rabbits together.

Two types of questionnaires were used: (i) a “screening form”; and (ii) a “holding questionnaire” (long questionnaire). Holdings with activity exceeding at least one of the thresholds mentioned above were enumerated by means of the holding questionnaire. The rest of the holdings were enumerated using the screening form.

²⁷ FAO. 2019. Country Note

El Salvador

Different criteria were used to classify the agricultural holdings in the Census of Agriculture (CA) 2007–2008:

- i) Based on juridical status of holders, the agricultural holdings were classified in: (i) holdings operated by a natural person (individual) and (ii) holdings operated by a juridical person (cooperative, enterprise or corporation, government, other).
- ii) Three types of holdings were distinguished according to market orientation and land type: (i) commercial producers; (ii) subsistence producers; and (iii) with production activity in gardens, aimed mainly for family consumption.

Senegal

Two types of holdings have been defined, according to the sector these belong to: (i) household (traditional) sector (in French “*exploitations familiales*”) and (ii) non-household sector.

The latter sector, in its turn, is defined through three, not necessarily mutually exclusive, types of holdings:

- “large farms” whose area is at least 10 ha, generally operated by the marabouts (religious leaders) and farms associations or cooperatives;
- “business farms” or “specialized farms” characterized by the existence of an accounting system and a registration in the national business register (NINEA);
- the “modern farms” which are distinguished from the latter one and characterized by modern facilities but not necessarily formally registered.

Annex 2: countries experiences of listing tracts/plots in segments in survey with area.

Rwanda Seasonal Agricultural Survey (SAS 2013-2016)

The Rwanda Seasonal Agricultural Survey provides data on background characteristics of the agricultural operators, farm characteristics (area, yield and production), agricultural practices, agricultural inputs, agricultural equipment and use of crop production in Rwanda.

Sampling design

The country was demarcated into 12 strata. Only the first five strata were subject to agricultural land sampling. The sample selection was a two-stage sampling design as follows:

- a) In each stratum, primary sampling units, i.e. portion of land within natural borders and within a pre-defined range, were selected using probability proportional to size (PPS) sampling where area was the size measure;
- b) For each selected PSU, one secondary sampling unit or, in this case, segment was randomly selected.

If, for example, a PSU had 225 hectares, it was divided into (22) sampling units (segments) of 10-hectares each. If this PSU was selected, one of its 22 sampling units would be selected for data collection.

Data collection

Data collection is done in two visits (called phases):

1. Phase I – Screening (Listing of tracts, plots and operators in the segments) – Data are collected by questionnaires administered to the operators in the segments.
2. Phase II –Yield Measurements and General Agricultural Modules.

During the first phase, enumerators perform the data collection through direct interviews in the sampled segments, where they inspect all the area using imagery (Ortho-photo enlargements through enlarged satellite images uploaded on the tablets) that includes the boundaries of the each segment. Every enumerator completes a questionnaire for each tract in the sampled segment except for the area of the segment included in a Large-Scale Farm on the list frame (to avoid duplication). Indeed, a list frame is provided for the large-scale farms whose land is larger than 10 ha or own 70 LUs (Livestock units) or more. The livestock unit (LU) is a reference unit for aggregating cattle or different species using the standard units of LU are as follow: one cow equals 1 LU, 2 pigs equal 1LU, 5 goats/ sheep equal 1 LU.

A large-scale farmer is a farmer rearing

- 70 cows and above (including calves); or
- 140 pigs and above; or
- 350 sheep and above; or
- 350 goats and above.

Moreover, in the Rwandan context, a farmer is qualified to be a large-scale farmer if:

- He/she rears 500 chickens and above; or
- He/she has at least 50 beehives.

In addition to the completion of a questionnaire, the field operations involve operators' and land use identification plus the measurement of plots areas.

Preparation before going to the field (items to carry)

Before enumerators start moving to the demarcation site, they ensure to carry the following items:

- A tablet (in case of CAPI)
- A measuring tape (in case of PAPI)
- GPS receiver (Example: Garmin Etrex)
- Well charged battery
- Well sharpened pencils (HB) and a sharpener
- A ruler
- Ordinary ball point pen
- An umbrella to protect maps/tablets from light rain and sun shine
- Field writing clip board for carrying maps
- Note books to keep notes of demarcated plot numbers and other necessary information.

Procedures to follow during screening fieldwork

For each tract within a given sampled segment, the enumerator uses a GPS to localize the segment and has to account for every piece of land contained therein. The enumerator notes land use within the segment and verifies the crops planted using information provided also by the farmer.

Enumerators conduct face-to-face interviews with operators of all farms establishments with land inside a segment, and account for all land within the segment. All farmland, non-agricultural land, barns, corrals, pasture, ponds, etc., are included in the tract. However, in most cases, the enumerator does not measure any field because all measurements can be accomplished using the imagery.

For the screening activity, every team is composed of two enumerators. One is delineating plots on segment photomap while the second enumerator is filling the screening questionnaire (the same can be applied when using CAPI). Once enumerators are at the site, they must ensure and follow the procedures below.

- They must first search for one (or more when possible) member of village committee, and show him/her the segment boundary;
- After segment boundary demarcation, the member of village committee identifies all plots and their respective operators. The latter are therefore requested to show and walk along the boundaries of the claimed land;
- The Enumerator, at the same time, identifies the features marking the identified plot boundaries on the segment photomap using a sharpened pencil.

In case of CAPI, the data is collected by two enumerators using different software tools. Enumerator 1 measures the area of the agricultural plot by walking around the field perimeter with a GPS, tracing the boundary. For this purpose, Enumerator 1 uses the Collector for ArcGIS app together with a high-precision Trimble R1 RTX GPS handheld unit. He surrounds the plot to measure the plot area by tracing the boundary every 5 meters using GPS polygons. If boundaries are well visible, the enumerator can use the GPS polygons without moving.

The same enumerator also completes an electronic questionnaire about the agricultural plot using the Survey123 app. The Survey123 data are appended as attributes to the GIS polygon of the agricultural plot, which Enumerator 1 traced before using the Collector app. The dataset is then uploaded to ArcGIS Online. Enumerator 2 completes the same electronic questionnaire at the same location but using the CSEntry

app and without measuring the plot area. The CSEntry data is uploaded to the CSPro online database. GIS analysts at NISR headquarters inspect the newly submitted field polygons uploaded by the enumerators to the ArcGIS Online and CSPro databases on a daily basis. The analysts check for errors and inconsistencies by reviewing the datasets and comparing the values collected by the two different enumerators. If inconsistencies exist, the analysts request corrections or, if necessary, send the enumerators back to the field to repeat the data collection.

Hints

- Most boundaries follow along the physical features that can be seen on the field sheets.
- Most plots of land generally have regular shapes; just very few plots exist with very queer shapes.
- Complete marking the boundaries of each plot before writing the number in it.
- Complete one plot before moving to the next one.
- Walk around each plot's boundary as you draw it. Don't just stand at one place and draw where it is pointed, go to the point.

The Enumerator then issues a unique plot identifier by writing within the closed perimeter of the plot and reports the same plot identifier on the screening form. The plot identifier is made up with a letter and a number. The alphabet is used to designate the operators (tracts). The 26 letters are as follows: ABCDEFGHIJKLMNOPQRSTUVWXYZ. If all letters are used, begin doubling the letters to identify the tracts, i.e. write **AA, AB, AC... AZ, BA, BB, BC**, etc. Numbers are used to designate number of plots for one tract, i.e. write **A₁, A₂,...AA₁, AA₂, AB₁, AB₂**, etc.

Tract letter: write a letter in the reserved box. We will use the alphabet to designate the operators (tracts). This letter must be the same as the one recorded on Segment Photo map when delineating plots (A, B, C, AA, AB, AZ, etc.).

Tract number: record every tract sequentially with a three digits number starting from 001. Automatically, the tract A should have as Tract Number 001, tract B, =002, tract C=003, tract Z=026, tract AA=027 etc. See Table 2.

These are crucial information that will guide enumerators during the screening activity.

Table 7. Assignment of letters and numbers to the tracts

A	001	AA	027	BA	053	CA	079	DA	105	EA	131	FA	157
B	002	AB	028	BB	054	CB	080	DB	106	EB	132	FB	158
C	003	AC	029	BC	055	CC	081	DC	107	EC	133	FC	159
D	004	AD	030	BD	056	CD	082	DD	108	ED	134	FD	160
E	005	AE	031	BE	057	CE	083	DE	109	EE	135	FE	161
F	006	AF	032	BF	058	CF	084	DF	110	EF	136	FF	162
G	007	AG	033	BG	059	CG	085	DG	111	EG	137	FG	163
H	008	AH	034	BH	060	CH	086	DH	112	EH	138	FH	164
I	009	AI	035	BI	061	CI	087	DI	113	EI	139	FI	165
J	010	AJ	036	BJ	062	CJ	088	DJ	114	EJ	140	FJ	166
K	011	AK	037	BK	063	CK	089	DK	115	EK	141	FK	167
L	012	AL	038	BL	064	CL	090	DL	116	EL	142	FL	168
M	013	AM	039	BM	065	CM	091	DM	117	EM	143	FM	169
N	014	AN	040	BN	066	CN	092	DN	118	EN	144	FN	170
O	015	AO	041	BO	067	CO	093	DO	119	EO	145	FO	171
P	016	AP	042	BP	068	CP	094	DP	120	EP	146	FP	172
Q	017	AQ	043	BQ	069	CQ	095	DQ	121	EQ	147	FQ	173
R	018	AR	044	BR	070	CR	096	DR	122	ER	148	FR	174
S	019	AS	045	BS	071	CS	097	DS	123	ES	149	FS	175
T	020	AT	046	BT	072	CT	098	DT	124	ET	150	FT	176
U	021	AU	047	BU	073	CU	099	DU	125	EU	151	FU	177
V	022	AV	048	BV	074	CV	100	DV	126	EV	152	FV	178
W	023	AW	049	BW	075	CW	101	DW	127	EW	153	FW	179
X	024	AX	050	BX	076	CX	102	DX	128	EX	154	FX	180
Y	025	AY	051	BY	077	CY	103	DY	129	EY	155	FY	181
Z	026	AZ	052	BZ	078	CZ	104	DZ	130	EZ	156	FZ	182

Source: Author's own elaboration, 2020.

Information Collected During Screening (Listing of Plots within Segments)

The following information have to be collected during the screening.

- i. **Operator's name and address:** names of the operator of the plot and his/her address: village name, cell name and sector name where the operator lives plus the telephone number of operator if any. Then write the code 1=Yes if the Agricultural Operator is resident. Otherwise write the code 2=No.

N.B:

- a. When the Agricultural Operator of the plot considered is not known in the region, the term "Unknown" should be reported in the place of operator's name.

- b. If the operator lives in other District/Province, the District name should be written near the sector name (Example: Nemba/Gakenke).
- ii. **Plot size:** plot size in m² (in case of CAPI, area is calculated by the used application).
- iii. **Land use:** most appropriate land use code for the considered plot among those provided in the list of land use codes (e.g. 96 = Cultivated land, 97 = Pasture, 98 = Fallow, 99 = Uncultivated land -Forest, rocky soil, water, etc.).
- iv. **Non-agricultural Land Type:** most appropriate non-agricultural land code for the considered plot among those provided.
- v. **Additional Information**

Crops planted in the plot:

- a. **Crop code:** code of the crop planted in the plot with reference to the crops codes found at the last page of the Screening Questionnaire or in the instruction manual.
- b. **Crop name:** write the name of the crop planted in the plot.

Crop proportion: portion of the land occupied by the crop over the total area of the plot. The proportion is recorded in terms of percentage with reference to the given proportion codes. The most appropriate code among the codes provided at the last page of screening questionnaire should be reported.

vi. **Summary**

This section has to be completed by the enumerator's team leader (supervisor). It helps to check if the number of plots recorded in the screening questionnaire is equivalent to the number of plots on the segment photo map. It includes the following information.

- **Total number of Tracts:** the sum of all the tracts found in the segment.
- **Total Number of Agricultural Tracts:** the sum of agricultural (cultivated) tracts, fallow tracts and pasture tracts.
- **Total Number of Non-agricultural Tracts:** the sum of non-agricultural tracts.
- **Total Number of Agricultural Plots:** the sum of plots that have crops in the reference agricultural season.
- **Total Number of Fallow Plots:** the sum of plots that are fallow in the reference agricultural season.
- **Total Number of Pasture Plots:** the sum of pasture plots in the reference agricultural season.
- **Total Number of Non-Agricultural Plots:** the sum of plots that are uncultivated.
- **Total Number of Plots:** number of all plots in the segment, i.e. the sum of agricultural, fallow, pasture and non-agricultural plots.
- **Total Number of Operators resident in the segment:** number of operators that live in the segment.

Costa Rica National Agricultural Survey

The Costa Rica National Agricultural Survey (Encuesta Nacional Agropecuaria – ENA) produces information on the characteristics of the farms and their production (crop types, area planted, harvested, production, livestock raised and sold, etc.), on the destination of the agricultural production, on forestry products in Costa Rica. This survey is conducted annually by the National Statistical Office of Costa Rica (INEC – Costa Rica) through Computer-Assisted Personal Interviews (CAPI).

Sampling design

The sampling design of the survey takes advantages of a multiple frame that was developed after the 2014 Agricultural Census. It consists of a list frame of big farms and specialized farms and of an area frame of geographical areas (UPAs – Unidades Primaria de Muestro) corresponding to the administrative areas identified for the 2014 Census. These geographical areas were split into segments (regular areas measuring from 10 to 100 hectares) that were stratified according to the cultivation area of the associated UPA. The area frame included 90650 segments that were grouped in 4 strata. The sample size was set to 2000 segments that were selected with a systematic procedure within stratum where the segments were ordered by region, then by province, then by canton and finally by district. The reference units that were interviewed were the agricultural holdings. Each holding located in the segments selected from the area frame receives a weight equal to the weight of the corresponding segment multiplied by the ratio between the area of the holding within the segment and the total area of the holding. Hence, the weighted segment estimation method is adopted. The agricultural holdings belonging to the list frame receive instead a weight of one.

In order to find the agricultural holdings within each sampled segment a listing procedure is required. Starting from the tracts located in each segment and visible on the maps, it is possible to link them to the corresponding agricultural holdings. The aim of the screening procedure is then to create a list of tracts and in parallel a list of the corresponding agricultural holdings.

Data collection

Data collection was performed in two separate phases:

1. Phase I – Screening (Listing of tracts and agricultural holdings) – Data was collected by questionnaires administered to the operators in the segments.
2. Phase II – Main data collection with the Agriculture Module questionnaire submitted to all the agricultural holdings.

The work is organized through a top-down approach:

- the general coordinators are responsible of creating the teams and making the assignments, they have to control the routes, the maps and the material, they are responsible of the quality of the overall collected information and of the complete coverage of the geographical area, they have to monitor the progress, the strategy and the efficiency of the project;
- the general supervisors are responsible of the quality of the collected data, they have to check daily the completed interviews and monitor the work of the field supervisors, they report to the general coordinators;
- the field supervisors have to check daily the completeness and correctness of the filled questionnaires and have to support the work of enumerators when necessary, they have to guide the enumerators

to and within the segment, they have to administer the field resources including the vehicle and driver, they report to the general supervisors;

- the enumerators have to conduct the interviews in the assigned segments, respecting their duties and responsibilities that are described in details below. They report to the field supervisors.

Each team is composed by one enumerator, one field supervisor and one driver.

Preparation before going to the field (items to carry)

Before starting the field work, the enumerators have to be sure to carry the following items:

- A tablet
- GPS application uploaded on the tablet
- Oruxmap application uploaded on the tablet
- Other useful applications uploaded on the tablet
- Well charged battery
- Ordinary ball point pen
- An umbrella to protect tablets from light rain and sun shine
- Note books to keep notes

Procedures to follow during screening fieldwork

During the screening phase, the enumerator has first to use the application Oruxmap uploaded on the tablet to open the map of the assigned segment and to find the easiest way to reach it. This is achieved also thanks to other applications like Google Drive, Google Earth, Sygic, Google Maps that may also not require an internet source. The map of the segment can be also visualized off line.

An example of map where the sampled segments are coloured in red is given in Figure 3. A zoom-in would allow to notice the reference points of each segment as for example the closest localities, hospitals, schools etc. The reference points allow the enumerators to identify and reach the segments.

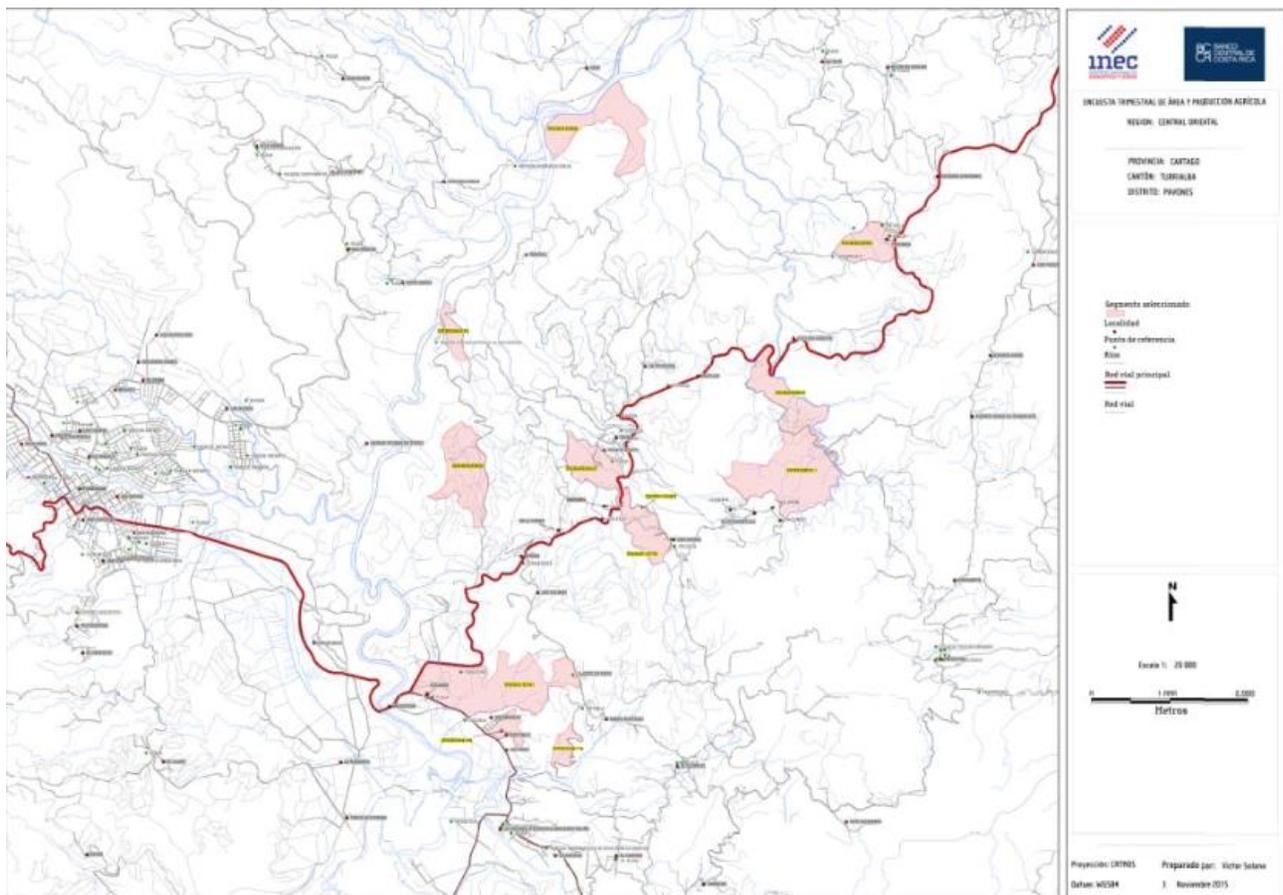
Once the enumerator has reached the segment, he/she has to have first an exploratory tour of the segment in order to find the most efficient route to track all the pieces of land and all the agricultural holdings. If possible, he/she has to find a local authority who can guide him/her to reach out the holders/operators of the agricultural tracts within the segment.

The enumerator usually starts from the north-eastern most point of the segment and proceed in a serpentine way. The aim is to list all the tracts and the agricultural holdings that are located inside the segment. The challenge is to list also those tracts that are hidden and/or without an easy access.

In order to do so and not miss anything, the enumerator has to proceed tract after tract, listing one and moving to the adjacent one. When he/she finds a tract, he/she has to associate to it a consecutive number on the tablet and try to find the holder. If the tract is non-agricultural or if it is agricultural but without an identifiable operator, the enumerator should ask the support of the local authority or of the neighbours. If it is still not possible to identify the holder, the enumerator has to come back to the tract before moving to the next segment. When the holder is identified and reached, the enumerator asks to him/her the permission to be interviewed and to take the measures of each parcel (area of the agricultural holding surrounded by water or land that do not pertain to the holding itself) of the agricultural holding. If the holder agrees, the enumerator fills in a screening form where he/she indicates the number of the parcel,

the portion of the parcel located inside the segment, the number and the locations of other parcels if they are far from the segment or inside the segment but not adjacent, the name of the holding and holder, the number of plots inside the parcels, the land use and the crops planted. Moreover, the enumerator has to track down the GPS coordinates of the holding's headquarters that are defined as the residence of the holder or of the manager (household sector) and as the location of the main offices or the entrance gate (non-household sector). The coordinates can be generated and registered automatically through the Oruxmap application connected to the GPS installed on the tablet. The same system can be used to measure the perimeter of the parcel. Indeed, the Oruxmap application allows drafting a polyline of the parcel directly on the map of the segment. The same should be done when the tract is not agricultural. In this case the reference point is registered through Oruxmap as a point in the middle of the polyline. After a proper check of the field supervisor, the enumerator sends to the central office all the data collected and saved in a GPX format.

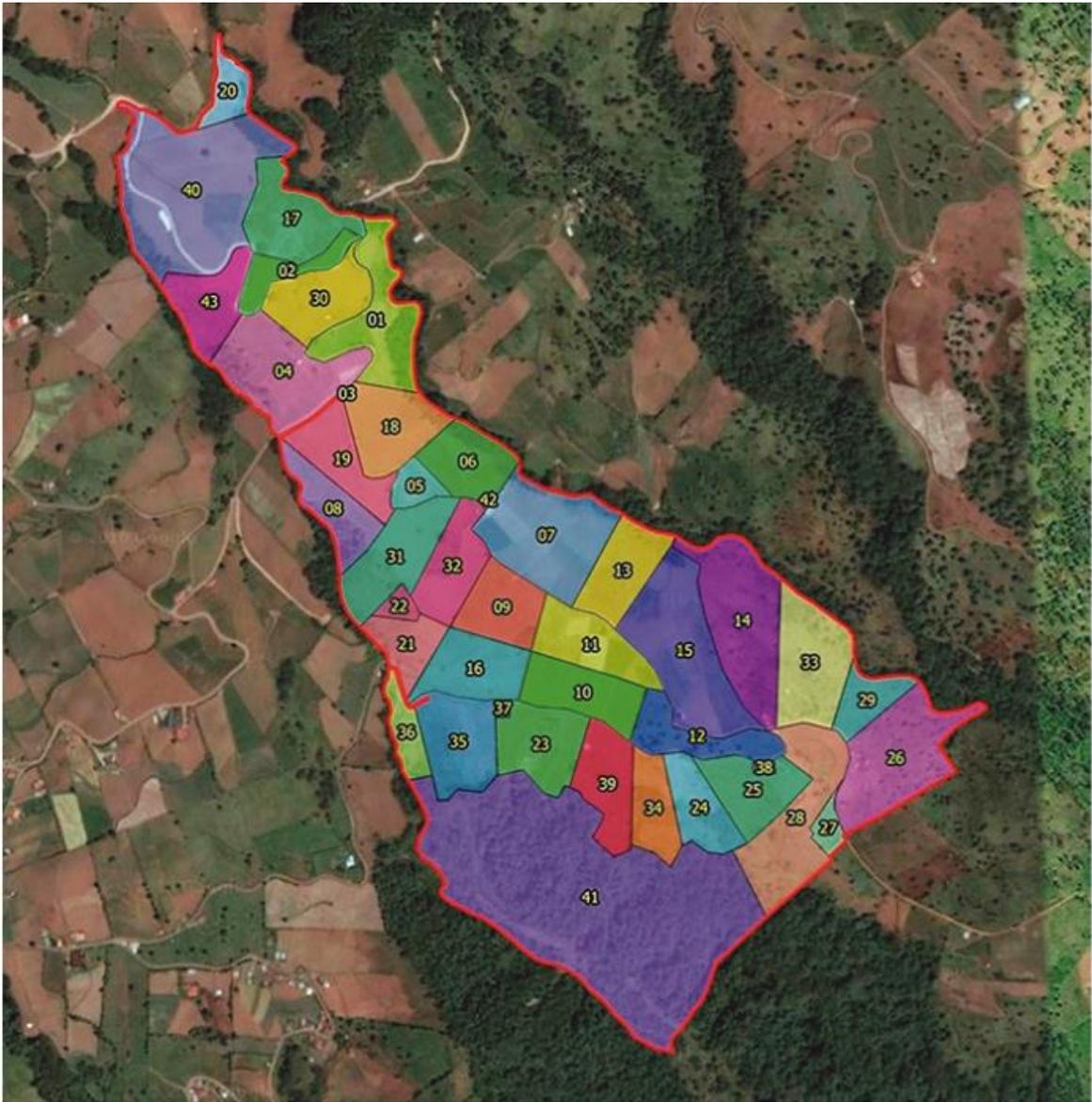
Figure 3. Map of a geographical portion of Costa Rica where some sampled segments are coloured in red.



Source: INEC, 2020.

At the end of the screening operation, the result is a list of all the tracts (both agricultural and non-agricultural) within each segment and the relative agricultural holdings (both from household and non-household sector). In this way, the material can be prepared for the main data collection procedure. Indeed, during the second phase the enumerators will go to the field with a map of all the tracts within the segment as that of Figure 4. Once they insert the number of the tract in the Oruxmap application, the name, contact and address of the agricultural holding will appear, making easier the process of identification of the interviewee. If the enumerators find inconsistencies or changes during the main data collection, they have to fill in a form called “Actualization of the segment” where changes are tracked and sent to the central office for proper checks. These procedures enable to have clear and updated information on the sampled segments, facilitating periodical data collections.

Figure 4. Map of a segment with the tracts listed during the screening



Source: INEC, 2020.

Annex 3. Country examples of screening questionnaire for households listing

CAMBODIA

CIAS2019
Listing of Households
Cambodia Version 1.0, December 2018

SECTION 1: Geographic information

Q1	Municipality/Province	<input type="text"/>
Q2	Krong/Khan/District	<input type="text"/>
Q3	Commune/Sangkat	<input type="text"/>
Q4	Village	<input type="text"/>
Q5	Enumeration Area	<input type="text"/>

SECTION 2: Information on the Involvement of Households in Agriculture and/or Aquaculture Activities

Q0	Name of Household head (Family Name first, then First Name)	<input type="text"/>
Q1	Enter house number that is drawn on EA map	<input type="text"/>
Q2	Enter phone number for household member	<input type="text"/>
Q3	GPS of dwelling	<input type="text"/>
Q4	Exact address of the household (Enter House Number and Street Name)	<input type="text"/>

Q5 Did you or any of your household members engage in any crop cultivation activity during the last 12 months as an employer or on your own account? (including homelot with intensive growing of crops)

(Fill in one circle only)

- 1 Yes -> Go to Question 7
 2 No -> Go to Question 8

Q7 What is the total size of all agricultural lands that you are managing and using for agricultural activities?

Enter Number

Select unit of measure: 1 Hectares
 2 Ares
 3 Square Meters

Q8 Did you or any of your household members engage in own account in raising livestock or poultry activity during the last 12 months? (Include homelot used for raising and keeping livestock or poultry)

(Fill in one circle only)

- 1 Yes -> Go to Question 9
 2 No -> Go to Question 10

Q9 How many livestock/poultry do you raise as of this day? (enter number)

Q9a Total number of large livestock (cattle, buffalo, horses and other large livestock)

Q9b Total number of small livestock (pigs, goats, sheep and other small livestock)

Q9c Total number of poultry (chickens, ducks, quails, swallows and other poultry)

Q9c Total Kilogram of Insects (crickets, spiders and other insects)

Q10 In the last 12 months, did you or any member of your household engage in aquaculture on their own account?

(Fill in one circle only)

- 1 Yes
 2 No

Q11 In the last 12 months, did you or any member of your household engage in capturing fishing on their own account?

(Fill in one circle only)

- 1 Yes
 2 No

BURKINA FASO

Permanent Agricultural Survey (Enquête permanente agricole, EPA)-2014

No. Dwelling	Household serial number	Name Of the Head of the household	Sex Of the Head of the household 1 = M 2 = F	Age Of the Head of the household	Education Level Of the Head of the household 1 = Not literate 2 = Literate 3 = Primary 4 = Rural school 5 = Medersa 6 = Second. 7 = Superior	Household size	Number of trees by species (enter the number of trees per species)							Activities practiced (Enter 1 if yes and 0 otherwise)				Equipment and draft animals (Enter the number)					Type of plowing		Number of parcel managers benefiting from improved seeds	Selected in the Sample? (Enter 1 if yes and 0 otherwise)
							mango	banana tree	papaya	guava	citrus	pineapple	cashew	Cereals	Cash crop	Other crops	Livestock	Plow	Carts	Beef	Donkey	Tractors	Number of plots plowed with draft animals	Number of plots plowed with motorized equipment		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
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Rome, Italy

ISBN 978-92-5-134190-2



9 789251 341902

CB4065EN/1/04.21