



United Nations Economic Commission for Africa
African Centre for Statistics

The 2010 Round of Population and Housing Censuses

A guide on census planning and enumeration for African countries





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Foreword

A Population and Housing Census (PHC) is one of the major and more complex statistical operations in terms of its length, financial costs, institutional implications and the outputs that it can produce. Nevertheless, a PHC provides the most important information for the effective planning and monitoring of socio-economic developments in a country, including progress made towards attaining the Millennium Development Goals (MDGs). In addition, it provides a unique source of baseline data for policy-making, planning and administrative purposes that can also be used for political purposes such as apportioning seats in legislative bodies and delineating electoral boundaries.

It further provides the necessary information for building social infrastructure such as schools and hospitals; and establishing sampling frames for sample surveys. Recent censuses have also been beneficial for countries in terms of capacity building by providing training opportunities to staff. This increases the number of skilled staff while at the same time enhancing institutional capacities of the National Statistical Offices (NSOs) and establishing permanent subregional statistical services in the countries.

Following an aggressive advocacy campaign by African stakeholders through the Africa Symposium on Statistical Development (ASSD) for the 2010 Round of Population and Housing Census (RPHC), nearly all African countries committed themselves to undertaking a PHC. In supporting this fundamental engagement, countries have so far organized five symposia on statistical development that focused on census undertaking in Africa since 2006.

Among pertinent recommendations and resolutions emanating from these forums was the mandate from countries to UNECA to produce a number of technical documents that could assist them to properly undertake their PHCs. The first one has already been published: The Africa Addendum to the Principles and Recommendations for PHC, which is an adaptation of the Global Recommendations on PHC to the African context. The purpose of the current handbook is to provide African experts with guidance on how to plan for a PHC properly, building on other African countries' experiences. The third document is about census data processing, analysis and dissemination.

The efficiency of a census depends mainly on the planning stage since all phases should be well anticipated. Therefore, the development of this handbook on census planning and enumeration is very timely as it aims at providing African practitioners with pertinent guidance on undertaking censuses. While planning for a PHC is a universal endeavour, it is worth noting that some of the challenges facing African countries in this regard are specific to the continent and therefore need to be tackled specifically. In the region, some countries have not conducted a census for relatively long periods of time.

They therefore need to learn from the experiences of other countries based on African realities and capacities. The planning for a census should also take emergent challenges into account, related to new technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS) and data entry with scanning technologies. The implications of all these technologies have crucial impacts during mapping activities, data processing, analysis, dissemination, and archiving and should therefore be taken into account at the planning stage.

Without any doubt, this handbook will contribute to the quality of participation of African countries in the current Round of PHCs. UNECA stands ready to assist African practitioners on a regular basis in support of national, subregional, regional, and international development efforts.



Abdoulie Janneh
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Acronyms

ASSD	-	Africa Symposium on Statistical Development
EA	-	Enumeration Area
GIS	-	Geo-Information System
GPS	-	Global Positioning System
MIS	-	Management Information System
NSO	-	National Statistics Office
NSS	-	National Statistical System
PES	-	Post Enumeration Survey
PHC	-	Population and Housing Census
P & R	-	Principles and Recommendations
QMP	-	Quality Management Plan
RPHC	-	Round of Population and Housing Census
SA	-	Supervisory Area
UNSC	-	United Nations Statistical Commission

Chapter 1 : Introduction

1.1 Background

1. The United Nations (UN) Principles and Recommendations (P&R) for the Population and Housing Census (PHC) Revision 2 defines a PHC as “*the total process of collecting, compiling, evaluating, analysing and publishing or otherwise disseminating demographic, economic and social data pertaining, at a specified time, to all persons in a country or a well-defined part of the country*”. Population censuses collect information on every individual in a defined geographical area, and hence provide information on the size and distribution of the population as well as its characteristics. Thus, censuses are used to generate demographic and socio-economic indicators.

2. There are several types of population censuses adopted for the 2010 Round of PHCs (RPHCs).. These include the traditional census, where information is collected about everyone who is supposed to be enumerated as by the set criteria whether *de facto*, *de jure* or a combination of the two. The information may be obtained through face-to-face interviews (an approach mostly used in Africa), or by self-completion questionnaires that are mailed out or hand-delivered¹.

3. A census may be conducted separately for population and housing or a combined PHC. The latter is most commonly done by many African countries.

4. The UN P&R for the 2010 RPHC publication has defined four essential features that characterize a population census. These are:

- Individual enumeration
- Universality within the agreed territorial boundaries
- Simultaneity: conducted at the same time for all persons
- Defined periodicity: most countries carry out a census every 10 years.

1.2 Uses of population censuses

5. A population census is required for several reasons including:
- a) Providing census data for effective socio-economic planning and monitoring of progress made towards attaining the development objectives of the country such as the Millennium Development Goals (MDGs);
 - b) Contributing to the overall planning and management of national affairs by providing essential baseline data for policy-making, planning and administrative purposes;
 - c) Formulating and monitoring of national development programmes such as poverty reduction, employment creation, etc;
 - d) Apportioning seats in a legislative body and electoral boundary delimitation;
 - e) Locating social infrastructure such as schools, hospitals, etc;

¹ The other types include the register-based census and the rolling census and a combination of a 10- year census interval and the results of community surveys conducted over a period of 10 years.

- f) Obtaining and generate statistics for individuals and institutions in business, industry and labour; and
- g) Providing sampling frames for sample surveys.

6. Census data make it possible to study the desired characteristics down to the smallest level of a country's geography. This usually cannot be done using only sample survey data.

1.3 Current status of census taking in Africa

7. Census taking in Africa started with ancient population counts which were used mainly to identify males eligible to be inducted into military service or for taxation. As such they were limited in content. However, modern censuses in Africa were undertaken as early as the 19th century.

8. Census taking after independence was characterized by irregularity. To date, most countries in Africa have conducted at least one population census. However, the 2000 RPHC witnessed the diminished participation of African countries with only 37 countries partaking. Thus, it was estimated that nearly half (48 per cent) of the population of Africa resided in a country that did not conduct a population census for that year. The current RPHCs has registered 19 censuses so far and by end of 2011, hopefully, 11 more countries will have conducted their censuses; all African countries, but one, committed to undertake their censuses during the current round.

1.4. Organization of this report

9. The subsequent chapters of this report give detailed guidelines on the implementation of PHCs. In as much as possible, the activities have been presented in the order in which they occur. However, due to big overlaps in census activities; this has not been possible in all cases.

10. Chapter 2 gives the legal and institutional framework required for undertaking the census, while chapter 3 deals with strategic planning required for carrying out the census. The four sequent chapters (4 to 7) deal with the preparatory activities required for a smooth enumeration. These include development of instruments, census mapping, publicity and advocacy and logistics management.

11. Chapter 8 handles aspects relating to census enumeration, including recruitment, training and deployment of field staff as well as the actual enumeration and supervision. The last chapters (9 to 11) present the post enumeration processes including, data processing and product development and dissemination and census evaluation.

Chapter 2: Legal and Institutional Framework

12. A PHC is a countrywide exercise and its implementation requires a sufficient legal and institutional framework within which to operate. Legal authority is required for fixing the primary administrative responsibility of the census, determining the general scope and timing of the census, protecting the confidentiality of the information to be collected, obtaining the necessary resources and placing the legal obligation of the public to cooperate. The institutional framework serves to define the offices that will implement the population census and assign them the desired authority.

2.1 Legal framework for census taking

13. Countries usually have a law governing data collection, which provides for, among others, authority to collect data, confidentiality of information collected and ways of disseminating the census results. The census law may be a general one covering census taking in general. Although such a general law may be more difficult to set up in the first place, it has the advantage in that it ensures the regularity of census taking.

14. Another option is to establish a new legislation specific to the census in question. Such a law is easy to set up and can be tailored to suit the conditions existing at the time. When a census law is written to compliment an existing census/statistics law, it will only be required to address the unique features of a particular census such as:

- a) Appointment of the officials to undertake the exercise; and
- b) Stipulating the census process including setting the census date, stating the questions to be asked, who will ask them and to whom.

15. Usually, a combination of both approaches is used. Thus, there is a primary census/statistics law which provides the general rules and the power of the government to undertake a census. A secondary legislation is then issued which stipulates the detailed arrangements of a particular census, such as the date, coverage, content and institutional framework.

16. The census/statistics law should provide a guide to ensure that everyone understands their responsibilities to the data and guards against unauthorized disclosure. It is important for census law to specify the offences for which people may be prosecuted and the penalties for non-compliance. Such offences include:

- a) Households/individuals who refuse to answer the questions or give wrong information;
- b) Enumerators who improperly disclose information collected from respondents; and
- c) Census staff neglecting their role, for instance, enumerators deliberately not covering the whole area under their jurisdiction.

17. It is therefore crucial that the census law be synchronized with any other existing laws in the country.

18. Often the cost of enforcement far outweighs the level of the fines recovered but, if a law is to be made to work, it has to be backed up by effective and visible sanctions. The threat of such sanctions alone is usually sufficient to get the cooperation of people who would otherwise have refused..

2.2 Institutional framework

19. A population census, being a countrywide exercise, will involve large numbers of persons at different times. Therefore, it is very important that a proper institutional framework be set up to implement it. Due to the large numbers of personnel involved and the fact that most of them are employed for a short period (as is the case with the enumerators), it is essential that all persons have clear and well-streamlined roles and reporting arrangements.

20. Implementation of a census will need both core and support structures. A typical census has a secretariat to actually implement the census exercise; and committees to guide, monitor and supervise the secretariat.

Census secretariat

21. The census secretariat will be responsible for the day-to-day implementation of census activities. There are several options for the formation of the census secretariat. The most common ones are:

- a) A secretariat setup within the NSO is where the department responsible for population statistics becomes a central part of the census secretariat. This department will need to be supported by some temporary staff with a wide mix of skills including IT, GIS, communication, among others. These may be seconded from among the NSO staff, from other line ministries or persons hired specifically for the exercise. Whatever the case, whoever is seconded must be available at the time required. This is regarded as the most ideal option because it taps from and preserves the institutional memory of the NSO; and
- b) The second option is where an independent census secretariat is specifically set up for purposes of census implementation. Such a secretariat may be an existing body such as a Population Commission as in Nigeria or in Burundi where the census was organized by the Ministry of the Interior or another temporary secretariat. Such an office, though dedicated to the census activity, lacks linkages with the rest of the National Statistical System (NSS) and will not benefit from the experience and institutional memory existing at the NSO. There is also a risk of losing data and methodology of the operation in cases where the census secretariat is a temporary one.

22. In the majority of African countries, the department responsible for the census will be part of that country's NSO. Therefore, the management structures that are put in place for the census implementation will largely depend on the established management structures in the NSO.

23. A typical census secretariat will have units responsible for: strategic planning; instrument development; publicity and advocacy; mapping and GIS; logistics management; enumeration; data processing; products development; dissemination and census evaluation. These need to be supported by adequate financial and human resources coupled with an effective administrative unit.

24. For purposes of this handbook, the overall head of the census is referred to as the census manager, who is responsible for giving strategic guidance to the entire census programme. In most cases, the census manager reports to the head of the NSO who may take direct responsibility for the census

implementation. If this approach is used, appropriate measures must be taken to ensure that neither the census nor the routine NSO activities are compromised.

25. In fulfilling this role, the census manager will be supported by several activity managers who will be responsible for day-to-day implementation of the census activities. In addition to the activity managers, several other staff will be required to implement the census.

26. The actual number of staff to be employed by the census secretariat will vary depending on the level of activity and stage within the census cycle. However, not all units can be operating at full capacity all the time but there must be some core staff responsible for each activity at all times.

Subnational offices

27. The census is a countrywide exercise whose operations take place at all administrative levels in the country. At the peak of activity, there will be census personnel in all administrative areas that play a crucial role. It will therefore be necessary for the subnational offices to be capable of coordinating census activities at these levels. The specific duties of these offices include:

- a) Attending to the day-to-day matters relating to census implementation in their area of jurisdiction;
- b) Carrying out recruitment, training and deployment of field staff including enumerators and supervisors; and
- c) Publicizing the census and sensitizing the general public in liaison with the local administration and opinion leaders in the area.

28. If the NSO has existing subnational offices, their responsibility may be expanded to include census activities. Care must be taken to ensure that the extra roles relating to the census do not compromise the routine activities of the office. If subnational offices do not exist, temporary ones should be set up specifically to manage census activities. These may follow the administrative structures of the country or may be created to suit the convenience of the census activities.

29. There is a need to minimize confusion and maximize support from these offices. This calls for clear lines of responsibility, authority and decision-making between the subnational offices and the different units of the census secretariat.

Census committees

30. Census committees are needed to oversee the census secretariat in the implementation of the census activities. The committees are usually composed of representatives of organizations with a stake in the census. These include relevant government agencies, development partners, non-government organizations (NGOs), the media, etc. Care should be taken in constituting the committees, at all levels, to ensure that the members are flexible enough to meet as and when required.

31. It must be mentioned that in some countries, there is a High Commission composed by ministries and high policy-makers, which supervises the whole process.

32. The national committee is usually the national supreme body responsible for the census and reports to a higher authority such as the responsible minister, parliament or cabinet. In addition to the national committee, subject specific committees may be set up to offer guidance in specific areas. The most common of these are the census technical committee which oversee the census planning, from instruments design through to products dissemination; the census publicity and media committee

which oversees publicity and communication issues; and the security committee. These committees may be subcommittees of the national committee or may be independent committees but reporting to the national committee.

33. While constituting the committees, care should be taken to ensure that:
- a) There is a clear distinction in the role of the committees/subcommittees from those of the census secretariat;
 - b) The reporting procedures between different entities in the census implementation are clearly explained. There is need to minimize dual allegiance for instance, the census manager should not be reporting to both the national committee and the head of the NSO;
 - c) Committees are created only if they have sufficient work to do. Idle bodies may create confusion in such a delicate exercise; and
 - d) There is control of the census committees so that the interests of the institutions they represent do not adversely affect decisions regarding the population census.

34. The population census will have some activities implemented by the subnational offices. It is usually necessary to form committees at the subnational level to monitor census implementation at the local level and enhance ownership and participation at those levels. Such committees may be set up to oversee implementation of activities such as publicity, security, etc. The membership and roles of the subnational committees should mirror their counterparts at the national level. However, it may not be necessary to have a technical committee at the subnational level since all technical issues would have been resolved at the planning stage and have to be implemented in a uniform manner across the country.

2.3. Capacity of NSOs to undertake a population census

35. A population census involves many activities which are not necessarily part of the usual mandate of the NSO. Such activities include census mapping, publicity, and instrument testing. The NSO needs to evaluate its capacity to undertake these activities within the desired time frame. If the capacity is found to be lacking, the NSO may opt to contract out some of these activities.

36. If subcontracting is to be done, the census secretariat has to ensure the following:
- a) A good system is put in place to manage the subcontract both technically and financially. The NSO should be the driving force of the contract and the contractor left with just the implementation role;
 - b) There is no loss of ownership of the outcome from the census process;
 - c) There is no loss of confidentiality of the information collected as provided for in the law which provides for the census; and
 - d) There is need for capacity building of the NSO and to ensure that the necessary skills are transferred to the NSO staff to carry on work after the contact. This is more critical given the interrelated nature of the census activities.

37. Several African countries have undertaken more than one population census and have built enough capacity in census taking. All African countries should work towards establishing peer support mechanisms (South to South cooperation) whereby countries with the necessary skills, support those countries lacking or with limited skills, including the countries emerging out of conflicts.

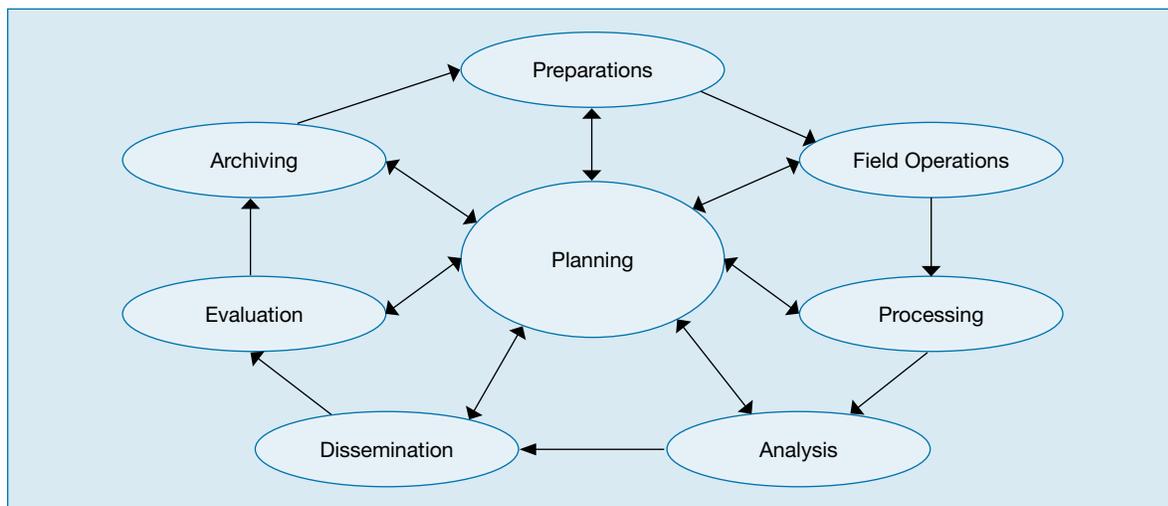
Chapter 3: Census Planning

38. A population census is a huge undertaking and therefore requires good planning for it to be successful. Planning entails identifying what needs to be done, when and by whom. There are different levels of planning that will be required. These include:

- Strategic planning
- Tactical planning
- Operational planning

39. Planning is core in linking the different phases as shown in Figure 3.1. Therefore, census planning can be regarded as the core of the cycle and the process that is most critical to the successful completion of the census exercise. The focus in the early stages of planning will be on setting strategic directions for the entire census programme. Each phase of the census cycle is dependent on a preceding phase and the quality of the output from each one has a direct effect on the success of the next and subsequent phases.

Figure 3.1: Census management cycle



40. The planning process aims at ensuring that not only that each phase is properly resourced and organized, but that the output is of sufficient quality for all subsequent phases and that all relationships between each one are identified. The census cycle has a long duration; therefore planning should not remain static but be dynamic and flexible to take into account changes that occur as implementation goes on.

41. There are a number of issues that require careful consideration when planning for a census. These include specifying the objectives of the census, defining the role of government and other stakeholders, setting goals and targets, developing the overall project plans (including the monitoring plans) and developing a budget.

3.1 Overall census strategy

42. A population census should be demand driven. Therefore, the census objectives should take into consideration the national data and planning requirements. The content and timing of the census should fit within the framework of the national planning and development agenda including the PRSP and the electoral calendar. Consideration should also be given to other data collection efforts in the country (both past and planned) to avoid unnecessary conflict or duplication. The census should also take into account all the core topics recommended in the UN P&R (Revision 2) which were approved by the United Nations Statistical Commission (UNSC). This would ensure comparability of census information among different countries.

Setting the enumeration date

43. Planning for the census is a long, iterative and protracted process. However, certain key decisions have got to be taken early. One key decision is the date when the census results are needed. Other important and related decisions include a decision on the enumeration date (month and year), method of enumeration and method of data capture. These need to be fixed early in the planning process since everything else is dependent on and scheduled to these.

In the first quarter of 2009, Ghana experienced a transition from an old government to a newly elected one with associated changes in top level government appointments. The National Census Steering Committee had to be reconstituted. Also, the Central Procurement Board and the Ghana Statistical Service Board were affected.

Though it was smooth, the transition took some time and therefore affected the timing of the piloting of the census which was planned for March 2009, the best period for censuses as there is an absence of rain and the opportunity to use teachers as fieldworkers due to the closure of schools.

The trial census was eventually held in November 2009 – a period of the minor rainy season and in which most educational institutions were in session. Ghana Statistical Service (GSS) therefore had to fall on non-teachers for the trial census fieldwork and therefore could not take advantage of the well structured system of supervision of Ghana Education Service (GES) by using head teachers as supervisors and teachers as enumerators. Teachers are found all over the country, even in the most remote areas. Other activities also affected by the transition included procurements, particularly that of a data processing solution.

44. Ideally, the enumeration should be carried out when it is easier to reach as many people in the population as possible. Therefore, the choice of date needs careful consideration. Ideally it should be a time of limited social, agricultural activities or festivals and limited population movement (e.g. pastoral movements). This will ensure a greater likelihood of people being at their usual place of residence, enabling enumerators to get to them.

45. Weather conditions can affect the ease of movement around a country by the general population and to some extent by the field staff. This should therefore be taken into consideration when setting the enumeration date. Similarly, periods with many tourists/holiday makers should be avoided.

Census timeline

46. A population census has three major phases, namely the pre-enumeration phase; the enumeration phase; and the post-enumeration phase. The phases are further broken down into specific activities and smaller tasks. When the enumeration date is set, planning for other activities can begin. A schedule should be created for each major activity.

47. It is essential from the onset to develop a critical path so that key dates are known so as not to affect other activities. In general, a period of about three years prior to the enumeration date is generally recommended for the planning phase of the census. Another 2 to 3 years (with scanning, the delay should be shorter than 2 years) may be needed after the enumeration to carry out the data processing, analysis and dissemination of the findings, and evaluation of the census. The population census activities are highly inter-related and therefore it is crucial that the processes are implemented according to the schedule, as a delay in one activity can lead to a delay in other processes. Examples of such critical dependencies include:

- a) A fully tested questionnaire is required before a pilot census can be conducted;
- b) An updated geo-database (from the census mapping) is a pre-requisite for the planning of the census enumeration;
- c) Questionnaires need to be printed and delivered before training of enumerators (and eventually enumeration) can commence; and
- d) Enumeration must be completed before the Post Enumeration Survey (PES) field activities can begin.

48. The critical path should include administrative process (elaborating and issuing the act, setting board/or commissions/committees, staffing, data processing, mapping, mobilization of funds and acquisition of materials and equipments).

49. A commonly used approach is to use the Gantt chart which provides a visual perspective of the work plan. It gives each task a name, duration, start and finish, and timescale. Figure 3.2 gives an example of a census plan.

Figure 3.2: Gantt chart of basic census activities

MAJOR ACTIVITY	Months before census				Census date	Months after census			
	36	24	12	6		6	12	24	36
Setting up the census secretariat	XX								
Census planning	XX								
Mapping	XXX	XXXX							
Questionnaire design	XXX	XXXX							
Pilot census			X						
Procurement of field logistics			X						
Recruitment & training of field staff				XXX					
Enumeration					X				
Post enumeration survey						XX	XXXX		
Data processing						XXXX	XXXX		
Analysis and dissemination						XX		XXXX	XXXX
Census evaluation				XXXX					XXXX
Archiving									XXXX

X – Activity is taking place at the time

Method of enumeration

50. A choice has to be made on the method of enumeration to be used. There are two common approaches of enumerating the population namely *de facto* and *de jure*. The *de facto* census counts people where they are found on census day, whilst the *de jure* counts them where they *usually* live.

51. In the past, most countries conducted a *de facto* census whereby individuals were counted where they were found on census night. The census night is usually fixed in countries that experience high mobility. The *de facto* approach is usually desired because it easily ensures that everybody is counted only once.

52. It is becoming common to use a combination of both methods at the time of the census, where enumeration is done on a *de facto* basis but the characteristics of usual household members who are away at the time are also recorded and identified as 'Not Present'. The *de facto* information would be used to provide the figures on the population size and distribution. On the other hand, while the *de jure* information is used to study population characteristics, such as economic activity and mobility/movements (internal migratory flows); it is also useful in making population projections.

53. The choice of method to use should be decided based upon the country's needs. In such cases, a detailed description of the enumeration method used needs to be provided to the data users.

Technology to be used for data capture

54. There are several systems that can be used for data capture including direct keyboard entry or scanning technology. A decision on which system to use needs to be taken early in the planning stages.

3.2 Resource requirements

55. Census undertaking will require a huge amount of non-financial resources including personnel, transport storage space, office space and equipment, including cars (especially if they are to be imported, given the administrative process), furniture and stationery. These resources may not be in existence at the NSO in the required quantities; therefore, appropriate plans for acquiring them need to be developed early in the census planning.

56. One of the options for minimizing the cost of the census is to form partnerships with other government agencies and share resources. Examples of these include use of other government institutions for office space or staff (such as pupils or teachers), obtaining transport from government ministries or using government printers to print the questionnaire.

Human resources

57. Human resource is the biggest resource required for any census undertaking. These include the census managers, professionals, field staff (enumeration and mapping staff), data entrants and support staff. These will be required in different numbers and at different times during implementation. The biggest number of staff will be required for field based activities (field mapping and enumeration) and during data processing.

58. The types and number of staff that will be required for census undertaking is highly affected by the method used for data collection (face-to-face interviews, self-completion, mail interview, etc) and the method used for data-capture (direct key board entry or scanning technology). Therefore, these decisions need to be made early in the planning process.

59. Priority should be given to appointing the census manager who will take charge of overseeing the entire operation, including the recruitment of all other staff. The census manager should have a good combination of technical and managerial skills. In addition to the census manager, a core team composed of professionals and administrators will be required to support the census manager. They are expected to remain in place throughout the entire operation.

60. Since most NSOs in Africa have undertaken a population census or a large scale sample survey, individuals who participated in these are a good source for core team members as they are likely to have the required skills. As the census activities intensify, more persons will have to be recruited. In order to plan the staffing levels, it is important to develop a complete list of all tasks that need to be done, when to be done and by whom so as to determine the desired numbers and skills mix.

61. Given that the census activities are short term (3 to 5 years) and yet require skilled personnel, it is highly recommended that the census personnel are seconded from among the skilled staff of the NSO or any other government agency rather than recruiting fresh and inexperienced staff.

Office space

62. A census office needs to be up and running at the very beginning of the census taking process in order for work to start. Office space will also be required for the subnational census offices to carry out recruitment, training and storage at a local level. However, these will be operational for a short period around the enumeration time. If the NSO already has subnational offices, they can be used for this purpose. If they do not exist, then they need to be planned and budgeted for alongside the main office.

63. The different stages of the census will require varying amounts of space. Mapping will require ample space for display and reproduction of maps. The data processing stage will require the biggest amount of office space to accommodate the different activities including coding/verification and data capture, as well as room for storage of completed questionnaires. A processing centre to accommodate these processes is essential, as further elaborated in section 9.2.

64. In addition to office space, office equipment and furniture will be required. Also some special furniture for office based mapping activities, which include extra tables and even boards for displaying the maps.

Storage space

65. Safe storage of the census questionnaires is a big concern in any census operation. Space is needed for receipt and packing of materials before enumeration and will also be required during data capture. The questionnaires have to be kept for some time after processing to allow for any crosschecking and therefore, space will be needed for their final storage after processing.

66. While choosing the census offices, some of the key considerations are security and accessibility. Security is vital to ensure that no tampering or deliberate damage occurs to the census questionnaires, so that the results produced can be trusted by the entire population. The questionnaires also need to be protected from other disasters such as rain, winds, etc. Ideally the questionnaire storage needs to be located within the census secretariat premises. Paper is heavy and there will be a lot of it. Therefore, the ground-floor office space is ideal for questionnaire storage. The security of the completed questionnaires is also very important so if it is in the same building, it can be easier to monitor.

Transport

67. Transport is an important component of the census during the preparatory phase as well as the enumeration. The choice of transport to use depends on country/area specific considerations.

In one country, the scarcity of fuel stations engendered fuel shortages and then hindered the development of activities in some regions.

The raining seasons had occasioned important detours from what had been planned before, so fuel consumption were seriously increased and also cars « health » were affected.

In other countries, the Army assisted in dispatching materials and accessing some difficult areas.

3.3 Census financing

68. A population census is the biggest and most expensive data collection activity that a NSO will undertake. The costliest phase in a census undertaking is the enumeration phase. The costliest components are salaries, equipment and transport. The strategic planning process should include a comprehensive resource mobilization and management policy.

Census budget

69. As part of the census planning, the census secretariat needs to develop a comprehensive, well-structured, itemized and time-specific budget. It is therefore important to know what activities are going to take place and when, so that a cost can be attributed to each and built into the overall budget.

70. For each item, one needs to know what quantities will be required and when. For many, the main cost is personnel (wages, training, expenses) and all other aspects of employing people. It is important that each individual item is budgeted for, because despite a low unit cost, the total cost is likely to be high because of the large numbers required. A contingency provision is vital for unplanned expenses and costs that are higher than expected.

In one country, the activities of the PHC were not insured and no budget had been allocated for that. Therefore, motorcycles were stolen and bad accidents happened to the fieldworkers. Since nothing was allocated to the reimbursement of treatment, enumerators confiscated the questionnaires.

71. A population census is implemented over a period of time; therefore, its original budget will be affected by inflation over time. To address this, one could make the budget at current prices and add an adjustment at the end to cater for inflation based on recent trends in price movements. The other alternative is to forecast inflation and adjust the unit prices accordingly. Whichever method is used, it needs to be noted and understood in any request for funds. It is important to budget for the PES at the time you are budgeting for the main census, so that the former, benefits from the overall budgeting. Experience in Africa shows that PESs more often than not run short of funds because they were independently budgeted for after undertaking the main census.

In one country, the Act for advance payment for the training had been delayed creating a massive resignation of employees. The long delay in sending payment to the regional treasurers for field workers, caused disruptions in activities.

Therefore, some fieldworkers who had not been paid at the end of the operations, kept questionnaires at least for four months until they got their salaries; in some cases, some EA files had not been found at all.

Sources of census funding

72. The national government should take fully responsibility for census funding. However, experience from the 1990 and 2000 RPHCs showed that African governments were not able to fund censuses in totality. From the countries which have already conducted the 2010 round of census, more and more countries contribute to the funding of their PHC. In any circumstances, it is not recommended to start the process of census before having the whole required budget.

Financial management

73. A census is a massive exercise involving a lot of expenditures taking place at many operational centres. Therefore in addition to looking for resources, the finance unit needs to set up a good financial management system:

- a) It should have appropriate control measures to control wastage and misuse or misappropriation of resources at all stages;
- b) The system should be able to quickly respond to emergencies, for instance if there is need for an emergency procurement of extra census materials; and
- c) Good management of resources enhance confidence in those who provided funding for the census and therefore, may have high prospects for future financial support.

3.4 Linking of data collection activities

74. The UNSC has considered three broad statistical activities (PHC, household surveys; and administrative registers) as inter-related and essential for the study of population and housing. It is both efficient and effective to integrate the basic national survey needs of the country into the census planning. Both surveys and censuses can be linked at the national (and international) level by requirements for common definitions, concepts, classifications, and tabulation programmes so that they may collectively meet the programme and policy requirements for standardized and comparable information.

75. There is need for international agreement on standards and methods supporting cross-comparisons of census results. In a number of countries, the long census questionnaires are being replaced with sample surveys that are conducted separately during the inter-censal period, but linked to the census. In other cases, surveys and various sets of national administrative records have been linked to obtain data that have traditionally been collected in a population census.

76. In recent years, register-based censuses had begun being used in countries where administrative data are readily available. Community surveys (a form of household surveys) are also being used innovatively as important complements to traditional censuses.

3.5 Census quality assurance

77. Quality within the context of the data refers to the output produced and covers the following areas:

- a) **Relevance:** The degree to which the data meets the needs of users. It shows whether the data shed light on issues of importance to the user;
- b) **Methodological soundness:** The application of international standards, guidelines and agreed practices to produce statistical outputs. Application of such standards fosters international comparability;
- c) **Accuracy:** How close are the estimates to the true value; the degree to which the output correctly describes the phenomenon it was designed to measure;
- d) **Timeliness:** The period of delay between the reference point to which the information pertains and the date when the information become available;
- e) **Accessibility:** The ease with which information can be obtained from the agency. This includes ease with which existing information can be obtained, as well as suitability of the medium through which the information can be accessed by users. The cost of the information is also an aspect of accessibility;
- f) **Interpretability:** The ease with which users understand statistical information through the provision of metadata.
- g) **Coherence:** The degree to which information can be brought with other statistical information within a broad analytical framework and over time; and
- h) **Integrity:** Values and practices that maintain the confidence of users in the agency producing the statistics and ultimately in its statistical products.

78. There is a need to balance the different aspects of quality. For example, obtaining accurate census data takes time and so there needs to be a balance between accuracy and timeliness.

79. No census will ever perfectly count everyone in the country but it is important that the Census tries to reach as many people as possible, and where necessary, measures are implemented to adjust for undercounting and incompleteness.

80. Cost is another important factor that affects quality, so there may also need to be a balance between quality and cost. To ensure quality outputs are delivered, quality needs to be built into all the census processes, from planning through to dissemination. It is generally more cost-effective to invest in activities that prevent things going wrong, so that fewer things will go wrong and less checking is be required.

Census quality management plan

81. A Quality Management Plan (QMP) is a useful way to set out how quality will be achieved in the census. This is broader than a work programme and would show how quality will be built into all aspects of the census process to ensure that the end product is of the required quality. A QMP should cover all or some of the following areas:

- a) **Commitment from leadership:** To achieve quality results requires commitment from the leadership team supporting the project as well as from others such as the census project board. The QMP can show potential users of the data that the leadership team is committed to producing a high-quality product and will provide the leadership which is necessary to do this;
- b) **Training:** The training of staff is essential to ensure that they can carry out the necessary tasks. This can be an ideal opportunity to show staff the importance of quality in all aspects

of the census process. It is helpful if staff can be encouraged to feel responsible for maintaining and improving quality. The QMP could set out the general approach to training and show how the training will be used to help staff to feel responsible for maintaining and improving the quality of the census;

- c) Documentation: The QMP could set out clear guidelines for implementing standard documentation of all processes. This should help to ensure consistency of approach as well as providing a set of clear standards against which the work can be measured; and
- d) Review and evaluation: At all stages of the census it is important to check on the process. This procedure, which is outlined in the next chapter shows how work should be planned then implemented, followed by a checking process (this could include provision for an independent audit or check of some of the work); then any necessary changes that are to be made to the process This should be continual, whereby improvements are constantly being made to the census processes.

Chapter 4: Development of the Census Instruments

Introduction

82. One of the measures taken to assure the quality of the census is the use of standard tools. There are several instruments that are required in census processing. These include those for collecting the information such as questionnaire(s) and those for guiding the process such as; code lists, instruction manuals, training manuals, work schedules, calendar of events, among others. The accuracy of the Census data depends much on how well the instruments are designed in both content and layout.

4.1 Census questionnaires

83. Prior to development of the questionnaire, it is essential to decide on the *indicators* that are required from the census. The choice of indicators should be informed by the national development framework as well as regional and international data needs. After deciding on the expected indicators, a tabulation plan² needs to be developed. This plan includes tables meant for direct publication, those for use in analytical work and those to be used as reference tables.

84. A detailed tabulation plan serves to ensure that all the desired information is collected (the right questions are asked), the information is coded in desired categories and disaggregated to the desired levels of geography. Thus, the tabulation plan guides the design of other instruments (see UN P&R, Revision 2).

85. In some cases, tabulation plans have not been explicitly drawn in advance, which usually has created problems at the analysis stage where either the desired data were not collected, or if they were collected, they were not coded/disaggregated in the desired way.

Content of the census questionnaires

86. A population census is the only statistical exercise in which the entire population is covered at the same time. Therefore, there will always be a desire to collect as much information as possible. A census questionnaire is the tool that is used for collecting information from the public. The type of questionnaire, its format and the exact wording and arrangement of the questions require very careful consideration, since the handicaps of a poorly designed questionnaire cannot be overcome during or after enumeration.

87. The following are some of the critical factors that should be taken into account when designing the questionnaire:

- Type of data to be collected
- Method of enumeration to be used
- Type of technology to be used for data capture

² A Tabulation Plan is the set of tables that will be expected to be derived from the census data.

88. Designing the questionnaires starts with a decision on the topics to be included.³ The choice of the topics would be guided by the objectives set for conducting the census and the indicators expected there from. The UN P&R for PHCs has a list of recommended topics (core and non-core), covering topics on both housing and population characteristics (Appendix 2), which can act as a good starting point. In order to take care of the needs of many stakeholders, the census secretariat should consult as widely as possible. This can be done through a variety of media including formal meetings with stakeholders (including line ministries), seminars and workshops, emails or online inquiries.

89. Once the list of topics (and reasons for inclusion) has been solicited, the census secretariat should prioritise those topics to be included. There are several criteria that can be used for the inclusion/exclusion of any topic:

- a) Need: Relevance of the topic needs to be well understood and that there are no other better means of obtaining the same data;
- b) Practicability: Questions need to be easily understood, it should also be easy to phrase and easy to code for data input;
- c) Acceptability: Some topics may not be acceptable due to fears of invasion of privacy; or on cultural and other social grounds.. Such topics should be left out of the census completely as their inclusion may negatively affect overall response rates; and
- d) Cost: Every topic has a cost in terms of interviewing, processing and storage time, as well as the impact on the overall quality of the data.

90. Having decided on topics to be investigated, the next stage is to choose the questions necessary for each selected topic. It is the questions (not the topics) which will be asked to the respondents. The questions should be chosen carefully and should be short, clear and concise, with clarity of language that can easily be understood. Too many questions can lead to questionnaire fatigue from both the enumerator and the respondent. The primary choice is relevance to the selected topics. As with topics, a process of checking need, practicability, acceptability and cost for each question can help the decision making process.

91. The census secretariat should keep a list of all topics and questions considered, with their outcomes and reasons for acceptance/rejection. This is a key piece of documentation and can be used as a starting point for discussion on topics during the subsequent censuses or the inter-censal sample surveys.

92. In the past, many countries have used two types of questionnaires. These included:

- a) A short questionnaire administered to the total population. This would have a few questions mainly to be used for determining the size, composition and distribution of the population; and
- b) A long questionnaire with more detailed questions which were used to study the demographic and socio-economic characteristics of the population. This questionnaire would be administered to a representative sample of the population e.g. in urban and rural areas.

93. However, in the recent past, there has been a tremendous increase in availability of specialised data through the national survey programmes. Therefore, it is recommended that the population census maintains one uniform questionnaire for all persons in the country. The extra questions should be made part of the country's sample survey programme, which is fairly advanced in most countries.

³ There may be more than one question that can be used to solicit the information on topics such as disability, economic activity.

Method of data collection

94. There are several approaches that can be used for collecting the data. These include face-to-face interviews, telephone interviews or self-administered interviews. Each method of interview has different requirements and poses different challenges.

95. The self administered questionnaire requires a literate population and that all questions are clear and easily understood; despite the cost advantage, this option is not applicable given the low literacy rate in many African countries.

96. The face-to-face interview approach is most commonly used in African countries for the majority of the country's population. This approach will benefit from the enumerator's training and the use of a detailed enumerators' manual. Countries may however, use a combination of methods, choosing the method of enumeration which best suits a given subpopulation.

Unit of recording

97. A census entails enumeration of every individual in the country. A decision has to be made on the unit of recording and this will affect the format of the questionnaire:

- a) A single questionnaire per household with a provision for recording the characteristics of all household members on the same questionnaire. This approach requires fewer questionnaires thus reducing printing costs;
- b) A separate questionnaire per individual. This will require as many questionnaires as the total population in the country and hence costly to print; and
- c) A combination of the above where there is a household questionnaire on which all the household members are listed as well as the common characteristics of the household; and another questionnaire for every individual. This is very expensive as it requires as many questionnaires as the sum of individuals and households in the country.

98. The final choice of the questionnaire will be guided by mode of enumeration (self administered or interview), technology of data capture and cost.

Questionnaire layout

99. The design/layout of the questionnaire is determined by several factors which include how the questionnaire is to be filled, the working conditions and the technology to be used for the data capture. It is preferable that the information relating to a given unit of enumeration is kept on a single sheet of paper. Multiple pages are harder to handle in the field and have chances of partial capture, or stand the risk of information switching during processing. The cost is also one of the factors which determine the format of the questionnaire.

100. Many decisions regarding the data processing are dependent on the final content, form and arrangement of the census questionnaires. An A4 size questionnaire is an easy size to manage and one that is widely available, while a questionnaire larger than A3 paper size is very difficult to manage in the field. This is because enumerators are not likely to have a large flat surface on which to place them when recording the answers. The technologies to be used for data capture (e.g. scanning), will also dictate the decision on paper size.

101. In addition to paper size, there are other important details that should be considered when designing the layout of the questionnaire: The materials used for writing the response (pencil, black or blue pen) which greatly affects the choice of paper colour and printing ink to be used; Similarly, paper

colour and the ink for printing are also important considerations when scanning technology is to be used.

102. Another consideration regarding questionnaire layout is whether to have it laid out in loose sheets or bound in booklets. Loose sheets are easier to manage and are economical while dealing with contingencies. However, they are more difficult to manage in the field and stand a high risk of vital information getting lost. Loose sheets also increase the burden of material control at the enumeration and data processing stage, since every sheet has to be tracked independently.

Language of the interview

103. In most African countries, there is more than one language commonly spoken and therefore is bound to be used during the census enumeration. This requires the questionnaire to be translated into these languages to ensure uniformity of the translation. Special provisions have to be made if two or more languages are used in the country. However this poses a more serious problem in the case of non-written languages.

104. Several methods have been used to deal with this situation and these include:

- a) A single multilingual questionnaire. This is only feasible where there are few languages used in the country. Care must be taken to ensure that the questionnaire does not become overcrowded and subsequently unclear to the respondent;
- b) A version of the questionnaire printed for each major language. This option may be easy to manage if the languages are few. However, in case of many languages with a wide mix, it poses problems of management including allocation of the questionnaires to the enumerators; and
- c) Translations printed in the various languages in the enumerators' instructions manuals or on separate translation cards that are supplied to the enumerator. This is the most feasible option in countries where many local languages are spoken.

Questionnaire pre-tests

105. Questionnaire pre-tests are carried out with the objective of testing the suitability of proposed census questions. Specifically, the questionnaire pre-tests will test the following:

- a) The formulation of the questions and the enumerators' instructions provided;
- b) The suitability of sequencing the questions on the questionnaire;
- c) The questionnaire layout and design;
- d) Whether people answer the question as you expect them to. If they do not, then you have to find out why and decide how the question could be better phrased;
- e) Adequacy and completeness of the codes provided for each question;
- f) The duration of an interview. This then feeds back into the overall planning of the main census enumeration; and
- g) Correctness of translations whether pre-printed or spontaneous.

106. Questionnaire tests involve using the draft questionnaire and administering it to a set of individuals. This may be done informally (by asking the questions to a few individuals) or formally in a field test. The magnitude of the test will vary with the complexity of the questionnaire. The longer the questionnaire, the higher the number of cases required to test it.

107. One questionnaire pre-test may be sufficient for the census planner to draw a conclusion. However, if major changes are made to the questionnaire after the pre-test, especially those leading to

introduction of new questions, then another pre-test should be carried out. Under no circumstances should a question be regarded as final without being pre-tested.

108. In addition to the questionnaire-specific pre-tests, the questionnaires will be tested again as part of the pilot census. This is further elaborated in section 4.3.

4.2 Other census instruments

109. Several other instruments will be required to support the census enumeration. These will vary with the method of enumeration to be used and they include: household listing forms, code lists, instruction manuals, training guides and population summary sheets.

Household listing forms

110. In some countries, a household listing exercise is carried out prior to the actual enumeration. This serves to improve coverage by ensuring that the total number of households in an area is known prior to the actual enumeration. The household listing form has to be developed with the necessary questions that will be used to cross-check the accuracy of the census coverage.

Code lists

111. A code list is a set of codes that are assigned to all the possible responses to census questions. Data are coded to ensure ease and consistency during data capture. The codes must be exhaustive (take care of all possible response options) and mutually exclusive (no response option falls in more than one coding category). Numeric codes are generally preferred to the alpha-numeric because they tend to be easier and quicker to data capture. To the extent possible, open-ended questions should be avoided in a questionnaire.

Instructions manuals

112. In order to ensure uniformity in the understanding of the census concepts, all census field staff should be provided with a set of Instructions that guide them in all aspects of census implementation, whether technical or administrative. These include the census methodology, the quality assurance procedures and any related administrative and reporting arrangements. A census exercise will use several types of instruction manuals to guide conduct of the various activities, including cartography and mapping, enumeration and supervision; coding, and data editing.

Enumerators' instructions manual

113. This manual is a step by step guide on how to undertake the census enumeration. It gives the enumerator guidelines on how to go about their work, how to handle unique situations (when, where and how to refer difficult cases) and the administrative guidelines that are required to support the enumeration. Census field staff at all levels must be conversant with the enumerators' instructions. It also gives explanations of questions.

Supervisors' instructions manuals

114. This manual is a guide for census supervisors on how to undertake their tasks i.e. guidelines should guide the supervisors on what to do during the supervision, how to do it and when. Such tasks include, among others:

- Allocation of assignments to the enumerators
- Areas to look out for during supervision
- Management of materials and human resources
- Supervision of checklist and schedule
- When and how to handle difficult cases referred to them by the enumerator(s) and
- Summarizing of some data that have been collected.

115. The supervisors' instructions should be clear on what roles are to be undertaken at different levels to avoid omission of some roles or over-burdening of some individuals. All supervisors should be conversant with this guide as it is the key to doing their work successfully.

116. Due to the different levels of supervision, the census secretariat has to develop separate guidelines for each level. However, the senior supervisor must be knowledgeable of the junior supervisors' role.

Training guides

117. A population census will have many training centres all operational at the same time (see section 8.2). It is therefore important that clear guidelines on training are developed so that the census information is shared uniformly across the country.

118. The training guide should provide the trainers with information about the training timetable, objectives of every given training session, list of training materials required per session and areas that need emphasis,.

Verbatim training guide

119. The verbatim training guide is the most comprehensive form of training guide which is read to the trainees verbatim. However, the trainer is free to make clarification if desired by the trainees.

120. A calendar of events is pertinent in African countries because it assists respondents to ascertain their ages, in cases where dates of births are not known or recorded. Prominent historical events and dates of their occurrence are therefore given, in the hope that respondents can relate to some of the events, thus enabling them to establish dates of births and deaths.

4.3 Pilot census

121. It is essential that all preparations for the census exercise are thoroughly tested prior to carrying out the actual census. This entails testing the individual processes separately as is the case with the questionnaire pre-test, as well as testing them together. The most commonly used approach of ensuring that the census plans are adequate is to carry out a pilot census.

122. The pilot test is a final test, which is a rehearsal of the main census activity. The latter serves to test the suitability of interaction between the individual processes. This test also provides an opportunity to revise the costing estimates. It should test the entire census process including the instruments, publicity and communication, logistics management, enumeration and PES, data processing and tabulation, and report generation.

Size and scope of the pilot census

123. The sample is usually purposively selected to cover all the crucial elements that need to be tested. Therefore, the pilot census should not be used to generate estimates.

124. The size of the pilot census and geographical distribution of the EAs will be affected by; and depends on, the diversity of the issues to be tested.

125. Other considerations include, among others, the diversity in levels of urbanisation; population types (nomadic and sedentary populations); terrain of the country (flat, hilly, mountainous, island areas, etc.); cultural and social groupings; languages spoken; and the method of enumeration and the technology to be used for processing.

Pilot census enumeration

126. The pilot census should be carried out early to allow enough time for necessary revisions to be incorporated in the census planning process. Ideally, the pilot census enumeration should be carried out at about the same time of year as the actual census enumeration. Thus, it is recommended that a pilot census is taken about one year before the planned census date so as to conform to the expected seasonal patterns of climate and activity (e.g. weather conditions, holidays, agricultural seasons and people's availability).

Pilot census and post-enumeration processes

127. Although most countries conduct a pilot census, in most cases it has only been used to test processes up to enumeration and does not test post enumeration activities. This has the disadvantage that little is known and tested about the adequacy and preparedness for post-enumeration activities, which may lead to delays in production of results after the main enumeration, hence compromising the quality.

128. Specifically, the pilot census should test the data processing Management Information System (MIS), questionnaire registration, coding, data capture, editing and tabulation to ensure that the required information can be obtained from the data.

Chapter 5: Census Mapping

129. Census mapping is a pre-enumeration exercise which is undertaken to update existing maps including updating geographical boundaries of civic and administrative units in the country and delineating the country into EAs and Supervisory Areas (SAs). Census maps are also useful during data collection to minimize errors of duplication/omission and are also used in presentation of census results in pictorial format which enhances effectiveness of dissemination.

130. EAs are small geographical units which are used in the census enumeration. EAs will help to ensure manageable workloads for the enumerators and supervision staff and to help plan, administer and monitor census activities.

5.1 Census-mapping programme

131. To achieve all the mapping tasks required for accurate and useful censuses and other statistical activities, a formal census mapping programme involving systematic preparations, such as use and publication of maps for census purposes, is needed. A mapping and cartographic unit is established with the responsibility of executing the mapping function, where maps are gathered from many sources from which census maps are compiled.

132. The mapping programme should be established as an integral part of the NSO. Mapping undertaken too late or with insufficient planning almost surely will result in maps that are inadequate for the enumeration of critical areas. The NSO will need personnel with strong cartographic background to plan and logically undertake censuses or large scale surveys.

133. The timing of the mapping activities is critical in the overall Census planning. Undertaking the census mapping too early has the risk of generating EA maps that may be outdated at the time of census enumeration, if major boundary changes take place after the mapping exercise (for example, in case of urban areas). On the other hand, carrying out the mapping exercise too close to the enumeration has the risk of either failure to complete the mapping in time for the enumeration or failure to avail the mapping information early enough to be used as an input into the enumeration planning.

During census preparations in Tanzania, the central census office normally requests the Government through the central census committee, chaired by the Prime Minister, not to create new administrative units one year prior to the enumeration. If it happens that a new administrative unit have to be created then the Ministry of Regional Administration and Local Government, which is responsible for creating new administrative units, is requested to ensure that the new administrative units do not cross ward boundaries. In this way, the demarcated EAs will not be disturbed as they are created in such a way that they do not cross administrative boundaries such as sub village, village, ward, district and region.

This is an important measure to ensure total coverage of the population as under this setup, nobody is enumerated twice and no one is omitted either. The demarcation of EAs is done in such a way that all land area falls in one EA or another. Therefore, once the EAs are created all over the country then it is easy to ensure total coverage of the population.

134. There are several decisions that have to be made before the census mapping can start namely:

- a) How much of the information from the previous mapping activities will be used in the updating;
- b) The size of the EAs (population and geographical area) to be demarcated. This is critical, bearing in mind the anticipated size of the questionnaire and the desired duration of the enumeration, in addition to their use in subsequent censuses and surveys; and
- c) The technology to be used in the actual mapping i.e. whether the maps are to be hand drawn (produced manually) or produced in digital format. Hand-drawn maps are mainly compiled from topographic features, maps of administrative units, town and city maps as well as thematic maps, while digital maps can be derived from aerial photography.

135. The census office may decide to use a mixture of approaches. For example, co-ordinates that define EAs are determined using GPS and buildings, roads and other features useful for orientation in the EA are added by hand.

136. The census office has to make a decision on the types of products that are expected from the census mapping programme. These include those to be used in support of the enumeration and those for dissemination of the findings. The following are some of the products that are therefore expected to be produced on completion of the activity:

- Updated administrative unit list and area maps
- List and numbers of EAs and SAs delineated
- Updated geo-information database for socio - economic facilities

137. The tasks and the timing of mapping activities are quite similar whether maps are digital or manually produced. There is a need for map inventory to determine what needs to be done to achieve the required tasks.

5.2 Choice of the census-mapping institution

138. There are two major options of institutions that can be used to carry out census mapping. These include :

- a) NSO: Census organizations in most countries establish permanent cartographic/Geo-information System (GIS) units. In some cases, the unit is created specifically for census purposes and ceases to exist after enumeration is complete; and
- b) Where the capacity of the NSO is inadequate, particularly on the cartographic side, the NSO may opt to out-source the services from a specialized mapping organization, which may be a government or private agency.

139. It should be noted that NSOs are not mapping agencies and should not, for the most part, try to duplicate the functions of one. Likewise, mapping agencies are not statistical agencies and often may not fully appreciate the statistical value of the information they hold or how best to present statistical information in map based products.

140. Despite this, undertaking a census can provide a catalyst for the statistical and mapping agencies to work together to the benefit of both agencies and the community. For instance, the government mapping agency may be used to provide the base maps while the census cartographic unit may update and delineate enumeration areas.

5.3 Organization of the mapping activities

141. While in the field, the census mapping teams are expected to carry out the following tasks:

- a) To update the base maps including all administrative boundaries and names, as well as plotting area boundaries;
- b) To geo-locate socio-economic infrastructure such as schools, churches, mosques, industries, hospitals and parks as land marks using the GPS sets; and
- c) To carry out listing of households/dwelling units and EAs based on the updated maps. This also serves as a preliminary count of the expected population of the area.

142. In addition to the maps required for the census, a systematic, complete and up-to-date listing of localities is needed for the coding of place names and for determining to what extent data for localities will be tabulated. In some countries, establishment of a definitive list of localities is a major operation because of difficulties arising from the frequent fragmentation, disappearance or combination of small localities and from changes in name, variations in spelling, the existence of more than one name for the same place or the use of identical names for different places. This listing should be held as a formal database or as an integral component of the databases forming part of a GIS.

143. Census mapping is different from regular cartographic activities. Therefore, the mapping field staff have to undergo training on mapping procedures. If the GPS is to be used to obtain point feature locations, then the mapping staff needs to be trained on the procedure for collection and storage of these locations. Likewise, if a list of households/dwellings is to be compiled alongside the mapping, the field staffs needs to be trained on identification and location of the households/dwellings.

144. A census-mapping operation involves several activities being executed at the same time. These include updating of area boundaries (assuming some maps do exist), listing of households/dwellings, collection of coordinates for point features and finally EA demarcation. It is therefore important to combine the staff into teams with appropriate number and skills mix so that all tasks pertaining to a given geographical area can be accomplished by a single team. For instance, a team may have two persons updating area boundaries, one person listing the households and one person collecting point features.

145. The field-mapping group will involve several teams of staff and a decision on their deployment is crucial. One option is to deploy all of them in the same area to carry out the mapping and complete in a short time, then move to another area. Another option is to deploy each team in its own area where they take longer to complete the mapping.

5.4 Delineation of enumeration areas

146. The principal objective of EA delineation is to create EAs, so that one contains a population that is approximately ideal in size. An ideal population size is the number of people that one operator can enumerate in the time period scheduled for enumeration.

147. There are some factors that may determine the size of an enumeration area to vary from the ideal in population size. They include the need to observe administrative boundaries; use of well-defined visible features as EA boundaries; and to consider the enumerators' amount and ease of travel. In some countries, EAs are accommodated to the administrative units; e.g. in Rwanda, EAs correspond to cells units, which are an administrative unit of around 100 households.

148. There are several other considerations that affect the decisions that are made about the number of enumeration and supervision areas to be delineated and the kinds of features that are chosen to be used as EA boundaries. One of the major considerations is size; it has two meanings in connection with enumeration areas. It is used most often to mean population size, that is, the number of people in the EA. On the other hand it may be used to mean area size.

149. The ideal EA size is determined on the basis of pretests of the questionnaire and procedures that are to be used in the census, e.g. if the field pretest shows that 16 households can be enumerated in a day in urban areas, but only 10 in rural areas, and if the enumeration period in both types of areas is to be 10 days, then the ideal urban EA would contain 160 households and the rural EA would contain 100 households.

150. After EA base maps have been compiled and drafted, individual EAs should be established. This is done by making one or more enumeration areas out of the smallest administrative divisions or statistical areas for which census data are to be tabulated. This process is called EA delineation. The collected information is used in the construction of a geo-file that forms the information base for census data capture, cleaning and editing.

151. In the rural areas which are generally sparsely populated, only a few households can be enumerated in a single day due to the distance one has to travel between households. On the other hand, in the urban areas, the problem of getting the respondents at home to enumerate them may reduce the number of households to be covered in a day. This is more so when the enumeration is extended over a long period of time. Ideally, an enumerator should enumerate one and only one EA. Ideally census enumeration should take one day to complete.

5.5 Post-enumeration mapping activities

152. Maps play an increasingly important role in the dissemination of information. Statistics compiled from census data can be geographically referenced and provide for methods of analysing the geographic characteristics of those statistics. Maps are produced and effectively used to relate statistical data to the geographical area to which the census results refer. This makes the statistics easier to understand and more readily usable both by expert users and the general public.

153. A GIS is a computer-based system for managing spatial data. The word geographic in the context of the census cartography implies that the data locations are known or can be calculated in terms of geographical coordinates, while information implies that the data in the system are organized to yield useful information.

154. The use of digital mapping can also bring an enormous workload and requires sufficient expertise in the process. Digital maps can be analysed, manipulated and disseminated to suit the requirements of the many users. Digital mapping techniques ensure accessibility of data and geo reference information (relating information to geographic location) for the decision makers. In rapidly growing urban areas, remote sensing techniques can enable census cartographers to quickly update city maps. New technologies can thus be useful to fill gaps that would be difficult to cover by traditional approaches.

155. The primary purpose of GIS is to provide support for information based decision making. In the context of census cartography, GIS will be used to assemble EA data to facilitate logical planning.

156. The potential of GIS is to answer questions of what, where and how much. If well harnessed, GIS brings about significant assistance in deciding on priorities and alternatives for enumeration. Therefore, with a proper organizational framework and detailed implementation strategic plan for GIS, a number of questions with regard to the EA, will be addressed (such as total number of dwelling/ households per EA or locality). The crucial issues concern distance between localities within the EA. GIS has the potential to address these issues.

157. The quality of geo-information, including maps that are used in the census undertaking, has a major influence on the quality and reliability of census data collected.

Chapter 6: Census Logistics

Background

158. A population census uses lots of different types of equipment, materials and supplies; including cars, motorcycles, computers, printers, bags (to carry all the materials and protect them from rain and/or dust); questionnaires in sufficient quantities, training and instructions manuals; writing materials (pens or pencils depending on the method to be used in filling questionnaire); material (chalk, markers) for identifying households; map of their area of responsibility; staff Identification (such as identity cards, appointment letter, badge, apron); and other logistics control forms.

6.1 Determination and allocation of enumeration materials

159. It is important to estimate the amounts required and their distribution among the different operational areas. Information from the census mapping on the number of households expected and distribution across the country is very instrumental. An appropriate amount of contingency materials needs to be built in the estimate since there will be no time to procure and distribute more if shortage occurs during the enumeration exercise.

160. Printing of enumeration materials is a very sensitive process and should *not* be rushed. In case of scannable questionnaires, the alignment of the questionnaires on the paper is as important as the legibility of the print. Ample time also needs to be devoted to proofreading the different instructions manuals to ensure that there is no alteration of the message. Equally important is the need to check the final product when it is delivered, all of which require time.

161. Procurement needs to be done early because of the huge amounts involved and yet, the enumeration process cannot start if some of the enumeration materials are not available. In some cases, some materials may not be locally available in the country (e.g. if special pencils are required for filling the questionnaire) and have to be procured from outside. Ample time is required to take into account time required for shipping and clearing of the items.

6.2 Packing of enumeration materials

162. Once printed, the enumeration materials are received at the head office prior to their distribution; space will be required for materials and for packing. It is most logical to pack materials by the operational unit e.g. all materials for an EA are packed in one bag. Materials for several EAs but within the same SA are also packed together. This will ease the process of distribution once the materials are delivered in the field.

163. An appropriate contingency needs to be provided to the field staff to take care of unforeseen deficits. The amount and level of implementation needs to be determined at the planning stage. While a contingency provision at the lowest level EA is most convenient in terms of implementation, it is

wasteful, as many of the EAs will not require the contingency. On the other hand, a contingency provision being tagged to a very big area will delay work, as the enumerator with a deficit will take long to access the supervisor with the contingency. A compromise between the two options has to be struck.

6.3 Distribution and retrieval of enumeration materials

164. The training materials need to reach the training centres before the training can commence. Similarly, enumeration materials need to be distributed to the enumerators and other field staff prior to the beginning of the enumeration process. This calls for development of a good distribution system, so that materials are delivered when they are needed and can be retrieved soon after being used.

165. There is also a need to ensure that the correct type and quantity of materials are in the right place at the right time. There will be storage needs at various locations and for various times including storage before training, during training, enumeration and after the enumeration. Unfortunately, there may be no storage space at the subnational offices for storing these materials for a long time. This calls for careful logistics planning.

166. In order to track the distribution of materials, control forms have to be designed and filled at all levels. These would show what materials have been dispatched/received and for which operational area. This can be compared with the plan shown in section 6.1. Similar forms are needed when materials are being returned to ensure that all dispatched materials return. A good MIS would be handy in tracking the flow of materials and ensuring that no materials remain unaccounted for at any stage. Some countries called for the Army in dispatching material, equipment, supplies and staff to areas with difficult access (mountains/hills, forests, desert, islands, etc.).

Chapter 7: Census Publicity and Communication

167. A census is based on the trust, support and cooperation of the general public and is a key to the success of any census operation. To gain public trust, official statistics must respect certain principles:

- a) There must be public access to the information collected;
- b) The information collected must not reveal individual persons and their characteristics. Information is compiled and made available impartially. Official statistics must honour the citizen's entitlement to public information and use scientific principles and professional ethics on procedures. Information collected on individuals and their households is strictly confidential and is used only for statistical purposes. Laws and regulations under which statistical offices operate are to be made public. When these principles are violated, they result in lack of trust and public cooperation. This reduces the validity and reliability of the information; and
- c) Public relations campaign of necessity promotes the cooperation of the public. Distrust and fear by a considerable number of people can be reduced through an extensive publicity campaign.

168. Although the census law usually makes it a legal requirement to participate in the census, this may in itself not be sufficient to achieve the full public cooperation desired for successful census enumeration. Therefore, census publicity must be undertaken.

7.1 Census communication strategy

169. The primary goal of a census publicity campaign is to inform the general population about the census. It aims at ensuring that policy makers, opinion leaders and all citizens are aware that the census is going to be undertaken, what information will be obtained from of it, how it is useful to them and what is expected of them. Census publicity is also required in the post enumeration period to promote the use of census results as it becomes available. In order to achieve its objectives, the census publicity campaign should be an integral part of the overall census planning and phases.

Census publicity objectives

170. A census should consider the target populations, including their attitudes towards the census, identify issues that need to be addressed, such as the opinions of stakeholders, potential use of census information for non-statistical or inappropriate purposes, and concerns about potential government intrusion into private affairs.

171. Further, a census requires definition of target audiences such as influential people, e.g., religious leaders, teachers and unions; heads of households; opinion leaders and public figures who can endorse the census; population groups (e.g. ethnic groups) with special geographical, social, communication or logistical disadvantages; speakers of the national languages but also of other languages; staff of the census agency, the media (print and electronic); and census-data users. It should also identify seg-

ments of audiences or communities that require particular attention, including those who may have been under-represented in the past.

172. The strategies through which the publicity campaign will be implemented, such as the building of awareness through effective media advertizing and an active media programme of information dissemination.

173. The implementation of a publicity strategy depends on a country's cultural, social and administrative circumstances, as well as on the mass media role and should be directed at the following:

- a) The census office staff: The staff should be regularly briefed on publicity strategies or be given background information on the publicity campaign so that they are aware of the communications environment that will impact on their work;
- b) General external audiences: Publicity should be greatest just prior to and during the enumeration activity; and
- c) Other audiences: Those who require particular attention and tactics when implementing the publicity strategy, including people travelling on census night, the homeless, overseas visitors, minority ethnic groups within a community and isolated populations (living in mountains, islands, desert, forest, refugees camps).

7.2 Publicity tools and media

174. There are numerous channels of communication with varying levels of effectiveness in reaching different subgroups of the population. Therefore, the census campaign should use a mixture of methods to adequately target the various audience groups. Some methods and media that have been used in the past and include census at schools; census handbook as part of the school curriculum; census T-shirts for babies born on census night; census coins and stamps; and T-shirts for census-mapping teams. Other census-promotion materials include:

- a) Census posters: These must be clear, unambiguous and displayed in official places;
- b) Information leaflets: To be distributed to every dwelling/household within a country some days before the enumeration;
- c) A census song or drama: To be done in all the main languages, composed and aired on radio stations;
- d) Mass media: TV, radio and newspapers, where Information about the census can be presented;
- e) Lectures: To be organized in various institutions (e.g., municipalities, and universities, among others.);
- f) Influential personalities: Such as politicians, village heads, religious leaders, industry leaders, sports people and popular entertainers making announcements about the importance of the census; and
- g) Schools, that are provided with resource materials about the census with a view to voicing the census messages to their students/pupils so that they in turn pass them on to their parents/communities.

175. In addition to publicizing the census, it is necessary to have publicity-support services to provide assistance and to handle concerns or complaints by the public. Such support services include a census web page, e.g. on the census office's website; a telephone-based enquiry service or hotline providing standard answers; broadcasting radio messages; and engaging with community/opinion leaders so they have information to pass on to their communities.

176. The publicity campaign needs to be continuously evaluated from the beginning of the campaign, with regard to cost, content, target and impact. The census secretariat should use market research to ascertain the effectiveness of the publicity.

7.3 Census publicity campaign

177. Census information is required for all aspects of the census including questionnaire development, census mapping, the pilot census the main enumeration and during the post enumeration phase. However, the coverage and intensity of the publicity will vary with each activity. More publicity will be required for the field-based activities such as census mapping, the pilot census and enumeration.

178. Census publicity should reach its peak during enumeration. That is the stage which requires the most intensive and widespread publicity campaign. The campaign should publicize all necessary information about the enumeration to get the total cooperation of the public.

In Mali, the sensitization of Ministers has been done in conjunction with the enumeration of households. It has been elaborated as a “VIP census calendar” following memos sent by their counterpart in charge of the census. The Ministers have been enumerated by the Ministry advisers and the NSO Director-General. At the end of the enumeration, the Ministers gave their view of the census’ importance to the sensitization team during 5 to 10 minutes and called upon the population to fully adhere to the operation. Then, images were released on TV several times. This convinced the population that the operation was collective and without any distinction of class and title.

179. The enumeration publicity campaign must start well in advance at the start of enumeration to prepare the population for it. However, the intensity should increase as the enumeration draws closer, reaching a climax when the enumeration is actually ongoing.

180. The publicity campaign should utilize a mixture of skills including communication experts in conjunction with the demographers. The campaign should involve and utilize political, civic and opinion leaders in the build-up to the enumeration activities. However, sufficient controls should be included so that their involvement does not influence the recruitment exercise. Further, non-census staff should not get directly involved in the enumeration to avoid introduction of biases arising out of their other interests.

Chapter 8: Census Enumeration

181. An important feature of a census is its comprehensive coverage. The census attempts to count each person in the population. Census enumeration is a very crucial stage in the census-taking process and often has the biggest cost.

8.1 Enumeration staff

182. Census enumeration requires different categories and the largest number of staff. These include enumerators (who do the actual collection of the information), supervisors (who monitor the enumerators) and administrators (who facilitate the exercise).

Categories of enumeration staff

183. The enumerators are responsible for interviewing the people and recording the information on the questionnaires. In the past, many countries have used school teachers or secondary school students as census enumerators/supervisors because of the minimum level of education required to do the work. Other countries have used civil servants, while many have hired individuals irrespective of their usual employment.

184. In addition to the enumerators, other personnel are also needed to support and facilitate the enumeration exercise. The most critical are the supervisors who monitor the enumerators to guarantee the quality of the data collected. The duties of supervisors include:

- a) Ensuring that the enumerators carry out their duties as designated;
- b) Ensuring that all households and individuals in their supervisory area are enumerated, and that none is enumerated more than once;
- c) Ensuring that the data being collected by the enumerators are of the desired quality; and
- d) Enumerate the difficult cases which the enumerators cannot handle within the specified period.

185. Senior supervisors at higher administrative levels are required to carry out a more managerial role. They serve to ensure that the enumerators and supervisors are in place and adhering to their schedules. They also act as the bridge between the census secretariat and the enumeration staff.

Determination of number of field staff

186. The number of enumerators will vary depending on how many households one can enumerate in a day and this in itself will be highly affected by area. The census-mapping exercise delineates how the country is divided into EAs. Therefore, the list of EAs from the mapping exercise will be used to determine the number and distribution of enumerators and other field staff (see section 5.4).

187. The number of junior supervisors is generally obtained as a ratio to the number of enumerators. A ratio of four enumerators to one supervisor is deemed acceptable for effective technical supervision of the enumeration. This ratio may be altered depending on other factors such as terrain of the area and the need to restrict supervisors within the existing administrative units.

188. At the higher levels of supervision, similar ratios may be used. However, in many cases, the higher administrative hierarchy of the country is usually easier to implement.

189. An appropriate contingency of field staff will be needed at all levels to take care of incompetent persons, drop-outs or in cases where the work load was under-estimated. A provision of one reserve enumerator per supervisor would suffice as a contingency.

190. The concept of reserve enumerators pose two major challenges to the management of the enumeration exercise:

- a) Sustaining the knowledge and morale of the reserve enumerators throughout the enumeration period when not deployed; and
- b) The basis for their remuneration, especially in cases when the enumeration ends without utilizing their services.

191. It is recommended that the census secretariat should budget for them and assign them some other census-related duties but keep them available for their deployment should the need arise.

8.2 Recruitment and training of the field staff

Recruitment of field staff

192. The enumerators should have a minimum level of education to manage the interview. Enumerators also need to be socially acceptable to the communities in which they intend to work in and should be able to communicate easily in the language mostly spoken by the community.

In one country, real evidence was noticed that high authorities pushed for the recruitment of their relatives or political partners to the detriment of the qualification of candidates.

193. Census enumerators are required to enumerate in all EAs over the whole country. Therefore, the recruitment should not be centrally done, but should be done as close as possible to the area of deployment to ensure social acceptability. However, if no competent persons are locally available, persons can be recruited from neighbouring areas. It would be easier to make such persons socially acceptable than to make incompetent persons competent.

194. The procedures for recruitment of field staff should take into account the various languages spoken in the country. Therefore, information on the distribution of the population by the languages spoken in the country, is important for sound census planning; and if not available, should be collected at some stage during the census preparations, for instance, during the census-mapping exercise.

195. Prior to participating in the census enumeration activities, all persons who will be involved in the exercise *must* undergo training on the census concepts, procedures and their respective roles. This will serve to ensure that the data are collected as agreed.

Organization of the training of field staff

196. The senior supervisors (who participated in the planning of the census and the design of the questionnaire), managers and other senior personnel should be trained first. Each group will have dif-

ferent training needs, but can pass on information to the next group. They in turn act as trainers for the junior supervisors and finally the enumerators.

197. In some countries, special persons have been recruited as trainers to support the census officers. While this approach may be costly, it has the advantage of ensuring that there is someone dedicated exclusively to the training of field staff and ensuring that census concepts are clearly internalized.

198. All trainers need to have the same materials about a given topic so that the same message is passed on in the same way to all trainees; this is because of the cascaded and countrywide nature of training. The most ideal situation would be to use a verbatim training guide, such that everyone receives the census procedures in exactly the same format. If this is not done, the census secretariat should prepare detailed training manuals for all levels of training. The manual should specify the timetable, objectives of each session, recommended duration, reference materials and required teaching aids. This ensures appropriate training for all field staff.

In Egypt, all participants in the census were trained using most advanced means. The technical data for the census methodology and instructions were produced on video and CDs to unify the concepts for all fieldworkers.

199. The training of field staff (especially the enumerators and junior supervisors) should be undertaken as close to the actual enumeration as possible. A longer interval between the training and enumeration may lead to drop-outs and field staff being at the risk of forgetting the concepts. Likewise, in as much as possible, the training should be continuous over the training period. However, in cases where the participants are mainly teachers/students, this may not be possible since the schools may be in session. In such cases, the training can be spread over a longer period of time, although this poses the challenge of recall since the training is interrupted.

200. The ideal training class should not exceed fifty trainees. If the number of trainees is bigger than the ideal class size, it should be split into different classes with different trainers. Given the big numbers of field staff to be trained, many training sessions will be conducted at about the same time, therefore many training venues will be required, which calls for careful planning.

201. Training venues chosen should be centrally located to allow easy access by all trainees and to minimize travel costs. Subnational offices (of the NSOs) or temporary offices set up for census purposes could also be used as training centres. If these do not exist or are not sufficient, spaces such as schools, church or community halls may be hired. It is advantageous for a single training venue to have more than one class, as this will allow sharing of information between trainers. A situation of a single trainer at a training venue should be discouraged.

Content of the field staff training

202. The most critical part of any census training is the explanation of census concepts and definitions; how to fill in the questionnaires, how to deal with cases of refusal or non-response and how to deal with special cases. The training should also include map reading and EA identification, rapport building, record keeping and confidentiality of the information collected. Every person involved in census data collection will need this training.

203. The training of census field staff should be a combination of classroom lectures and some practical sessions in the field. The latter may be in the form of mock interviews within the class or trial interviews. The trainees should be subjected to tests to ascertain that the concepts are well internalized.

They must make sure that the trainees have a chance to test the language translations where they are to be used. Other methods of training include narrowcasting, videos and plasma.

204. Apart from the technical aspects, training on logistical/administrative issues; staff remuneration and its modalities; distribution and retrieval of enumeration materials; and reporting structure are aspects which need to be handled well during the training of field staff.

205. Several training materials will be developed to ease the training process. These include instructions manuals, training guides and supervision schedules among others. These should be provided to everyone who is engaged in the enumeration exercise and should be written in a simple and clear language. It should also be made portable so that the enumeration staff can carry it with them all through the enumeration exercise to be used as an easy reference document while out in the field.

206. The duration of the training should be such that there is enough time for the lectures, question and answer sessions, mock interviews and field practice. The managers/ supervisors should be given slightly longer time to cover their extra responsibilities. The decision on the actual duration of the census training will be determined by the size of the questionnaires and the trainees' level of education. Supervisors should be chosen from among the best enumerators.

8.3 Census enumeration

207. Census enumeration involves trained enumerators visiting all households within their area of jurisdiction and recording the characteristics of persons in the households. There are other methods including self administered questionnaires (consider issues of drop off and collection of questionnaires; and checking on accuracy). All EAs in the country are visited at the same time for the defined census period. This makes census enumeration highly labour-intensive and the most crucial stage in any census undertaking.

Enumeration of the general population

208. The PHC aims at counting everyone within the country or a designated territorial boundary. The most common method of enumeration used in Africa is the face-to-face interview method. This involves trained interviewers moving from household to household interviewing its members and recording information about the characteristics of the household members and household habitat. The rest of the discussion in this chapter assumes that method of enumeration.

209. Although the aim of the enumeration is to obtain information about all members of the household, it is not necessary to interview every individual in the household. Usually, information about household members is obtained from the household head, or any adult person who is most knowledgeable about the affairs of the household.

210. There will always be people who are difficult to find at home. Enumerators should use different techniques aimed at getting such persons, including calling back at different times of day, asking neighbours for help in contacting people, making appointments, etc. If all efforts fail, the enumerator should refer the case to his/her supervisor. This is where the more senior personnel of the field team are needed as they are expected to have more experience.

Enumeration of special populations

211. There exist some special populations that may require special arrangements to be enumerated. Such populations include the homeless and nomads; people who are away from their usual residence at the time of the census; people living in areas difficult to access; military personnel and their families; street children; police, diplomatic persons (within and from the country) and their families; refugees; prisons; travellers; hotels and lodgings; etc.

The homeless are those people that do not have particular dwellings where they usually reside. As such, they cannot be enumerated in a household, as they do not belong to any household. They usually spend the night anywhere (i.e., verandas, in market places, train stations, bus stations, the port, under the tree, at the road side or any open place).

To enumerate such people during the day is very difficult. During training, the enumerators are given instructions to go to their enumerations before the enumeration day to inquire about the existence of such people in his/her enumeration area. Once he/she is aware of the existence of such a group of people, he/she can be instructed to get in touch with his/her supervisors to get instructions on how to enumerate them.

In Tanzania, such people are enumerated during the census night when they are already settled for the night. For 2002, Census enumerators were sent out very early on the morning on 25th of August 2002. The enumerators were normally specially selected male enumerators working in pairs and accompanied by plain clothes police officers (who were required to stay at a distance during enumeration so as to get maximum co-operation from respondents). The enumerators are usually helped by the local authorities to locate the homeless. Such groups are given special EA codes. During the census publicity programme, there is a special campaign to alert people that such an activity will be taking place on the census night.

In Burundi, agreement was reached to have the rebels as enumerators of the populations living in the areas under their control.

212. Appropriate strategies should be devised to deal with the above categories of persons. This may mean enumerating those using different approaches or recruiting special enumerators. It is necessary to secure advance permission or put in place special arrangements for the interview in each group. Enumerating them on a different date may even be necessary. It is possible to ease the enumeration of such persons by obtaining information about the numbers and location of such persons from administrative records. In some countries only basic limited demographic and social information is collected for some special groups such as the homeless.

213. For certain groups, it may be a common practice to ask the chief or leader of the group to answer on behalf for all its members. This is likely to be culture- or country- specific. Thus, one has to bear in mind the customs that exist in a country. NGOs can help in enumeration of street children and refugees.

Duration of enumeration

214. Ideally, the census enumeration should last one day so as to avoid problems of reference period. However, it requires a large number of field staff to accomplish this. The 1990 and 2000 RPHCs saw many countries extending the enumeration over a longer period (4 to 30 days), but with a fixed reference night.

215. Use of an extended enumeration period requires less staff and has the following advantages:

- a) A smaller workforce is easier to manage during training and the actual enumeration; and
- b) Supervision of the enumeration is more practical and hence leads to improved data quality.

216. On the other hand, the extended period of enumeration has a higher risk of staff drop out (which may lead to loss of information) and also has higher chances of omission or duplication because of failure to adhere to the procedures.

217. There may be cases where the enumeration workload will exceed what was anticipated, irrespective of duration of enumeration adopted. This may arise out major changes in population size taking place between the EA demarcation and the actual enumeration. In such cases, special measures need to be taken to ensure that the enumeration is completed within the specified period. Such measures include:

- a) Deployment of reserve enumerators; and
- b) Redeploying enumerators who may have completed their assignment.

218. When extra staff are deployed in an EA, care should be taken in allocating the areas of enumeration so that no household is enumerated more than once or is skipped.

Supervision of the enumeration

219. Supervisors need to monitor performance of enumerators to ensure that they are following the census procedures correctly. The supervisors should review the filled-in questionnaires for legibility, completeness and accuracy. Standards need to be set and questionnaires are then either accepted or rejected on the basis of the set standards. The supervisors should provide the enumerators with feedback to encourage improvement of the data collected. If interviewers do not meet the set standards, they need to be retrained.

220. The supervisor is also required to re-interview some of the households. Re-interviewing allows supervisors to check the quality of the enumerators' work and provides an opportunity to check for errors as well as deliberate falsification of information by enumerators. The re-interviewing can be done either at random or systematically. The supervisors should also ensure that all the households are enumerated.

Potential challenges to census enumeration

221. Despite adequate planning, there are conditions that present big challenges to census taking. Below are some of the major difficulties that may be faced in a census undertaking.

- a) People may be living in conflict with the law and therefore not wish to be enumerated at all or withhold some information for fear of ramifications from other official sources. Ideally, the enumeration exercise is only used for the census and this should be firmly reiterated to people;
- b) Census at a time of conflict has its own challenges that will need strategies to overcome. People are more likely to move during times of conflict, so the population may reduce as people leave the country. The following points should be noted:
 - i) Taking a census after conflict also raises a lot of issues that will be unique to that country. The participation of post-conflict countries in census programmes is usually a critical component of peace building, reconstruction, producing benchmark data for socio-economic planning and establishment of the infrastructure of civil society;
 - ii) Countries emerge from conflict under differing and unique conditions. Therefore, the priority, precedence, timing, appropriateness and execution of the tasks in a census will vary with each case; and

- iii) This situation is challenging, especially if a census has been quoted as a target of any political agreement. It may mean less time than is usually available for carrying out the census preparations and there may be, unnecessarily, high expectations.

8.4 Remuneration of field staff

222. Payment of field staff is very crucial because it involves many persons and their remuneration constitutes a substantial portion of the overall census budget. The payment includes both advance/re-imbursement for costs incurred as well as honoraria for work done. The target of the enumeration planning is, as much as possible, to assign an equal workload to all enumerators. However, this is not possible because of variations in household sizes, population density and terrain of the areas.

223. There are different methods that can be used in the payment of honoraria to the census field staff. These include:

- a) Flat rate: Where the work load is presumed to be almost equal and all the enumerators are paid the same amount of money. This is the easiest to plan for and implement. However, this may not be fair to persons who end up with a heavier workload than initially anticipated;
- b) Piece rate: Enumerators' payment is in relation to the amount of work done. This will enhance the speed at which the work is done. If this approach is to be used, it should be properly managed to ensure that it does not compromise the quality of the data. It is also very difficult to plan for and implement as one would not know where to despatch the funds to; and
- c) A combination of the two approaches: The enumerators are paid in two components (1) a basic salary/payment; and (2) a piece rate (payment) based on accurate and timely delivery of results. This is often a cheaper, quicker and more consistent way of ensuring that the job is carried out correctly than having to 'hire and fire' people throughout the process.

224. Some countries require payment in advance while others require more than one instalment. In some countries, the existing regulations stipulate when and how much should be paid to different categories of staff. Whenever possible, the final payments should *only* be made after completion of the work and certified by the respective supervisor.

8.5 Quality assurance during enumeration

225. Quality assurance during the enumeration stage is absolutely essential because this is the stage in a census undertaking where errors committed cannot be corrected or are very expensive to rectify. The quality-assurance processes should help to detect and deter interviewer errors and any potential falsification of results. Some of the quality assurance measures to be taken include:

- a) Training of field staff: The population census involves very many field staff, who needs adequate training to clearly understand the census concepts and procedures. Details on this are given in section 8.2;
- b) Household listing: Some countries undertake a household listing exercise prior to the actual enumeration. This helps to prevent under-coverage or over-coverage. If there is a major variation in the results of the two exercises, then such an area may need to be investigated and possibly enumerated again. However, because of its impact on the cost of enumeration, some countries do not carry out this stage;

- c) Supervision of enumeration: Enumerators need to have adequate supervision throughout the enumeration to ensure that all correct procedures are followed (see section 8.3); and
- d) Control visits: This entails the supervisors re-interviewing some households. This could be one of the measures used to ascertain the quality of the data. Monitoring reports can be used to track progress and to identify any problems early, so that steps can be taken to rectify them.

Chapter 9: Data Processing

Introduction

226. Data processing is the process of converting the information written on the questionnaires, into an electronic database, which can be used for the analysis. More on development can be found in the African Handbook Experiences on Census Data Processing, Analysis and Dissemination.

227. Several decisions affecting data processing have to be made early in the census-planning process. These include the type of technology to be used for the data capture (traditional keyboard capture or scanning technology, which uses software for data entry, editing and data analysis). A decision has to be made at the census planning stage whether the data processing will be done in-house (by the NSO) or out-sourced, and whether the data processing will be centralized or decentralized.

9.1. Choice of the technology for data capture

228. There are several technologies that can be used for data capture, including direct keyboard entry; Optical Mark Recognition (OMR); and intelligent character recognition.

229. Traditionally, data was captured with direct keyboard entry. This required many individuals and also has a high-risk error arising out of human errors. It also takes a long time to process.⁴

230. Intelligent Character Recognition (ICR) and Optical Character Recognition (OCR) capture data straight from forms, thus reducing keystroke errors data entry time, errors and cost, thereby almost making the entire process automated, while maintaining the high level of accuracy required in form-processing applications.

231. OMR works with specialized forms. Each form contains data in pre-coded format. If the forms and the system are properly designed, OMR is more accurate than ICR or OCR. The major limitation of OMR is that its questionnaire layout requires a lot of space. It is therefore more suitable to use short and less-complicated questionnaires.

232. The use of scanning technology has a number of advantages as well as a number of challenges. Below are the major advantages and possible limitations of the technology.

Advantages:

- a) It reduces data-entry time and increases accuracy (compared to the use of manual data-entry operators);
- b) Validation rules may be included in the system to validate and edit the data;
- c) Errors are identified using different colours thus facilitating the review and correction process;
- d) Recognized data fields are updated automatically in the appropriate database form;

⁴ Traditionally, census processing has taken 2 to 4 years to process and therefore getting the census results when they are already obsolete.

- e) Scanned forms are stored digitally thus eliminating the need for physical storage of paper forms;
- f) The system stores data in a database thus facilitating data analysis;
- g) The number of data-entry operators needed is reduced;
- h) Forms can be designed easily thus allowing in-house capacity to manage the form-designing process; and
- i) The use of drop-out colour improves the accuracy of recognition.

Limitations

- a) The quality of paper is an important factor. Thin or dirty forms may cause reduction in the recognition rate;
- b) Errors in filling of questionnaires decrease the rate of recognition as well as in manual data entry;
- c) The speed of enumeration is reduced due to the care required thus increasing the cost of enumeration;
- d) Variation of enumerator handwriting can cause major problems in form processing and may decrease the recognition rates;
- e) The technology is not yet under full control for many staff in African countries; and
- f) Printing quality can cause problems if it is too dark or too light. This may reduce the rate of recognition of the forms.

9.2 Processing centre

233. A processing centre is the place where data processing will be done. This may be within the offices of the NSO or outside.

234. A decision has to be made on whether to use centralised or decentralized processing. If the data processing is to be decentralized to several centres, the structures can also vary according to the tasks carried out at each centre. For example, one centre may be responsible for a particular process (e.g. coding), with other processes (e.g. data capture) being conducted at different centres.

235. Another alternative is to use different processing centres in different parts of the country, with each centre responsible for the complete processing of data for the allocated region. It is highly recommended that all stages in census processing be housed in the same building to avoid transporting the questionnaires over long distances.

236. In some cases, the census data-processing activities cannot be accommodated within the offices of the NSO. This is because of the large numbers of staff involved and the volume of the questionnaires. It is therefore necessary to temporarily acquire extra space that can be used for processing the census data. This may be a centre set up specifically for census processing or using an already existing space.

237. The choice of the number of processing centres should take into consideration: (a) geographic location for delivery of questionnaires; (b) availability of skilled workforce; (c) availability of support services; and (d) ease of coordination of processing activities. The location of the processing centre is crucial. A good processing centre should have several qualities:

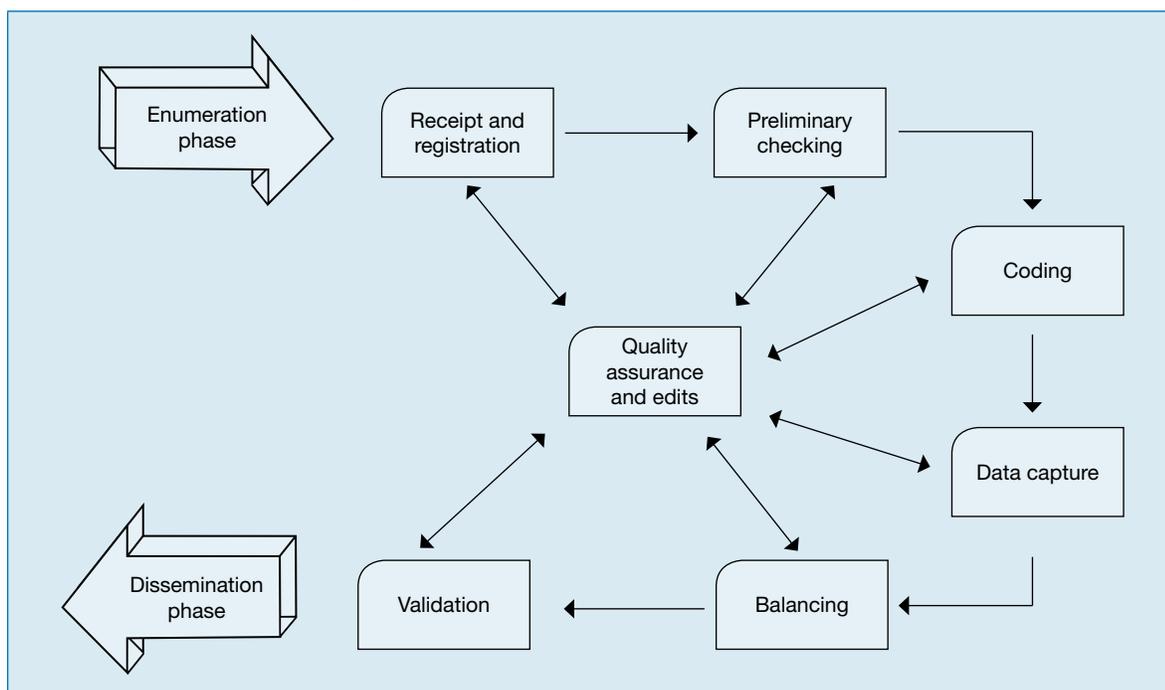
- a) Accessibility: Ease for delivery of materials from the field as well as transportation of staff;

- b) Security: Adequate security provisions against external as well as internal saboteurs need to be put in place. If the processing centre is rented, it should be clearly separated from other renters to avoid the risk of information loss and loss of confidentiality;
- c) Space: Sufficient space and good layout to provide easy flow of the questionnaires through the different stages of processing (sorting, coding, data capture, editing as well as their final storage, after capture; and
- d) Issues such as working environment, infrastructure, connectivity and security.

9.3 Data-processing activities

238. Census data processing has several stages which includes; questionnaire sorting and registering, coding, data capture, editing and tabulation. Figure 9.1 shows the logical flow and interrelationships between these stages.

Figure 9.1: The census data-processing cycle



Reception and sorting of questionnaires

239. When the census questionnaires are received at the processing centres, they need to be sorted in the order in which the data capture will be done. At this stage, some preliminary checking is done to ensure that all EAs in the country and all households within each EA are accounted for. At this stage, checking should also be done to ensure that all materials (especially questionnaires) sent to the field have been returned. This will make use of information from the logistics management, in terms of showing what materials were sent where.

240. Regardless of the technology to be used for the data capture, some form of checking will be necessary. It may be as simple as ascertaining that the questionnaires are in good condition to be scanned,

or as detailed as transcription of information from damaged questionnaires or manually editing inconsistent responses. This should be minimized as it is likely to introduce errors in the data.

Questionnaire coding

241. The coding process assigns codes to responses on questionnaires, in preparation for data capture. The list of codes used would have been prepared during the census planning stage (see section 4.2). The more detailed the codes are the better, as they will give flexibility in the data analysis.

242. Coding may be done manually, automated/computer assisted or a combination of the two. In case the questionnaires are to be scanned, coding may be done at the same time as the data capture. If coding is done manually, the codes are often written over the enumerators' entries on the questionnaires. They need to be clear, legible, and in a different colour pen from the original entry. This colour needs careful consideration as it must stand out, but it should not be too hard on the eye as the coder will spend hours working with it.

243. The coding clerks should be organized in small manageable teams (between 4 to 6) under one team leader. Such a number will enable the team supervisor to effectively carry out random checks to ensure quality.

In Egypt, CAPMAS replaced manual coding with automatic coding in order to reduce time and achieve results that are more accurate. Automatic coding is the process of selecting a code that matches the response given to a question. Possible answers to questions and their appropriate codes are included in a coding library and during the data entry a list of codes appear on the operator's screen. The operator may select a code from the list that matches the answer, or enter a different one.

Data capture

244. Data capture is the entry of the information from the questionnaires into a computer to generate an electronic data file. This is usually done after coding is completed. This may be done using direct keyboard entry (as was done previously) or using scanning technology (as is being adopted by African countries of late).

245. During the data capture, information that is captured must not be lost. Therefore, an appropriate back-up system should be embedded in the data processing plan. This may include frequent on-site back-ups of data and control files (from all stages of processing) and less frequent but regular off-site backups to protect against major disasters.

246. There is a need to carry out an *audit of the data*. This process ensures that a computerized data record has been created for every EA, every household within each EA and every person within those households. It also serves to finally ensure that there are no duplicate records and that each record is correctly located geographically

Data editing

247. Census data are bound to have errors arising out of respondent misinformation, interviewer error or data capture errors. In order to maintain credibility of the census exercise, it is essential for the NSO to produce data without invalid and inconsistent entries. Editing is the systematic checking and correction of responses based on pre-determined rules.

248. One approach to data editing is *macro-editing*. This is where the aggregated data are checked against other data sources to ensure that they are reasonable and consistent. For instance, the number of orphans reported in the census can be compared with the national registration of orphans. If wide variations are observed the data are scrutinized further for any errors.

249. The most commonly practiced form of data editing is *micro-data editing*. There are two types of micro-data edits namely (a) fatal edits, which identifies data items that are definitely in error (invalid entries, missing entries or outright inconsistencies); and (b) query edits, which identify those data items that are likely to be inconsistent (falling predominantly outside edit bounds). Correction of fatal edits is a must, while the NSO has the discretion on how best to handle query edits. Data editing may be done manually or electronically, but the latter approach is preferred.

250. Manual editing is usually done at the checking or coding stage, and it involves individuals re-viewing the questionnaire and taking a corrective decision in case of invalid or inconsistent responses. It is therefore highly subjective and is associated with lack of consistency as there is no guarantee that two individuals will make the same decision. Manual edits are generally recommended in situations where the error blocks further processing of the data.

251. Machine editing is where the completeness and consistency of the census data are checked based on a set of pre-designed rules embedded in a computer program. Machine editing is preferred because it is consistent across all records and also preserves the original information. Therefore, it is possible to carry out a fresh edit (with a different set of rules) and this can be done afresh if errors are noticed at the end.

252. While editing the data, care should be taken not to over-edit and lose too much of the original data. Rather, the role of editing should be to make analysis more consistent and accurate. Over-editing may have negative impacts in several ways, including timeliness, cost and distortion of true values which at times creates a false sense of security. The editing team needs to strike a good balance between the original data and a clean data set.

253. The editing process should always preserve the original data set as collected from the field. This will allow the editing process to revise the editing if deemed necessary e.g. if the macro-edits show that the editing is skewing the data or if it is noticed that a systematic error was committed during the editing. Any changes made can be marked with a 'flag' which will help any rechecking and quality-assurance process.

Tabulation

254. The utility of the census data can only be realized when the micro-data are condensed into usable information. This information is summarized at all geographic entities into macro-data in the form of tabulations, frequency distribution, other aggregate data or statistical indicators supported by graphs and thematic maps.

255. There are many software packages (such as Super Cross, SPSS, SAS, STATA and CPro) that can be used for producing the different types of statistical tables. They make the tabulation work much simpler and are designed for maximum execution speed given that large files are to be processed. The choice of which software to use will depend on the overall policy of the NSO. Whichever package is used, the issue of compatibility with other users should be considered seriously.

256. In a census operation, there will be users who will be interested in a series of tables at different periods of time, which may overwhelm the NSO staff. It is recommended that a database should be generated from the census data with a statistical computing interface, easy to be assessed by users in need of information.

9.4 Data-processing personnel

257. The levels of staffing and skills mix required for census data processing will largely depend on the processing technology to be used. In the past, direct keyboard entry was used and it would employ a large number of staff for a long period of time. With recent advances in technology, where scanning technology is used for data capture, the number of staff required can be reduced, as the skills levels are higher and the duration of data processing reduces substantially.

258. The strategies adopted for the data-processing staff recruitment campaign, and the management structure, will largely depend on the number of staff required at each processing centre. Therefore, the first step should be to estimate the number of staff required to complete data processing during the specified time-frame.

259. Another critical attribute of the data-processing staff is their skills. Coding is a job for which people can quickly be trained to classify census data easily and efficiently. However, experienced data-entry clerks and programmers are unlikely to be readily available, so training will be needed.

260. Coding may be considered by some people, as monotonous job and yet the morale of the coding clerks must be maintained at high levels to ensure the timely and accurate outputs. One way to maintain a high quality of work and efficiency of staff is to pay them a performance related bonus. Payment on completion of so many accurate records can keep up speed and accuracy, while not allowing staff to draw the task out longer than necessary.

9.5 Data storage and sharing

261. Once all data have been captured, the questionnaires need to be securely stored for future reference and to maintain confidentiality of the information. Therefore, a secure environment for the census questionnaires is essential. It is also important to ensure that no tampering can take place.

262. With advances in technology, the questionnaires can be scanned or photographed and stored as electronic images, rather than as paper files. The paper questionnaires can then be disposed off in a way that maintains confidentiality of the information.

263. During the processing, data will pass through a number of sequential activities, from data capture through to release of data files to the dissemination phase. Each activity will refine and change the data in some way. Therefore, it is advisable to maintain copies of all versions of data for auditing and tracking purposes. This will enable easy pinpointing of where problems were introduced and where corrective actions can be taken.

264. In general, data processing will generate two types of data namely:

- a) Input: Data as captured from the questionnaires before editing or partial editing; and
- b) Output: Data to be used for analysis after undergoing thorough editing.

265. The technology used for data storage depends on the architecture chosen for the data capture and processing systems. Simple text files may be sufficient, if appropriate to the architecture. Whatever data storage system is used, a key issue is the management of large volumes of data and multiple versions of files as the data pass through the different activities.

266. Management of the data needs to address issues such as ease of retrieval for the various activities within specified response times. A decision on the data-storage methodology will depend on the volume of data involved and the complexity of the processing system.

9.5 Quality assurance during data processing

267. Part of the planning process should include arrangements for data processing and analysis. It is important that data processing arrangements are fully tested and that quality checks are built into the procedures.

Chapter 10: Census Products and Dissemination

268. The objectives of a population census cannot be achieved until the information collected is made available to the users. This section discusses data analysis, generation of census products, and dissemination of findings to the users.

269. It is important to decide on what is important at the planning stage and what can be produced. Consultations with key stakeholders on their key requirements would guide which indicators should be generated from the census results. Usually, the results of the census are released in stages starting with summary information and subsequently releasing detailed analyses and presentations. There is also a need to generate timely census-administrative reports.

10.1 Data analysis

270. Data analysis can take many forms and produce different types of outputs, ranging from simple descriptive statistics that give a single number of the total population, to complex cross tabulations of two or more variables or maps. In order to improve the utility of the census data, NSOs should endeavour to produce more user-friendly reports. Census data can also be used for making inferences.

271. The NSO is responsible for carrying out the main analysis. This is usually descriptive in nature and is the source of key official figures. In order to save time and also benefit from existing competences, the NSO may hire experts to assist in producing the main analytical reports.

272. The NSOs should move beyond the traditional generic and descriptive reports to generating analytical reports. This may require extra human resource, skills and time than originally needed by the NSO. Therefore, the NSOs may opt to partner with other government departments and research institutions in producing these reports. However, they should retain control of the data and guard confidentiality of the information.

273. There are several computer softwares on the market today that can be used for data analysis. These have varying capabilities and cost implications. It is important that the software used is compatible with a wide spectrum of users and is manageable by the staff in place.

10.2 Census products

274. There are several products that the NSOs should generate from the census data. These include area information, profiles, monographs, poverty maps and impact analysis. The products should target different audiences; therefore, diversity is desired to address the issue of a wide variety of users with varying needs. A count of the total population broken down to lower geographical and administrative levels should be the first set of information produced. This should be done as soon as possible.

Preliminary results

275. Preliminary counts of the population based on summaries compiled by the enumerators, can allow an estimate of the population to be given within a few weeks from the end of the census enumeration. However, care should be taken to ensure high levels of accuracy. A big variation (over 1 per cent) between the preliminary and final counts may affect the confidence that the users have in the census and its products.

276. Therefore, a decision should be made on whether a country will publish preliminary results or not. If preliminary results are to be published, the NSO should inform the users that these are preliminary results subject to change when final results are released. It is important that the final results should be released at the earliest possible time. Otherwise, preliminary results may be entrenched in the minds of the users.

277. The NSOs should aim at producing summaries of key data, using available tools. These are cheap to produce, relatively easy to read and can be widely disseminated so that everyone can gain a general understanding of the census results. It should be supplemented by longer and more detailed papers and specifically focused publications for a more informed audience.

278. More in-depth analysis of the socio-economic characteristics of the population, such as migration and economic activity, is likely to take longer as this requires more careful checking of the data. It is here that the real worth of a census, in terms of understanding the population and planning for the future, can be realized. Therefore, ample time and financial resources to carry out the desired in-depth analysis of the data should be provided for at the planning stage.

279. The analysis process will produce many numbers and a choice has to be made on which to publish and how to display them. Given the wide range of census data users, there is no single product that can suit all users. The NSOs should devote time to packaging various products so that all categories of users are served. Some of the options include using tables, maps, charts or commentary to describe the figures.

10.3 Data dissemination

280. One of the duties of the census-communications unit is dissemination of census results. This may be through the traditional methods (such as printed reports) or using modern dissemination methods such as internet access to summarized data or providing raw data files. Hard copy publications and papers have been the traditional means of data dissemination. Examples of such publications include one-page summary papers, longer papers, academic papers, and full publications, which allow in-depth analysis of results. Seminars and workshops are also still used as another method of disseminating census results.

281. The advancements in technology such as development of the internet have eased the dissemination of information. Census results can now be disseminated via the internet which is cheaper and more readily available to a wide spectrum of users.

282. While disseminating census results, it is ideal to start the programme with a high-profile and well-publicized means of communicating key figures such as the total population count. For example, this could be a news item on national television or radio, or an item in national newspapers. Using such methods helps to further raise the profile of the census as an event of national importance. It

also allows everyone to hear the results and appreciate that their taking part can make a difference. Seminars can be used thereafter to present more detailed findings which will attract a different and more technically minded audience from the other media used.

283. The use of GIS will enhance the dissemination of census results by enabling combination of the socio-demographic data with the area maps. GIS makes it easier to produce maps and the NSOs will usually want to produce and publish quality maps that illustrate census results and complement the analysis. However, it is very costly for the NSOs to produce all maps of interest to users.

284. There are now many types of user-interactive software that enable the ultimate user to interact with the data (without loss of confidentiality) and generate user-determined products. Some of the software can be accessed over the internet. This will enhance user coverage as it reduces the cost of having to use printed reports.

10.4 Sharing census data

285. Stakeholders may wish to carry out their own in-depth analysis based on the census data. The NSOs do not have the capacity to carry out all the analysis possible from the census data. Such users should be allowed access to census data to produce further analysis so that the full richness of the data can be exploited. However, such access must be properly managed so that there is no threat to the confidentiality of the data on individuals.

286. The development of high-capacity storage devices, for example, CDs, DVDs and flash drives, has made it possible to disseminate large volumes of electronic data. The internet can provide an interactive service where customers can produce their own tabulations online. This can mean that data security is easier to control than when the datasets are given out for individual analysis.

287. There are several ways that can be used to maintain confidentiality of census data. These include anonymizing the data, and providing them in aggregated format or providing only a sample. Data are anonymous when names are not captured.

288. Sharing datasets outside a NSO but putting strict access controls and rights to this data must be employed. Password-protected files, signed agreements and secure means of transportation are just some ways to ensure security.

289. A decision on what data to charge for will be needed and on how much should be considered at the planning stage, as budgets can be affected by this. It would be inappropriate to charge for all outputs, as the collection of data are recognized as a public good, for which the census has been conducted. This would include such data as the main population counts and key tables of age, gender and geographic area.

Chapter 11: Census Evaluation

Background

290. The census enumeration should minimize both coverage and content errors if the results are regarded fit for use. Coverage errors include erroneous inclusions and exclusions; while content errors refer to erroneous information being recorded. Any population census is bound to have errors of inaccuracy of the information collected and errors in the coverage, usually under-coverage. Quality-assurance measures should be applied at all stages of the census to minimize coverage and content errors.

291. Therefore, census evaluation is undertaken to check on the accuracy and completeness of the census. There are several forms of evaluation that can be undertaken. These are:

- a) Demographic analysis: This involves comparing information from administrative sources with the census data;
- b) PES: This is a nation-wide sample survey undertaken to check the accuracy of the population census with respect to the completeness of coverage of the enumeration; and accuracy of the information collected;⁵ and
- c) Process evaluation: This aims at knowing what happened, what went wrong or right. It entails selecting a sample of EAs and implementing an independent sample survey.

292. African countries lack a comprehensive address system, the existing geography is based on demarcated EAs. The EAs may also face a challenge of ever changing place names. EA documentation, however, can be used as the first step to check for accuracy of coverage during enumeration.

293. The demographic analysis and PES should not be regarded as alternatives; rather they should be used to supplement each other.

11.1 Demographic analysis

294. Demographic analysis entails using information from different sources (mainly administrative) with the census data. Examples of such comparisons include:

- a) Comparison of the census population with the projected population as of the census date;
- b) Comparison of information on births and deaths in the last 12 months with records from the vital and civil registration system; and
- c) Comparison of census information with other administrative records such school register, pensioners' register, register of persons, register of PWDs, etc.

295. The demographic analysis does a comparison of aggregate figures at national and possibly sub-national level. However, the value of the comparison lies in the accuracy of the administrative data. For instance, most African countries do not have reliable vital and civil registration. Therefore, that cannot form a basis for evaluation of the census.

⁵ The PES should not be confused with control visits undertaken as a quality-assurance measure.

11.2 Post-enumeration survey

296. A PES is the most recommended tool for coverage evaluation. The approach is based on the assumption that the PES is more accurate than the main census since it is smaller in coverage and hence better managed. Thus, the PES is a tool for getting a better understanding of the quality of the data and for building user confidence.

297. The PES is a very large-scale survey and therefore requires adequate planning. If not well planned, the PES may generate data that are more inaccurate than the main census enumeration. In particular, it is essential that all of the process is also piloted alongside the main census pilot exercise.

In one country, the PES was conducted two months after the census enumeration, to examine the quality of census outputs and processes. All data were collected and questionnaires kept in storage rooms. Due to lack of trained staff within the NSO of that country, the PES data were not analysed for a long time.

298. In the past, many African countries have not undertaken a PES mainly because of the cost implications. Many have opted to use the extra resources to improve on the quality of the main enumeration. The choice on whether to conduct a PES or not lies with the individual country.

PES process

299. The PES is done by enumerators going to a selected sample of EAs and collecting data similar to the information from a census. Since the PES is carried out as an evaluation of the main census exercise, it should be carried out independently of the main census. It should be noted that in this case, independence of the PES refers to operational independence and not necessarily theoretical independence.

300. The institution selected to conduct the PES may be the NSO itself, a department of the NSO or a research/academic institution. The institution chosen to conduct the PES must have the census legal framework to access the main census micro-data records as they will be required during the process of analysis. It should also have a good combination of capability and operational independence from the census secretariat. Using the NSO to conduct the PES minimizes the cost by taking advantage of already existing infrastructure such as vehicles and a survey-management team.

PES Planning

301. As a large-scale national survey, the PES requires adequate planning. There are several decisions that have to be taken regarding the PES process. These include:

- a) The institution to carry out the PES;
- b) The sample size, which is itself determined by precision at which the PES estimates are required; and
- c) The method of estimation to be used in the analysis, i.e. a choice between aggregate estimates or individual record matching (see para. 318 for details).

302. Once the major decisions are taken, the PES is planned for as with any other data-collection activity. There are several instruments which have to be developed to enable implementation of the PES. In addition to the questionnaires and manuals (similar to those for the main census), the PES needs some unique documents such as matching guidelines and field-reconciliation guidelines.

Coverage and content of the PES

303. It is very costly to conduct a PES in all EAs throughout the country. Therefore, a PES is conducted on a sample basis and should aim at providing reliable coverage estimates for each main stratum. In some cases, countries have derived estimates at different levels such as obtaining coverage estimates at the highest subnational administrative level, and content estimates at the national level.

304. The PES is not used to study the accuracy of special populations such as street children, nomadic populations, etc. This is because such populations are very mobile and are not likely to be found in the same EA where they were enumerated.

305. It may not be possible to re-interview for all questions as they were asked in the main census enumeration. The questionnaire will be designed so that it captures main elements for measurement of level of coverage. Such variables may include full names, relationship to household head, sex and age.

306. The PES will also include other questions necessary to check the accuracy of the data from the main census. However, only a few questions from the main census questionnaire will be included on the PES questionnaire. These should be those questions whose response was not expected to change significantly in a short period of time, such as educational attainment. Questions such as 'economic activity last week' are not suitable for the PES since variations may be due to enumeration error or real change of activity in one's status. This would leave the PES results inconclusive.

PES field staff

307. It is important that the PES exercise is more accurate than the main census. Therefore, it ought to be better managed with better qualified staff than those used for the main census. Ideally, the PES field staff should be different from those who carried out the main census enumeration. However, this may not always be possible. Therefore, PES field staff can be drawn from among the best-performing census enumerators and supervisors. In order to reduce bias, the PES organizers should ensure that the enumerators are not deployed in the same areas where they were deployed for the main census enumeration.

308. As in the main census enumeration, all the PES field staff must undergo thorough training on PES concepts and procedures. In particular, care should be taken to ensure that field staffs do not confuse procedures for the main census with those for the PES, as they are likely to be slightly different.

309. The PES staff must undergo training on the concepts and procedures for the PES. Though the training is not as large scale as that for the main census, PES training is very crucial. The training should be regarded as separate from the main census training and should therefore be planned for separately.

PES enumeration

310. The PES enumeration involves trained enumerators administering the PES questionnaire to all households in the sampled EAs. Given that coverage measurement is one of the objectives of the PES, it is important to ensure that there is complete coverage of all the households in the selected EAs. Use of EA maps is very essential in this regard.

311. The PES enumeration should be as close as possible to the main census enumeration so that cases of persons moving away from or moving into the household are minimized. However, it should not be too close to interfere with the main census operations. If the enumerators from the main census

are to be used for the PES enumeration, they should be allowed ample time to complete the main census operations (and hand in all the materials) before they can start the PES training. The PES operations should not compromise the quality of the main census operation.

PES data processing

312. On reception at the processing centre, the PES questionnaires will be checked for completeness and legibility. Processing of the PES involves three major steps, namely:

- a) Matching of households and individuals (if these are to be used in the estimation process);
- b) Field reconciliation of partly matched and unmatched records; and
- c) Data capture and tabulation.

313. During the 'matching' stage, trained clerks compare the census records and PES records to determine their match status (whether they are matching or not). The matching of records is done for each household and for individual household members within the matched household using pre-determined rules and guidelines.

314. Questionnaires whose match status is in doubt (neither matched nor non-matches) have to be taken back to the field for further interviews and reconciliation. The purpose of the reconciliation visit is to improve on the match status of the records and on the inference that can be made based on the PES.

315. Ideally, cases that require field verification should be minimal (less than 5 per cent of the questionnaires). However, if there are many and the cost of field verification is likely to inflate the overall PES budget, then the field verification can be done on a sample basis and an inference made for the non-verified cases.

316. The data for all matched cases, PES and census, will be captured on computer for tabulation and estimation. Formal editing, as is usually done, should not be undertaken because it will impact on the main PES objective of assessing the level of accuracy of the data.

PES estimation procedures

317. The PES data will be used to derive several indicators for measuring coverage and content errors. These include census population estimate, PES population estimates, census omissions, coverage rate, erroneous inclusion rate, true population, gross error rate and census adjustment factor. For purposes of measurement of inconsistencies or agreement, the Net Difference Rate and Index of Inconsistency are used. The Dual System Estimates (DSE) methodology is used in analysing coverage and content error.

318. There are several methods that can be used for estimating figures from the PES. The two most common methods are individual record matching and comparing of aggregate figures:

- a) Comparing aggregate figures: Assumes that the PES is correct and compares aggregate figures from the PES with those from similar areas in the main census. For example, the number of households with four rooms can be considered for each data set and if the proportion is the same, or within a set tolerance limits, the census results can be deemed accurate; and

- b) Individual record matching: Individual household/person records from both the main census and PES are compared. Non-matching records would then be classified as erroneous inclusions/exclusions.

Utilization of PES results

319. There are basically three types of decisions that can be made based on the PES findings:

- a) Make no adjustments: This approach is generally used when no major discrepancies have been found. It is the easiest option and the majority of countries that carry out a PES do not adjust their census figures;
- b) Do not adjust the official figures, but provide a separate adjusted data set: This approach allows any relevant data to be used and for data users to understand any discrepancies. However, it has the disadvantage in that two sets of census results may create confusion to the lay users; and
- c) Adjust the official census figures: It combines all the data available to give the best estimate of a country's population. The main drawback is the time this takes, as all coverage and accuracy results need to be available. Quite often, any resulting figures only require minor adjustments and can damage the reputation of the figures and the statistical office.

11.3 Census documentation and archiving

320. Along with good planning, keeping good documentation will ease the census process the next time around. Keeping notes of decisions made and actions taken, with reasons and outcomes, will provide a sound starting point for the next census. Some of the areas that need documentation include:

- a) Choice of the topics (and questions) to be included and reasons for their choice;
- b) Instruction manuals;
- c) Choice of the method of enumeration (and its justification);
- d) Editing rules and the changes introduced to the data; and
- e) Data that are requested and by whom.

Appendix 1: Example of a typical table in a census tabulation plan

Table 1: Native and foreign-born population, by age and sex

Geographical division, sex and age (in years)	Total	Native	Foreign-born	Not stated
Total country				
Both sexes				
ALL AGES				
Under 1 year	Unit of tabulation: total population			
1-4	Classifications:			
5-9	(a) Geographical divisions: (i) total country; (ii)			
10-14	each major civil division; (iii) each principal locality.			
15-19	Distinguish between urban and rural for (i), (ii) and			
20-24	(iii)			
25-29	(b) Place of birth: native; foreign-born			
30-34	(c) Age: under 1 year; 1-4 years; 5-9 years; 10-14			
35-39	years; 15-19 years; 20-24 years; 25-29 years; 30-			
40-44	34 years; 35-39 years; 40-44 years; 45-49 years;			
45-49	50-54 years; 55-59 years; 60-64 years; 65-69			
50-54	years; 70-74 years; 75-79 years; 80-84 years; 85-			
55-59	89 years; 90-94 years; 95-99 years; and 100 years			
60-64	and over; not stated			
65-69	(d) Sex: male; female			
70-74				
75-79				
80-84				
85-89				
90-94				
95-99				
100 and over				
Not stated				
Males				
(Age groups as above)				
Females				
(Age groups as above)				

Appendix 2: Population census topics from United Nations principles and recommendations⁶

1. *Geographical and internal migration characteristics*

- a) Place of usual residence
- b) Place where present at time of census
- c) Place of birth
- d) Duration of current residence
- e) Place of previous residence
- f) Place of residence at a specified date in the past
- g) Total population
- h) Locality
- i) Urban and rural

2. *International migration characteristics*

- a) Country of birth
- b) Citizenship
- c) Year or period of arrival

3. *Household and family characteristics*

- a) Relationship to head or other reference member of household
- b) Household and family composition
- c) Household and family status

4. *Demographic and social characteristics*

- a) Sex
- b) Age
- c) Marital status
- d) Religion
- e) Language
- f) Ethnicity
- g) Indigenous peoples

5. *Fertility and mortality*

- a) Children ever born alive
- b) Children living
- c) Date of birth of last child born alive
- d) Births in the past 12 months
- e) Deaths among children born in the past 12 months
- f) Age, date or duration of first marriage
- g) Age of mother at birth of first child born alive
- h) Household deaths in the past 12 months
- i) Maternal or paternal orphanhood

⁶ Principles and Recommendations for Population and Housing Censuses http://unstats.un.org/unsd/demographic/sources/Census/docs/P&R_%20Rev2.pdf see page 128

6. *Educational characteristics*

- a) Literacy
- b) School attendance
- c) Educational attainment
- d) Field of education and educational qualifications

7. *Economic characteristics*

- a) Activity status
- b) Occupation
- c) Industry
- d) Status in employment
- e) Time worked
- f) Income
- g) Institutional sector of employment
- h) Employment in the informal sector
- i) Informal employment
- j) Place of work

8. *Disability characteristics*

Disability status

9. *Agriculture*

10. *Housing characteristics*

- 1) Type of living quarters
- 2) Location of living quarters
- 3) Occupancy status
- 4) Type of ownership
- 5) Number of rooms
- 6) Number of Bedrooms
- 7) Water supply system
- 8) Main source of drinking water
- 9) Toilet facility
- 10) Sewerage disposal
- 11) Bathing facilities
- 12) Availability of kitchen
- 13) Fuel used for cooking
- 14) Type of energy used for lighting
- 15) Main solid waste disposal
- 16) Occupancy by one or more households
- 17) Number of occupants
- 18) Type of building
- 19) Construction material of outer walls
- 20) Year of construction
- 21) Age and sex of household head/reference person
- 22) Tenure
- 23) Information and Communication Technology (ICT) Devices – availability of

Appendix 3: Africa standard guidelines for census taking

1. *Census plans*

The Population and Housing Census will require several plans in its implementation. In addition to the overall plan, the Strategic Plan, others to be developed include plans for:

1. Quality Management
2. Monitoring and Evaluation
3. Risk Management
4. Resource Management
5. Resource Mobilization
6. Financial Management
7. Capacity Development
8. Information and Knowledge Management
9. Communication

2. *Timing of the field mapping*

It is generally recommended that census mapping activities should be started about two and half years prior to the planned enumeration census date and field updating completed at least six months prior to the enumeration period.

3. *Length of a questionnaire*

The time it takes to fill in a census of population and housing questionnaire depends mainly on the size of the household and the knowledge of the characteristics of other household members by the respondent. It should take 15 to 18 minutes to complete a questionnaire for a one or two person household. The longest questionnaire would take 35 to 45 minutes per household.

4. *Size of the pilot census*

The size of the pilot census may be small-scale (a few enumeration areas) or large-scale, 5 per cent of the EAs.

5. *Size of the census EA*

Adherence to comprehensive, quality-assurance procedures would lead to census coverage of at least 95 per cent. Mozambique achieved 98 per cent coverage.

6. *Duration of enumerator training*

A period of at least 4 to 7 days is deemed appropriate for the enumerators training depending on the length of the questionnaire.

7. *Duration of census enumeration*

The time it takes to complete enumeration depends on the time it takes to complete the questionnaire; the size of the enumeration area and the availability of the members of the household. Ideally census enumeration should take one day to complete.

If an enumerator easily found respondents at an EA with 150 households and working eight hours a day in a fairly dense area, s/he would complete eight questionnaires a day allowing for 45 minutes of interview and 10 minutes of walking and introductions. Completion of eight questionnaires a day at an EA size of 150 households would take approximately 15 to 19 days.

8. *Timing of the PES*

A PES should be conducted soon after the main census enumeration so as to avoid errors arising out of persons moving from one place to another. However, there should be no overlap of the main census and PES enumeration. A period of 2 weeks to 3 months after the census enumeration is deemed fit for carrying out the PES enumeration.

