

Censuses of Population and Housing in Africa: Some Issues and Problems

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Abstract: A census of population and housing, which contributes immensely to the development of social statistics and national statistical services in general, has been carried out at least once in every African country except Chad. The common issues and widespread practices of design, implementation, processing, and evaluation of this census are reviewed. Also reviewed are the problems that arise at each of these stages of conducting

the census; problems arising as a result of the socio-economic and physical peculiarities of African conditions.

Key words: African Household Survey Capability Programme (AHSCP); Census of Population and Housing (CPH); Enumeration Area (EA); pilot census; de facto enumeration; de jure enumeration; post-enumeration (PES); Myers's index.

1. Introduction

Some African countries have developed capabilities for data collection. Others have not. Countries that have statistical programmes are countries enrolled in the African Household Survey Capability Programme (AHSCP). This programme was launched by the United Nations Economic Commission for Africa (UNECA) in 1978 to facilitate the development of national capabilities for efficient collection and dissemination of interdisciplinary, timely and reliable data on a continuing basis and on a wide spectrum of subjects.

The programme is functioning in eleven African countries. The remaining countries have uncoordinated and non-centralized

national statistical services and have problems with determining data priorities and targeting the wasteful use of resources for statistical work. There are also problems of data paucity and inadequacy in the area of social statistics and, in particular, household statistics. This paper addresses the problems, issues and practices involved in designing, implementing, and evaluation a census of population and housing (CPH) in Africa.

A CPH is the most important census performed in any African country. It contributes to the development of the national statistical services and, in particular, to the development of social statistics. It is for this reason that CPHs receive more attention in Africa than in Europe. This attention is warranted given that the conventional data sources, like sample surveys, administrative records, and even censuses, have been inadequate. The importance of CPHs is underscored by the legal statutes that authorize these censuses.

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CPHs contribute to the development of national statistical services in the following ways:

- (i) by providing benchmark data
CPHs provide benchmark data needed to plan socio-economic development. Specifically, these censuses give us data on:
 - size, nature and distribution (by age and sex, tribe, religion, etc.) of individuals in a country;
 - size, nature and distribution of the labour force;
 - literacy and illiteracy rates on the population in different age groups and correlated variables;
 - housing status of households with regard to tenure, type and availability of housing facilities.
- (ii) lists and supplementary data for intercensal sample surveys.

A well organized and executed CPH provides the following information:

1. Complete lists of all places and persons, villages and households, and enumeration areas (EAs) for the whole country. These lists have been a useful source of information for constructing sampling frames for intercensal large-scale household and other survey programmes in many countries. These lists have reduced the burden of constructing frames from scratch. Lists and data from the CPH have also been used to revise the national sample for the African Household Survey Capability Program (AHSCP).

2. Supplementary information, namely, information over and above that which is needed for the identification of sampling units. This information is used at the planning stage of sample surveys to choose efficient sampling designs (e.g., stratified sampling designs) or is used at the estimation stage to construct efficient estimators (e.g., ratio and regression estimators).

- (iii) Development of national data collection capabilities. CPHs have increased many African countries' confidence and experience in organizing and managing national data collection operations. In fact, there has been a significant increase in large-scale sample surveys in Africa since the majority of African countries successfully participated in the 1970 round of population and household censuses.

Most African countries have had at least one population census. The available records indicate that 32 out of 45 African countries participated in the 1960 World Population Census Programme. In the 1970 and the 1980 programmes, the numbers had increased to 35 and 47 respectively. Of the 47 countries participating in the 1980 round of CPH, 19 were carrying out their first census. Today, every country in Africa, except Chad, has had at least one census. Before 1970, population censuses in Africa were conducted separately from housing censuses. This proved both expensive and, in fact, unnecessary since the household is the unit of enumeration for both types of censuses. Since 1970, it has been more economical, both financially and organizationally, to combine the two censuses into one "census of population and housing" (CPH). Housing data, however, are collected only by a subsample included in the census programme.

Many countries that have carried out CPHs have benefited from the external technical and financial assistance without which they perhaps would not have been able to carry out their censuses. Sources of such assistance have included:

1. The African Census Programme. This programme was instituted in 1971 and financed by UNFPA; it continued till 1977 (UNECA (1986)). During the 1970 round of CPHs, a total of 102 man-years of assistance were supplied to the 22 countries belonging to the

programme. 58 man-years went to census organization, 16 to cartography, 4 to sampling, 16 to data processing and 8 to analysis.

2. Bilateral sources. Particularly for those countries that did not benefit the African Census Programme. United Kingdom, France, U.S.A., etc, were the main sponsors of assistance.

There are, however, countries like Algeria, Egypt, Morocco, Ghana, and Tunisia that have a tradition of censuses and now entirely, or almost entirely, financed their own census programmes.

2. Preparatory Activities

A CPH is a huge and complex undertaking. There is often no room for mistakes and second chances. If things do go wrong, the damage is most often irreparable. When planning a CPH one must work out a census calendar specifying a detailed time-table for the different census activities. This enables both local authorities and foreign sponsors to budget more accurately. In Africa, the following factors are usually taken into account when choosing dates for the field work:

(a) School holidays

Census organizations in many African countries employ school teachers and students as enumerators and supervisors. The field work must be scheduled to coincide with school holidays and the ministry of education usually cooperates by planning a school calendar that will give a sufficiently long break to accommodate the census.

(b) Rainy season

In many parts of Africa, poor roads make road transport slow and difficult especially during the rainy season. Some areas are completely isolated during the rainy season and for this reason, field work is usually scheduled for the

dry season. There is usually one long dry season per year in most countries and any postponement of the original census date can often lead to a postponement of a full year. Much of the mainland of Tanzania, for instance, usually experiences heavy rains from March through June, making any census field-work impossible before July.

(c) Periods of seasonal migration

It is best not to schedule a census during a migration period. Seasonal migration entails both internal and international migration. People migrate in search of work and other opportunities, to make pilgrimages (especially to Mecca and Medina) and to escape drought (e.g., in Ethiopia, Somalia, etc.). In every African country, people move from rural to urban areas and pastoralists wander from one rural area to another in search of green pastures (e.g. the Fulani of West Africa). Seasonal labourers in West Africa move southwards in the long-day season of October to April from countries like Mali, Upper Volta, Ivory Coast, and Ghana. In Southern Africa, principally in Botswana, Mozambique, Malawi, and Lesotho, there is the acute problem of labour migration to the Republic of South Africa.

(d) Periods of intense agricultural activities

Planting and harvesting are periods of intense agricultural activity and agricultural workers are rarely found at home during these periods. On the other hand, during the dry season there is little agricultural activity, leaving little incentive to migrate and thus increasing the chances that people will be found at home.

In East Africa, for instance, CPHs are normally taken in the month of August for three reasons:

- August is a dry month and allows for easier transport and communication;
- By August the harvest is over and there is little labour migration;

- August is a holiday month for all schools in East Africa so that students and teachers are available to do field work.

In Sudan, censuses are performed in May since nomads are expected to congregate at water points and the rainy season has not begun in southern Sudan where transport and communication are very difficult.

(e) The problem with delays

The importance of following the census time-table as closely as possible cannot be over-emphasized. It may be noted, however, that a number of census organizations in Africa failed to stick to their census calendars and this has led to delay and all sorts of complications. Major delays have occurred in the procurement of materials and equipment (e.g., vehicles, bicycles, etc.), printing of census documents and submitting progress reports, etc. All these had consequences for the census operations. For instance, in a number of countries the training of field workers started later than originally intended and was shortened to compensate for lost time. In some census documents, principally maps of the basic census units, the enumeration areas (EAs) were not ready in time to be used in the pilot census or in the training sessions for enumerators and supervisors. In the 1979 Kenya CPH, the intention was to issue census maps to districts as they were completed, starting in January 1979 to give the District Census Officers time to check and amend the maps before using them. This work was supposed to be completed by May 31st. There were delays and no district maps were issued until the end of June and map production was not finished until a few days before the enumeration began. The delay meant that errors in the maps and geographic files could not be corrected before field work started and the last stages of preparation were rushed. In the 1972 CPH in the Sudan, 3 600 vehicles

were expected. By census time, only 600 had been assembled. There was also a shortage of petrol. The computer hardware arrived a year later than expected and since this was a reconditioned machine, there were further delays in the installation (Sudan (1980)). All this led to considerable difficulties in maintaining the time-table and the quality of data. Perhaps the most protracted delay has been in the analysis and publication of census results. As can be seen from the following table, there were delays of up to eight years in the publication of the national report.

Table 1. Census Year and Year of Issue of Census which Participated in the 1970 Round of CPH

| Country | Census year | Issue of national report |
|-----------------------|-------------|--------------------------|
| 1 Algeria | 1966 | 1970 |
| 2 Angola | 1970 | 1977 |
| 3 Cape Verde | 1970 | 1975 |
| 4 Ghana | 1970 | 1976 |
| 5 Guinea-Bissau | 1970 | 1975 |
| 6 Liberia | 1974 | 1976 |
| 7 Libya | 1973 | 1977 |
| 8 Sao Tome & Principe | 1970 | 1978 |
| 9 Sudan | 1973 | 1977 |
| 10 Togo | 1970 | 1974 |
| 11 Tunisia | 1966 | 1973 |
| 12 Uganda | 1969 | 1971 |
| 13 Zambia | 1969 | 1974 |

Source: United Nations Economic Commission for Africa, Addis Ababa, Ethiopia 1979.

These delays almost always resulted from problems with the manual coding and the inability to process the census data using the computer installations found in some African Central Statistical Offices (CSOs). Shortages of qualified personnel in the field of data processing also caused delays. The long delays in the publication of national reports diminished the value and utility of the hard won census data.

2.1. Census Organization

2.1.1. Census-committees

Not all African nations have highly developed governmental organs that can easily administer a census and primary responsibility for a census usually falls on an ad hoc committee. Committee members come from various backgrounds in both the private and public sector. The census committee is usually chaired by a high government official, an appointment that reflects the importance placed on the census.

A number of other committees are established to facilitate the smooth implementation of the CPH. Among them are:

- a *Technical census committee* to handle all technical issues relating to the census including the practical organization of the census, questionnaire design, etc. Normally this committee is composed of the heads of principal departments involved in the census (Planning, Agriculture, Finance, Education, Health, etc.), the national university and the Central Statistical Office.

- *Regional census committees.* Census administration is kept as decentralized as possible to involve regional and district officials in the administrative tasks necessary for a smooth implementation of the census. It is also believed that the census publicity campaigns are best dealt with at the local level.

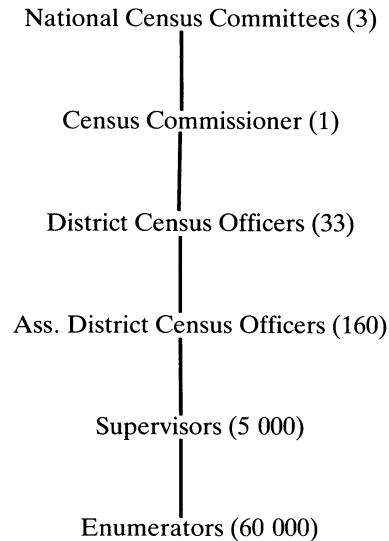
- *Publicity committee.* This committee consists of public relations experts who handle the publicity for the census. This committee's main task is to highlight the way the people benefit from the census. This committee sponsors radiocommercials in major languages; organizes talks and discussions; prints posters, stickers, T-shirts, cartoons in newspapers, etc.

2.1.2. Census structure

A Census Commissioner is usually appointed who executes the decisions made by the

National Census Committee. In most but by no means all cases, the appointee is a statistician or a demographer. He is assisted at the National Census Office by a technical staff who act as census officers. In some countries, the census office is an integral part of the National Central Statistical Office. In others, it is a separate and autonomous office, very much removed from the Central Statistical Office.

Further down the hierarchy are District Census Offices headed by District Census Officers who are usually local administrators. The structure of a CPH can be depicted by the organization of the 1980 Uganda CPH.



2.2. Cartographic preparation

In Africa, census maps are now recognized as prerequisites for effective census taking. The importance these countries place on census maps is reflected both in the proportion of total expenditure that is devoted to census cartography (usually 5–15 percent of the total census budget) as well as in the recruitment of expert assistance. 16 percent of the 102 man-years of technical assistance to countries that participated in the 1970 African Census Pro-

gramme were devoted to census cartography. This huge investment (money and other resources) in census cartography was absolutely necessary if complete coverage was to be achieved, (deGraft-Johnson (1975)). This investment is also valuable in creating national cartographic capabilities that can be used in all future censuses and surveys.

Topographical maps were used in the mapping operations for the 1970 CPH. In a few countries, namely Niger, Rwanda, and Burundi, aerial photographs were used. The general approach was to use the administrative structure of the country and divide the lowest administrative unit into EAs. We have considered the following when fixing the EA boundaries.

(a) Size

We tried to make all EAs about the same size to ensure equal distribution of workload among enumerators. It is also important that an enumerator can completely cover his territory within the enumeration period. The recommended size of an EA in the African Census Programme is 100 households or a population of 500 individuals. Uniformity of size for EAs has not been attained, as we will discuss later in this paper.

(b) Boundaries

To ensure the effective coverage of the whole country, every effort was made to create EAs with clearly identifiable physical boundaries employing natural dividers like roads, rivers, drains, etc. Except for enumeration of nomads, no overlapping or no-man's land was allowed as this would give rise to omission or duplication of count. This rule was not followed in all countries and not all uninhabited areas were excluded from the geographical frame.

(c) The accessibility of enumeration areas

Every area included in the EA had to be

accessible from within the bounds of the EA itself.

The overriding priority of creating EAs with clear and identifiable boundaries compromised the size of the EAs. In the 1970 round of CPH, the average size of an EA in the Central African Republic was an area with a population of 800, in Chad and Cameroon it was an area with a population of 1 000 against the recommended size around 500. In the 1979 CPH in Kenya, the average size of an EA was over 1 000 instead of the specified 500. There was, however, a great variation in the EA sizes. The distribution was as follows:

- 7 % of EAs had less than 50 households
- 42 % of EAs had between 50 and 150 households
- 25 % of EAs had between 151 and 250 households
- 20 % of EAs had between 251 and 500 households
- 4 % of EAs had between 501 and 700 households
- 2 % of EAs had more than 700 households.

District Census Officers were instructed to divide large EAs and record the changes on their maps. These divisions were made in some areas, but the accompanying annotation of maps was not always done. In the 1980 CPH in Zambia, many EAs were combined into "composite EAs" of two or more EAs. This was done where there were no identifiable boundaries. The lack of uniformity in size of EAs created unequal workloads for enumerators.

Frame construction for EAs was particularly difficult in the rural areas that ordinarily are not adequately mapped out and where there are no house numbers or definite addresses. In urban areas, however, this was much less of a problem because towns are usually well mapped out and can easily be divided into regular blocks, with a system of street names and house numbers (UNECA (1975)).

The problem of preparing census maps has been a difficult one. Cartographic work in Africa has been adversely affected by the non-availability of large-scale base maps, which are a necessary requisite for establishing satisfactory EAs, the physical environment, and shortage of cartographical skills, not to mention the shortage of funds. Base map coverage of the whole country either does not exist or where it exists the maps are not available when they are needed. As deGraft-Johnson (1975) points out, most of tropical Africa is recorded only by reconnaissance maps that are inadequate for census purposes because they lack detail.

In other cases, these maps are out of date. For instance, some maps used in the 1970 round of CPH were prepared in the late 50's or early 60's (UNECA (1977b)). In the arid and semi-arid areas of some countries (e.g., Mauritania, Niger, etc.) there have been considerable difficulties in establishing EAs with well-defined physical boundaries. In these countries, imaginary straight lines joining localities have been used as boundaries of EAs. However, enumerators did not have the same clearly defined ideas of their enumeration boundaries as census planners would have liked them to have had (UNECA (1977b)). It ought to be mentioned that poor cartographic work is in some cases the result of a shortage of cartographic skills at many African Central Statistical Offices. The cartographic needs of many African statistical agencies have been met by national departments of lands and surveys. The statistical agencies have neither influence nor control over these surveying agencies (Kiregyera (1982b)).

2.3. *Questionnaire design*

The demand for statistics is overwhelming when data is as scarce as is the case in Africa. Obviously, not all demands can be met by a single census operation. One of the major pre-enumeration activities is identifying which

needs (for development and planning) can be met by the census. The aim is to arrive at a list of topics that is not only manageable, but one that would yield reliable data given the available resources while at the same time ensuring that the most important topics for planning purposes are covered. The process of determining census topics involves consulting previous censuses (if in extant), studying the objectives in the current or previous national development plan, and following the United Nations guidelines for censuses.

In developing a questionnaire, only questions generating data that can be tabulated should be included. A matrix approach helps rationalize questionnaire development in that one can take consideration to overall census objectives and desired tabulations. A matrix displays data requirements against questionnaire items. Not many African countries construct this matrix and final tabulations reveal that a number of questions were asked that could not be tabulated (UNECA (1977b)).

It has been common practice in Africa to use two types of questionnaires for a CPH, namely a short form and a long form. The short form is used to collect information of limited scope from the entire population. The short form includes only the person's names, his/her relationship with head of household, sex, age, marital status, birth place, nationality, education, and literacy. This questionnaire is easy to administer. The long form is more difficult to handle and generally includes all the questions on the short form and several additional questions covering many socio-economic characteristics of households like housing conditions, economic activity, employment, source of power (fuel), source of water, domestic appliances, means of transport, health facilities, etc. This long form is generally administered to all respondents in urban areas and only on a sample basis (e.g. 10 % sample in the 1980 CPH in Uganda) in the rural areas where transport and communi-

cation is slow and difficult. A convenient enumeration technique in rural areas has been to make every tenth questionnaire a long form. This technique eases the burden of sampling especially when, in a number of countries, sampling frames were not completed in time to allow for the selection of a sample of EAs.

While the use of a long questionnaire on a sample basis leads to less work, the experience of some countries (e.g. Kenya's 1969 Census) has shown that this can complicate procedures. Moreover, if fertility and mortality rates are to be estimated at the district level, the sample must be large and the savings that would otherwise be made are diminished.

Many questions in the questionnaires used in African CPH are structured and pre-coded and the questionnaires are filled in by the enumerator at the time of enumeration.

Finally, the problem of questionnaire language must be dealt with. In tropical Africa there are multilingual groups (tribes) in each country. There is often an official language – French, English, or Arabic that the majority of people in these countries do not understand since it is acquired only through formal education. "It is very important that the enumerators be conversant in the language or dialect of the area where they work and that they are instructed in the correct formulation of the census questions in the vernacular when the questionnaire is printed in another language" (UNECA (1978)). In many African countries this problem has been solved by use of multilingual questionnaires, regional questionnaires, or by instruction manuals in the pertinent languages (UNECA (1978)). There are, however, countries, like Uganda where there are nonwritten languages. In these countries, the questionnaires are printed in the official language or another language and the enumerators do simultaneous translation of questions from the language of the questionnaire into the language of the respondent;

interpreters are sometimes used. There are yet other countries where census organizers have incurred the extra monetary costs involved in translating and printing the questionnaires in local languages. The benefits have been fewer errors than occur when the translation is left in the hands of enumerators, not to mention lack of consistency and uniformity in the way questions are translated into local languages by different enumerators. The 1973 CPH in Sudan avoided extra costs and probable mistakes involved in translating the questionnaires into the local languages of Bari, Diuka and Nuer by using English speaking enumerators who were assisted by interpreters from the tribe being enumerated (Sudan (1980)).

2.4. Recruitment and training of census field staff

A CPH is a grand operation that requires the deployment of a huge work force for a short time. In Africa and many other parts of the world, no useful information can be collected on a large scale by self-enumeration. Field staff, especially enumerators, are the corner stone of high quality census and survey data. Their recruitment and training have to be well-executed and their duties and responsibilities have to be well-defined. Because of the large number of enumerators needed in a census programme and the general low level of education in Africa, it is difficult to recruit high calibre, skilled, conscientious, and motivated enumerators (Kiregyera (1985)). Sudan could not recruit enough enumerators to carry out the 1973 CPH. This necessitated replacing the census with a sample (Sudan (1980)). It is important that enumerators be given adequate training and close supervision. In the African Census Programme, a supervisor/enumerator ratio of between one to five and one to ten is suggested (deGraft-Johnson (1975)).

It is a common practice in Africa to recruit high school students as enumerators and school teachers and staff of the departments of Health Agriculture and Veterinary Services as supervisors. The practice of recruiting teachers and department staff as supervisors has the advantage that these people are qualified and conscientious. Moreover, it does not cost much to employ these people since they receive a regular salary and need be paid only an honorarium. Perhaps, it ought to be mentioned that the experience of many African countries indicates that university students are disappointing as field workers. Their training is made difficult by their pompous attitude of "I know it all" or "I can read for myself." Once deployed, they would not withstand the hardships involved in field work. In the 1980 CPH in Uganda, for instance, only one third of the original number of university students recruited for field work actually served as enumerators.

Recruitment and training of field staff is decentralized, i.e., at a local level by the District Census Officers after a general recruitment campaign that starts approximately three months before the census. A lot of publicity on radio, in newspapers, etc. has assisted this recruitment of enumerators. The District Census Officers, who are often government administrative officers stationed at district headquarters, are usually trained for about two weeks. Enumerators' training usually lasts for 10–15 days and covers both classroom work as well as trial interviews with the census questionnaire. The classroom work has ordinarily covered:

- objectives of the census;
- basic definitions and concepts;
- questionnaire administration;
- identification of boundaries of EAs using census maps (where available);
- the art of asking questions;
- group discussion of completed questionnaires in trial interviews;

- roles and responsibilities as well as relationship to the supervisor.

Normally, the training of supervisors with more or less the above contents has preceded that of enumerators. The supervisors then participated in the training of enumerators.

2.5. Pilot censuses

Given a country's particular conditions, a census involves choosing among several procedures, methods, and materials. In Africa where the tradition of a census is not deeply rooted, there is an even greater need for testing. When testing, one is especially conscious of the following:

- (a) the feasibility of the census, particularly with regard to the census budget;
- (b) the adequacy of census documents, particularly the questionnaires and EAs;
- (c) census methods and procedures, e.g., listing procedures of addresses, sampling plan, enumeration procedures, general work control, document flow control, and training;
- (d) data processing methods, including development of code lists and coding instructions, editing, and tabulation programmes;
- (e) determining workload for urban and rural areas;
- (f) gauging the public's response to the census.

Few countries in Africa have any pretesting of the above items. Many African CPHs emphasize pretesting the questionnaire. Nevertheless in many EAs pretesting could not be conducted because the EAs were not ready at the time of the pretest. A great deal of experience is usually gained from field work and the difficulties encountered that were not anticipated at the planning stage. To benefit from the pretest, the pilot censuses must simulate the actual census conditions. The pilot census must be carried out at the same time of the year and use the same calibre of enumerators and supervisors that are used in the actual census.

A few examples can illustrate the usefulness of pilot censuses in Africa. The 1978 pilot census for Kenya indicated work rates of 120 persons per day in urban areas, 140 persons per day in densely populated areas and 60 persons per day in sparsely settled areas. From this pilot census, it was also discovered that the EAs were uneven and in some cases an EA had 250 households or more instead of the 100 households intended for an EA. On the basis of this discovery, extra enumerators were employed in large EAs. The 1973 pretest in Sierra Leone led to the discovery that the main causes of error was the enumerator's failure to ask correct questions or probe sufficiently (Benjamin (1981)).

3. Enumeration Procedures

A common characteristic of all CPH is that enumerators make house-to-house visits and records information for each individual on a separate line on the household's questionnaire. In Mozambique, a combination of house-to-house visits (for areas of high density) and group assemblies (for areas of dispersed population) is used. To canvass their work areas, enumerators use EA maps together with descriptions of both the location and the EA boundaries and a list of heads of households. The lists of heads of households are obtained in a prelisting operation in each EA either during the cartographic work or at the first stage of the field work. The prelisting consists of preparing an itinerary by following all paths and roads in the EA in a systematic manner and listing all clusters of huts and homes, talking to chiefs in each cluster, estimating the number of households, and recording the walking time between clusters (Liberia (1976)).

In a number of countries, census maps were not available for the EAs. In the 1980 Uganda CPH maps could not be drawn for rural EAs because these areas were not sufficiently stable

or well defined. In this census, EA boundaries were verbally defined to enumerators and supervisors (Kiregyera (1982b)). Even though the Liberian 1974 CPH had planned to use national maps for each EA, enumeration was done without the aid of these maps due to limited resources (Liberia (1976)).

In Africa, enumerators obtain responses from responsible adults, usually heads of households. In some cultures, female members of the households, especially those who have passed puberty and especially if they are unmarried, are not permitted to speak with strangers. The head of the household volunteers as much information as he considers safe to divulge. However, in certain cases responsible adults are willing to provide responses on especially sensitive questions like fertility. When the interview is not completed because the respondent is absent, revisits are made. If the third visit fails to secure an interview, the enumerators in some countries get information from neighbours (proxy interviews) while in other countries this case is classified as nonresponse. Proxy interviews are most frequent in urban areas where on the days after the census, heads of the households are at work for most of the day. Unfortunately, in urban areas, one does not know enough about one's neighbours to provide accurate data. Thus, using proxy interviews is unreliable.

3.1. Form of enumeration

The most commonly used form of enumeration in Africa is a *de facto* enumeration with a particular point of reference referred to as the *census night*, i.e., the night before enumeration begins. In a few countries, the idea of census night has not been used and census questions have been related to the Sunday previous to the enumerator's visit. The actual census has, however, been carried out on a census day, i.e., the day following the census night.

A de facto enumeration entails: a) counting only those persons who spent the census night in the country in a specified household, b) those persons who normally dwell in a specified household, but are temporarily absent on the census day and are somewhere in the country where they cannot be enumerated, e.g., someone who is out fishing all day. A household is usually defined loosely as "a group of persons who normally live and eat together." Separate arrangements are made for the enumeration of inmates or members of institutions. A de facto enumeration is clear and straightforward and may well be more accurate than a de jure enumeration. The de facto census involves simple instructions to enumerators while a de jure requires enumeration of people who are registered as residents regardless of where they are at the time of the census. This involves more complicated instructions and is most easily used in countries with accurate population registers. Most countries in Africa, however, do not have register systems. The de facto census is also a good method to use in cases like Sudan's first Population Census of 1955/56, where there were problems of shortage of transport, scarcity of suitable enumerators and supervisors, the difficulties of enumerating nomads (when they exist) and people living in widely scattered areas. Given these conditions, a de jure census would lead to a prolonged enumeration period, to double counting, or to people being missed out altogether.

3.2. *Duration of enumeration*

While the duration of enumeration varies from country to country, from five days to two weeks, every effort has been made to adhere to the United Nations' recommended principle of simultaneity of enumeration. Nevertheless, problems of inadequate logistical support, rough terrain, uncooperative respondents and in some cases uncooperative enumerators have made it difficult for enumeration to be

completed within two weeks. Indeed, in certain areas enumeration has dragged on for two months or so. The only country in Africa that planned not to adhere to the recommendation of simultaneity is Madagascar that carried out its 1974/75 census in three phases staggered over an eight month period.

3.3. *Enumeration of special groups*

(a) Nomads

Nomadism (movement of people together with their animals in search of pastures and water) presents serious problems when enumerating people and their animals. Many countries in Africa, among them Sudan, Niger, Ethiopia, Mauritania, Algeria, Somalia, Libya, Tunisia, Morocco, Chad, Mali, Kenya, Botswana must cope with this problem.

A number of methods have been used to enumerate nomadic populations. A few examples are:

(i) Group assembly method

This method has proved fairly successful in North African countries and involves the assembly of nomads at certain places for interview. Times and phases are fixed by an administrative or tribal authority. Unfortunately, this approach has not been able to ensure the nomads full participation in the census. If the head of the household cannot attend the enumeration assembly, it is often difficult to obtain adequate information from the representative sent to speak for the households. It is also difficult to determine absentees unless there is a list of households that are supposed to be present.

(ii) Social organization method

This method relies on register data on chiefs and their followers. These regis-

ters are usually used for tax collection. This is referred to as "administrative prelisting or special attempt to obtain lists through the chief system of tribes of equivalent social groupings" (UNECA (1977a)). Records kept by nomadic chiefs are, however, incomplete since many nomads attempt to evade tax. Use of these registers leads to coverage errors. In the absence of complete records, chiefs have to be relied upon to provide information on camp lists (camp approach) and water point lists (water point approach). Undercoverage results because these chiefs do not know all the camp-sites and water points.

(iii) EA method

The conventional EA method, normally used for enumeration of sedentary populations can also be used to enumerate a nomadic population. The EA method has the advantage of enabling one to distinguish between nomads and semi-nomads. There are, however, the persistent problem that maps are often unavailable or inadequate and it is almost impossible for enumerators to discern EA boundaries in desert and semi-desert conditions.

(b) Cotton pickers and pygmies

Special arrangements must be made for enumerating cotton pickers and pygmies. Cotton pickers in cotton growing areas like Sudan migrate to pick cotton when the crop is in season. The problem of their enumeration is essentially one of planning, knowing the period of their migration and making adequate arrangements to enumerate them where they are to avoid omissions or double counts. In Central Africa, pygmies can be approached only through missionaries apparently because they are suspicious of other people (UNECA (1977b)).

4. Data Processing, Quality Control and Evaluation

4.1. Data processing

In different African countries, processing of CPH data has been done both manually and by machine. Manual processing has consisted of limited editing, coding, and verification of coding. In many countries, coding has been done during enumeration using precoded questionnaires. Limited manual coding was then done in the office. Manual processing always entails recruitment and employment of a staff of editors and coders many of whom have no previous experience. Computer processing has been used in several phases, for example: conversion of punched data cards, editing, summary generation, and printing of census reports. In most countries, the traditional punch card approach of keying in data is considered obsolete and keying on to tape or diskette is the general practice.

In theory, a tabulation programme should be decided before the census questionnaire is completed. Few countries have been able to complete the tabulation programme before completing the final version of their questionnaires (UNECA (1977b)).

Cases have been reported where tabulation programmes were not ready at the time of data entry. In general, though, African countries have followed the tabulation recommended by the United Nations, with a geographical breakdown of data at three levels, viz. region, district, and local areas. Only recently have African CPHs begun to use software packages.

Data processing has been one of the major problematic operations of the African CPH. The reasons for such problems include:

1. Lack of computer facilities at Central Statistical Offices. In a number of countries, CSOs do not have computer facilities of their own and have to depend on other departments of government or agencies whose needs are

given first priority. This has been one of the obstacles to a timely processing of census data.

2. Manual data validation and lack of effective cooperation between subject-matter specialists and data processing staff.

3. Environmental conditions, especially fluctuations in voltage and frequent power cuts.

These problems have contributed to the long delays in both data processing and the publication of census results as illustrated by Table 1 on page 484. We recount the experiences of Sudan and Tanzania in grappling with data processing problems.

In the 1973 Sudan CPH, the census enumeration was finished in April. Coding took three months and was more or less completed by October 1973. Key punching of data was not complete until October 1974. At the time of the census, the CSO had a computer that was totally unsuitable for census processing since it had neither tapes nor disks, inadequate core storage, and a card reader and printer that were unusually slow. A United Nations data processing adviser recommended procurement of an IBM 360/22 with suitable configuration for census processing. A year later than scheduled, a reconditioned and slow IBM 360/30 computer (with core capacity of 32 K that was later upgraded to 64 K) was received with some components that operate at 110 volts. As a consequence, the installation of the computer was further delayed. The first set of consistent tabulations were produced in December 1976. The Census Report admits that the quality control of data conversion was poor; there was lack of planning and little communication between subject-matter and computer personnel and editing programmes were unsatisfactory. There were no funds allocated to the training of local staff in data processing.

As part of its preparation for the 1978 population census, the Central Census Office in Tanzania decided to acquire a key-edit

installation that could transfer data directly to magnetic tapes without using cards. By the time the Census Office cleared the red-tape to import the said installation, the earmarked machine had been sold to another customer. This resulted in a one-year delay in acquiring the computers. There was also a software problem. It was decided to use COBOL for validation work since the office had both a programmer who knew the language and a programme package for tabulation. A modified social science statistical package from the University of Edinburgh could not be used because of its limited memory. The US Bureau of the Census donated to the Census Office a COCENTS package that had been used successfully in Botswana. The COCENTS tape was accompanied by a print-out of the source programme. Unfortunately, the tape could not be read by the computers available in Dar es Salaam. After repeated failures to read the tape, the Census Office, in June 1979, approached the local USAID office and requested personnel to make the package operational (Tanzania (1981)).

4.2. *Quality control and evaluation*

4.2.1. *Quality control*

A review of the enumeration procedure of a number of African censuses indicates that the quality control of enumeration did not receive adequate attention (UNECA (1986)). In some countries, however, quality control methods to ensure high quality census data have been instituted. These have included:

- pretests of census documents (mainly the questionnaires) and materials;
- extensive geographic planning and field work as well as pre-enumeration of all areas;
- extensive education and publicity campaigns through the national press (radio, TV, and newspapers), posters, car stickers, T-shirts,

local chiefs, schools and churches have helped to arouse general awareness about the usefulness and benefits of the census to the people;

- systematic enumeration of all dwellings in each EA have helped to minimize the number of omissions;
- special effort to enumerate nomadic or migrating people and other special groups;
- improve training for enumerators and supervisors ranging from a few days in some countries up to two weeks in others;
- small supervisor – enumerator ratio to ensure close supervision. This has improved from 1:10 in some countries in the 1970 round to 1:5 in the 1980 round of CPH (UNECA (1986));
- operational control and reporting systems;
- use of historical calendars of major events (national, regional or local) in the life of the population being enumerated because of the difficulties in determining ages in Africa. These calendars were used in all African countries and have enabled enumerators to pinpoint the birth of individuals and determine their age fairly accurately (UNECA (1977b)).

For children less than one year of age, religious or seasonal calendars have been used.

4.2.2. Evaluation

In spite of the above quality control methods used to ensure high quality census data, census data in Africa remains fraught with all sorts of errors that arise at different stages of the census operation.

The more serious errors that arise concern both coverage and content and arise at the enumeration stage. Errors of coverage are generally easier to evaluate than errors of content. During the second meeting of the African Census Programme Country Experts held in 1974, it was stressed that census evaluation should consist of coverage rather than content checks (UNECA (1975)).

(a) Evaluation of errors of coverage

Two techniques are available for evaluating errors of coverage.

(i) Comparison of the census results with an existing body of data from other source

A demographic analysis of census data from a previous census and checks of consistency with existing birth, death, and migration statistics and registers can be done. Consistency checks can be performed and census totals can be compared with similar data from other sources. Since it is not always possible to find alternative sources of reliable data in Africa (because previous censuses were less well done and therefore less reliable and the registration systems are defective and highly unreliable), the general recommendation made during the 1970 round of African CPH was that ad hoc post-enumeration surveys be done to evaluate census data (UNECA (1977b)). However, two countries, Egypt and Mauritius that participated in the 1970 CPH, carried out evaluations of their census data using demographic analysis rather than a post-enumeration survey.

(ii) Post-Enumeration Survey (PES)

This is an ad hoc survey that should be conducted soon after the census as a check on the census data. It is best to take the post-enumeration survey as soon as possible after the census because:

- the publicity given to the census will still be fresh and the respondents will be more cooperative;
- the information that the respondents gave will still be fresh in their memories;
- the populations will not have moved very much.

The post-enumeration survey involves the complete reenumeration of a sample of census EAs (e.g. a 1 % sample of census EAs in the 1974 PES in Liberia) in such a way that:

- 1) the sampled EAs are representative of the total population;
- 2) the census and PES are independent operations;
- 3) a group of the best enumerators are used in the PES in order to achieve complete coverage;
- 4) total population census figures are not only compared with PES totals, but a "one-to-one" matching of individuals is done.

The conditions stated in (1) through (4) are difficult to achieve in Africa. Complete independence of the census and PES operations cannot be ensured when the same chiefs and headmen are used as guides and the same census maps are used. If these were inadequate in the census, chances are that they will be equally inadequate in the PES. In practice, the best enumerators may not be available for the PES. Chances are that these would be employed elsewhere (e.g. teaching) and while their employers are usually willing to release them for the census, they may not be able to do so for a PES which is expected to take longer (Blacker (1969)). Even if these enumerators were available, they would not want to work in new areas where they would not be familiar with the neighbourhoods and customs in the area. One-to-one matching poses difficulties in Africa because many people are either known by a number of different names (they may be shown by one name in the census and another in the PES) or many people may have the same name.

Many countries that participated in the 1970 round of CPH did not implement the elaborate quality checks that are discussed above. Most national reports did not contain much detail of the quality checks carried out. Only 11 out of 47 countries that participated in the 1980 CPH carried out a PES and coverage evaluation as part of their census programme. Those that did are: Algeria, Botswana, Burkina Faso, Cameroon, Ghana, Guinea Bissau, Ivory Coast, Kenya, Liberia, Senegal, and Zambia.

Lack of enthusiasm for PESs in Africa stems for the most part from the bad experience of those countries that have carried out the PES and partly from high costs involved (UNECA (1986)).

In some of the countries that conducted a PES as a follow-up to the 1960 and 1970 CPH, the results were inconclusive. These countries include Liberia 1962, Tunisia 1966, Algeria 1966, and Ghana 1960 and 1970. In the case of Ghana 1970, the disparity between the PES and census was large, indicating a completeness rate of only 67 %. In the 1960 Census in Ghana, matching of the census and PES returns showed that only 28 % of the people were given the same age in the two enumerations, and only 58 % were even in the same five-year age group. The data from the PES done in Tunisia was totally rejected and the Algerian experience has never been published. Some of the factors that have led to failure of the PES following a CPH in Africa have been identified (UNECA (1977b)) as:

- (i) Movement of the population during the interval between the census and the PES. This problem can be reduced by carrying out a PES immediately after the main census.
- (ii) Unrecognisable boundaries of the sample areas and general weakness in the cartographical material. This problem can be solved by improving the census cartographical preparation.
- (iii) People and localities are often known by different names. This was a great problem in Liberia where sometimes official and local names of localities differed considerably. All attempts to match the 1962 Census and PES in Liberia had to be abandoned because of this problem.
- (iv) The same name being used by a large number of persons or villages. This was a big problem in the Ivory Coast in 1976. The problem of different names is

essentially a matching problem and can be solved by careful planning and testing.

- (v) The general fatigue and apathy that enumerators, supervisors, and respondents experience.

In a few countries, however, useful results were obtained from the PES. These included Liberia 1970, Cameroon 1976, Malawi 1965, and Kenya 1969. Post-enumeration surveys showed that the national undercoverage in Malawi was 2.6 %, in Kenya 5 % and in Liberia 11 %.

The census figures were inflated and it was these revised census figures that were published. It is debatable whether the census figure should be corrected for coverage error following a PES especially given that census undercoverage will, for different reasons, vary from one region of the country to another.

A reexamination of the PES procedures has led to the use of a similar technique, the dual system of estimation. This places emphasis on independence between the CPH and the PES rather than attempting to achieve complete coverage in the PES. Countries that have used this technique include Liberia 1974 and 1980, Botswana 1981, Ghana 1984, and Ivory Coast

1975. In the latter two countries the approach did not yield satisfactory results (UNECA (1986)).

(b) Evaluation of errors of content

In African CPHs, questions that call for numerical responses in areas where people generally do not think in numerical terms are bound to generate responses that are almost certainly in error. These include questions on age, income, distance to the nearest social or economic facility. In some African countries, taboos forbid the counting of children or cattle (lest they should die). In Sudan, for instance, rural tribes believe that “The Evil Eye” will affect their children if their age and number are exposed to strangers, especially if the children are in the age group 5–10 and are males (Sudan (1980)).

Some studies based on matching PES records with census returns were attempted in at least one African country in the 1960 and 1970 rounds of CPH. Indices of consistency showed that age, which is one of the most important pieces of information collected in a CPH, was the most unreliable of all the basic data recorded. Ages 0 and 5 were the most stated

Table 2. *Myers’ Index of Digital Preference for Selected African Countries*

| Country | Census year | Quality rating | Myers’ Index | |
|------------|-------------|----------------|--------------|------|
| | | | M | F |
| Botswana | 1971 | C | – | – |
| | 1981 | A | 7.1 | 6.8 |
| Ghana | 1960 | C | 29.7 | 31.5 |
| | 1970 | C | 26.8 | 31.2 |
| Kenya | 1969 | B | 21.2 | 22.2 |
| | 1979 | B | 12.4 | 15.4 |
| Lesotho | 1966 | B | 11.8 | 12.8 |
| | 1976 | B | 10.4 | 9.6 |
| Libya | 1964 | C | 46.5 | 70.3 |
| | 1973 | B | 9.8 | – |
| Malawi | 1977 | C | 12.9 | 16.6 |
| Mozambique | 1970 | C | – | – |
| | 1980 | C | – | – |
| Tanzania | 1967 | C | 36.9 | 41.5 |
| | 1978 | C | 25.2 | 32.1 |
| Swaziland | 1966 | C | 32.4 | 17.0 |
| | 1976 | B | 14.1 | 14.7 |

figures. Other indices, especially for age distortion and in particular digital preference, were computed using demographic techniques.

The following table gives Myers' index of digital preference for selected African countries together with the quality rating of the underlying censuses.

The quality rating is: A, a score between 0 and 20 (accurate); B, a score between 20 and 40 (inaccurate); C, a score above 40 (highly inaccurate) (Ntozi (1985)).

It is clear from the table that out of 18 selected censuses, only Botswana's 1981 Census is ranked as accurate and only two others are ranked almost accurate. The remaining 15 are ranked inaccurate. It, however, should be noted that for eight countries that have carried out two censuses, almost all of them showed major improvements in age data. Only Mozambique's 1970 Census showed a deterioration of age data over the 1970 Census.

5. Summary

The Census of Population and Housing (CPH) is the most important census in any African country, and has been carried out at least once in every African country except Chad. Many of these censuses have been facilitated by external, technical, and financial assistance and only a few countries with a census tradition have entirely or almost entirely financed their own census programmes. Topographical maps have been used as a basis for creating EAs. These EAs have varied greatly in size. The main problem of EA frame construction has been unavailability of adequate base maps especially for rural areas that are often not mapped out at all.

Two types of questionnaires for the CPH have been used in Africa, a short form and a long form. Many questions on these forms are precoded and enumerators fill in the forms at the time of the interview. Questionnaire development in Africa has generally not used matrices that helps rationalize the procedure

by taking into consideration the overall census objectives and desired tabulations. Consequently, final tabulations for many CPHs have revealed that a number of questions asked could not be tabulated. Multilingual questionnaires or regional questionnaires have been used for the multilingual societies of tropical Africa. For unwritten languages simultaneous translation and interpreters have been used.

A characteristic feature of African CPHs is that enumerators make house-to-house visits on the census day, and thus conduct a *de facto* enumeration. Special efforts have usually been made to enumerate migrating populations and other special groups like nomads, cotton pickers, and pygmies.

Field work has always been preceded by pretests of the questionnaires. The factors that have been considered crucial for scheduling the field work have included school holidays, periods of seasonal migration (usually avoided), periods of intense agricultural activities – planting and harvesting periods (usually avoided) and rainy seasons (usually avoided). Despite that every effort has been made to adhere to the UN recommended principle of simultaneity of enumeration, problems of logistical support, difficulty of terrain and problems of respondents have in many cases protracted the period of field work for up to two months and in some cases, even longer.

Generally, data processing has been one of the major problems of the CPH and has been done both manually and by machine. The traditional punch card approach to keying in data has been abandoned and key to tape or diskette is now used in most countries. Most countries have followed the tabulation programme recommended by the UN. Few countries, however, have managed to finish their tabulation programmes before completing the final version of their questionnaires.

A number of quality control methods have been instituted and these have included pre-

tests, extensive geographical planning, extensive publicity, improved training, operational control and reporting systems, historical calendars, etc. Despite these controls CPH data in many African countries remain inaccurate. Many countries do not have a post-enumeration survey (PES) as part of their census programme to evaluate census errors. But even for those that have such a program the results have generally been inconclusive. There have also been long delays between completion of field work and publication of final census reports. All these factors have affected the utility of census data in Africa.

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