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DRAFT PRINCIPLES AND RECOMMENDATIONS FOR POPULATION
AND HOUSING CENSUSES

Part One

OPERATIONAL ASPECTS OF POPULATION AND HOUSING CENSUSES

Report of the Secretary-General

Note: For technical reasons, these draft principles and recommendations are being issued as four documents. The present document comprises Part One (Operational aspects of population and housing censuses); the introduction will be contained in document E/CN.3/515; and Part Two (Topics and tabulations for population censuses) and Part Three (Topics and tabulations for housing censuses) will appear in documents E/CN.3/515/Add.2 and Add.3 respectively.

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I. DEFINITIONS, ESSENTIAL FEATURES AND USES OF
POPULATION AND HOUSING CENSUSES

A. Definitions

1. Population census

1. A population census is 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 in a well-delimited part of a country.

2. Population is basic to the production and distribution of material wealth. In order to plan for, and carry out, economic and social development, administrative activity or scientific research it is necessary to have reliable and detailed data on the size, distribution and composition of population. The population census is a primary source of these basic bench-mark statistics, covering not only the settled population but homeless persons and nomadic groups as well. Data from population censuses may be presented and analysed in terms of statistics on persons, married couples, families and households and for a wide variety of geographical units ranging from the country as a whole to individual small localities or city blocks.

2. Housing census

3. A housing census is the total process of collecting, compiling, evaluating, analysing and publishing or otherwise disseminating statistical data pertaining, at a specified time, to all living quarters ^{1/} and occupants thereof in a country or in a well-delimited part of a country.

4. The census must provide information on the supply of housing units together with information on the structural characteristics and facilities that have a bearing upon the maintenance of privacy and health and the development of normal family living conditions. Sufficient demographic, social and economic data concerning the occupants must be collected to furnish a description of housing conditions and also to provide basic data for analysing the causes of housing deficiencies and for the study of possibilities for remedial action. In this connexion, data obtained as part of the population census, including data on homeless persons, are often used in the presentation and analysis of the results of the housing census.

^{1/} For the definition of "living quarters", see Part Three, para. 41.

B. Essential features

5. The essential features of population and housing censuses are individual enumeration, universality within a defined territory, simultaneity and defined periodicity.

1. Individual enumeration

6. A "census" implies that each individual and each living quarters is enumerated separately and that their characteristics are separately recorded. Only by this procedure can the data on the various characteristics be cross-classified. Individual enumeration does not preclude the use of sampling techniques for obtaining data on specified characteristics, provided that the sample design is consistent with the size of the areas for which the data are to be tabulated and the degree of detail in the cross-tabulations to be made.

2. Universality within a defined territory

7. The census should cover a precisely defined territory (e.g., the entire country or a well-delimited part of it). The population census should include every person present and/or residing within its scope, depending upon the type of population count required. The housing census should include every living quarters irrespective of type.

3. Simultaneity

8. Each person and each living quarters should be enumerated as nearly as possible in respect of the same well-defined point of time and the data collected should refer to a well-defined reference period. The time-reference period need not, however, be identical for all of the data collected. For most of the data, it will be the day of the census; in some instances, it may be a period prior to the census.

4. Defined periodicity

9. Censuses should be taken at regular intervals so that comparable information is made available in a fixed sequence. A series of censuses makes it possible to appraise the past, accurately describe the present and estimate the future. It is recommended that a national census be taken at least every 10 years. Some countries may find it necessary to carry out censuses more frequently because of the rapidity of major changes in their population and/or its housing circumstances.

10. The census data of any country are of greater value nationally, regionally and internationally if they can be compared with the results of censuses of other countries that were taken at approximately the same time. Therefore, countries may wish to undertake a census in the years ending in "0" or as near to those years as is possible. It is obvious, however, that legal, administrative, financial and other considerations often make it inadvisable for a country to

adhere to a standard international pattern in the timing of its censuses. In fixing a census date, therefore, such national factors should be given greater weight than the desirability of international simultaneity.

C. Uses in an integrated programme of data collection and compilation

11. Population and housing censuses are the principal means of collecting basic population and housing statistics as part of an integrated programme of data collection and compilation aimed at providing a comprehensive source of statistical information for economic and social development planning, for administrative purposes, for assessing conditions in human settlements, for research and for commercial and other uses.

12. The value of either census is increased if the results can be employed together with the results of other investigations, as in the use of the census data as a base or bench-mark for current statistics, and if it can furnish the information needed for conducting other statistical investigations. It can, for example, provide a statistical frame for other censuses or sample surveys. The population census is also important in developing the population estimates needed to calculate vital rates from civil registration data (see paras. 39-41 below). In addition, these censuses are a major source of data used in official compilations of social indicators, particularly on topics that usually change slowly over time. ^{2/} The purposes of a continuing co-ordinated programme of data collection and compilation can best be served, therefore, if the relationship among the population census, the housing census and other statistical investigations is considered when census planning is under way and if provision is made for facilitating the use of the census and its results in connexion with such investigations. The use of consistent concepts and definitions throughout an integrated programme of data collection and compilation is essential if the advantages of these relationships are to be fully realized.

13. A population and housing census also serves as the logical starting place for work on the organization and construction of a computerized statistical data base to serve continuing national and local needs for data in the intercensal period. ^{3/}

^{2/} See, for example, Social Indicators: Preliminary Guidelines and Illustrative Series, Statistical Papers, Series M, No. 63 (United Nations publication, to be issued).

^{3/} For a fuller discussion of many of the technical and policy issues that arise in the construction and use of integrated statistical data bases, see "Methods of collecting, organizing and retrieving social statistics in achieving integration" (E/CN.3/516), which is also before the Commission.

1. Uses of population censuses

(a) Uses for policy-making, planning and administrative purposes

14. The fundamental purpose of the population census is to provide the facts essential to governmental policy-making, planning and administration. Information on the size, distribution and characteristics of a country's population is essential to describe and assess its economic, social and demographic circumstances and to develop sound policies and programmes aimed at fostering the welfare of a country and its population. The population census, by providing comparable basic statistics for a country as a whole and for each administrative unit and locality therein, can make an important contribution to the over-all planning process and the management of national affairs. Population census results are also used in policy development and in management and evaluation for programmes in such fields as education and literacy, employment and manpower, family planning, housing, maternal and child health, rural development, transportation and highway planning, urbanization and welfare. Further and more specific examples are given in chapter II of Part Two, along with references to appropriate manuals and guidelines.

15. One of the most basic of the administrative uses of census data is in the demarcation of constituencies and the allocation of representation on governing bodies. Detailed information on the geographical distribution of the population is indispensable for this purpose. Certain aspects of the legal or administrative status of territorial divisions may also depend on the size of their populations.

(b) Uses for research purposes

16. In addition to serving specific governmental policy purposes, the population census provides indispensable data for the scientific analysis and appraisal of the composition, distribution and past and prospective growth of the population. The changing patterns of urban-rural concentration, the development of urbanized areas, the geographical distribution of the population according to such variables as occupation and education, the evolution of the sex and age structure of the population, and the mortality and natality differentials for various population groups, as well as the economic and social characteristics of the population and labour force, are questions of scientific interest which are of importance both to pure research and for solving practical problems of industrial and commercial growth and management.

(c) Uses for business, industry and labour

17. In addition to those given above, the census has many important uses for individuals and institutions in business, industry and labour. Reliable estimates of consumer demand for an ever-expanding variety of goods and services depend on accurate information on the size of the population in subnational areas and its distribution at least by age and sex, since these characteristics heavily influence the demand for housing, furnishings, food, clothing, recreational facilities, medical supplies and so forth. Furthermore, the local availability

of labour for the production and distribution of such commodities and services may be important in determining the location and organization of enterprises.

2. Uses of housing censuses

(a) Uses for development of bench-mark housing statistics

18. The Statistical Commission at its ninth session directed the attention of national statistical services to "the need to develop, from housing censuses, the sort of bench-mark statistics in housing that could be supplemented by current building and construction statistics and which would provide a continuous up-to-date picture of the housing position needed for the consideration of housing programmes". ^{4/} Since not all the basic information required to assess housing needs or to formulate housing programmes can be obtained through a housing census, additional data must be obtained through the population census, special housing surveys and environmental surveys and from vital statistics, economic statistics and so forth; but data obtained from the housing census will constitute the basic framework within which the estimates will be made, indices computed and further statistical inquiries planned.

(b) Uses for the formulation of housing policy and programmes

19. The formulation of housing policy and programmes represents one of the principal uses of housing census data. Housing policy is normally influenced by social and economic as well as political considerations and the availability of factual data concerning the housing situation provides objective criteria, which it is important for policy makers to take into account.

20. In most countries, housing programmes comprise both governmental and private activity. The data derived from a housing census are used by governmental authorities for making an analysis or diagnosis of the housing situation. ^{5/} Housing conditions are analysed in quantitative and qualitative terms and data from previous censuses are used to indicate the changes in the housing situation that have occurred during the intercensal periods; the housing deficit and future housing requirements are estimated and compared with the rates of dwelling production being attained; the characteristics of the households in need of housing are considered in relation to the availability and cost of housing. As part of over-all development plans such an analysis is necessary for the formulation of national housing programmes and for their execution. ^{6/}

^{4/} Official Records of the Economic and Social Council, Twenty-second Session, Supplement No. 7 (E/2876), para. 117.

^{5/} For some statistical indicators for measuring housing conditions, reference may be made to Statistical Indicators of Housing Conditions (United Nations publication, Sales No. 62/XVII.7) and to Social Indicators: Preliminary Guidelines and Illustrative Series (United Nations publication, to be issued). Statistical Papers, Series M, No. 63.

^{6/} Improving Social Statistics in Developing Countries: Conceptual Framework and Methods (United Nations publication, to be issued). Statistical Papers, Series M, No. 64.

21. The data that becomes available from the housing census will also be studied by commercial users. Those engaged in the construction industry as well as financing institutions and manufacturers of housing fixtures and equipment and household appliances need to assess the possible demand for housing and to visualize the scope of their activities within the over-all programme.

3. Relationship between the population census and the housing census

22. An especially close association exists between population censuses and housing censuses. The two censuses may comprise one statistical operation or they may be two separate but well co-ordinated activities, but they should never be considered completely independent of each other because essential elements of each census are common to both. For example, an essential feature of a population census is the identification of each occupied set of living quarters and of the persons living therein, and an essential feature of a housing census is the collection of information on the characteristics of each set of living quarters in association with the number and characteristics of its occupants.

23. In many countries, the population and housing censuses are taken concurrently, often with the use of a single schedule. In this way, the information on population and living quarters can be more readily matched, processing is facilitated and extensive analysis can be carried out. This also makes it possible to relate to the housing census data the information on demographic and economic characteristics of each household member that is routinely collected in the population census; if the population census cannot provide this information, it has to be collected in the housing census.

24. The advantages of simultaneous investigation may be offset to some extent by the additional burden on the respondent and the enumerator resulting from the increased amount of information that must be collected at one time. In countries where this is likely to be a serious problem, consideration might be given to collecting data for a limited number of topics on the basis of a complete enumeration in the population and housing census, with more complex data in both fields being collected on a sample basis only, either concurrently with or immediately following the full enumeration. Alternatively, consideration might be given to carrying out the housing census as part of the advance-listing operations of the population census.

25. The relationship between the population and the housing census will affect the means by which data on homeless persons are obtained. In the case of simultaneous censuses of population and housing, data on homeless persons will be obtained as part of the population census. Where the housing census is carried out independently of the population census, it will be necessary to try to enumerate them in the housing census.

4. Relationship of population and housing censuses to intercensal sample inquiries

26. The rapidity of current changes in the size and other characteristics of populations and the demand for additional detailed data on social, economic and

housing characteristics that are not appropriate for collection in a full-scale census have brought about the need for continuing programmes of intercensal household sample surveys to collect current and detailed information on many topics. Sometimes such a sample inquiry may be the only means available of obtaining bench-mark housing data.

27. The population and housing census can provide the frame for scientific sample design in connexion with such surveys (see paras. 215-218); at the same time, it provides bench-mark data for evaluating the reasonableness of the overall survey results as well as a base against which changes in the characteristics investigated in both inquiries can be measured. To permit comparison of census and survey results, the definitions and classifications employed should be as nearly alike as possible consistent with the aims of each investigation. Because of the relative permanence of living quarters, the lists available from the housing census (with suitable updating) may also provide a convenient frame for carrying out inquiries dealing with topics other than population and housing.

5. Relationship of population and/or housing censuses to other types of censuses and other statistical investigations

(a) Census of agriculture

28. Neither population nor housing censuses have as close a relationship to agricultural censuses as they have to each other. As the result, however, of increasing integration within programmes of data collection, the relationship between the population census and that of agriculture should now be closer than it was in the past even though the two censuses use different units of enumeration. This development did not necessarily imply an attempt to combine population and agricultural censuses into a single field operation, which might in fact place a very great burden on the field staff.

29. The unit of enumeration in agricultural censuses is the holding, which is the techno-economic unit of agricultural production; the units of enumeration in population censuses are the household and the individual within the household. In a change from past recommendations for agricultural censuses, the Programme for the 1980 World Census of Agriculture ^{7/} no longer recommends the collection of information on the total number of persons living on agricultural holdings. Instead, it points out that some of the data needed on agricultural population and employment may better be obtained through population censuses and household sample surveys of various kinds, and that "the agricultural census should provide the means to collect information on 'agricultural population' and employment which complements data obtained through other inquiries". Accordingly, it recommends (a) the collection of limited data on demographic characteristics and economic activity of members of the holder's household, (b) the collection of information on the number and sex of hired permanent agricultural workers for each holding and (c) an indication of whether or not occasional agricultural workers are utilized on the holding.

^{7/} FAO Statistics Series, No. 1, Rome, 1976.

30. Hence, agricultural censuses are no longer expected to provide data on all persons employed in agricultural work nor on the "farm populations". Greater reliance will be placed on derivation from the results of population censuses (and household and other sample surveys) of information on persons engaged in the agricultural industry and those engaged in an agricultural occupation. It should be realized, however, that the population census, particularly if it investigates only the principal economic activity of each person during a short time-reference period, may not identify persons connected with agricultural activity only incidentally during the period and will not identify persons who worked in agriculture during some other period of the year only.

31. Countries may, therefore, wish to consider the possibility of adding to their population census a question enabling them to identify persons who did some work in connexion with agriculture over a longer time-reference period, even though their principal or secondary activity during the shorter time-reference period was non-agricultural. Because of the difference in the units of enumeration between population and agricultural censuses, however, the population census cannot be expected to provide the information needed to allocate the persons thus identified to a particular holding. Further, countries may find it more appropriate to investigate incidental agricultural work through sample surveys, which are more suitable to detailed investigation that would overburden the population census.

32. As is emphasized also in the Programme for the 1980 World Census of Agriculture, it is important that the relevant definitions used in agricultural censuses and those used in population and housing censuses be compatible in order that the results of the agricultural census and those of the population and/or housing censuses can be used jointly, taking advantage of data-base capabilities.

33. Population and housing censuses can also be of use in the preparation of an agricultural census. Information from a recent population and/or housing census can be utilized for demarcation of enumeration areas, preparation of the frame for the census and design of the sample if a complete agricultural enumeration is not undertaken. In planning for a population and housing census, consideration may be given to the possibility of collecting some agricultural information that would facilitate the preparation of a subsequent agricultural census. For example, the population and/or housing census may serve as a convenient means of identifying agricultural holdings or at least holders for a subsequent census of agriculture. The housing census also provides an opportunity to collect data concerning small-scale agricultural activity carried on where the area in question would not fall within the definition of an agricultural holding. These data sometimes refer to the keeping of poultry, bees and so forth.

34. If it is desired to collect information in an agricultural census on some demographic or social characteristics of persons employed in agricultural work it would be useful to employ the same definitions and classifications of such characteristics as are used in the population census, in order to permit as high a degree of comparability as possible between the results of the two censuses. In some cases, the utilization of supplementary sample surveys in connexion with either census may serve to provide the information desired on the relationship

between the characteristics of the population of holdings and the characteristics of the holdings.

(b) Census of establishments

35. Although the collection of information on industrial and commercial establishments is not a part of the population census, some of the information that is collected regarding economic characteristics of individuals can be used for preparing listings of the proprietors of such establishments and/or of the establishments themselves. Experience shows that these listings can be used in a subsequent census of establishments or for supplementing the registers of establishments maintained by most countries and utilized in their establishment censuses. Since most of the registers cover at least all establishments in which more than a minimum of persons (e.g., 5 or 10) are employed, it is usually only necessary to obtain information through the population census on smaller establishments, particularly those operated by self-employed persons. But it is essential that this information from the population census be available shortly after the enumeration is carried out because this kind of information can become out of date rather quickly.

36. The population census information needed for these purposes is the industry and status (as employer, employee, own-account worker etc.) of economically active persons, the name and address of their establishments (if any) and (for employers) the number of employees. If all of this information appears on the census questionnaire, the data for the small employers and own-account workers can be extracted from the schedule or from the processing documents after the enumeration. If only industry and status appear on the schedule, the remaining information may be obtained from the desired group at the time of the population census enumeration and entered on a separate schedule.

(c) Census of buildings

37. Since, as part of the housing census operation, it is necessary to inquire concerning all buildings (both residential and non-residential) in order to ascertain whether they are occupied or not, it may be convenient to record all buildings at the time of the housing census, even though data may be collected only for those in which housing units or other living quarters are located. The comprehensive list thus obtained sometimes provides the basis for a census of buildings, carried out concurrently with, or subsequent to, the housing census, or it may provide for the identification of special types of buildings significant for other inquiries, such as the census of distribution, the school census etc.

(d) System of current housing statistics

38. Current housing statistics refer to housing activity. They reflect the number of dwellings constructed and certain related information such as value, number of rooms, floor space etc. as well as the number of dwellings destroyed or demolished. These data are usually obtained from a system of data collection based on the administrative procedures that are required in connexion with the activity in question. For example, construction statistics may be derived from permits issued for the construction of dwellings, from records of dwelling starts or completions, from certificates of occupancy. Statistics on dwellings destroyed may be obtained

from the records maintained for the levying of rates and the collection of taxes. Compiled monthly or quarterly, current housing statistics reflect changes in the housing inventory and, although they may serve other purposes, they are also used to update the bench-mark data obtained from housing censuses.

(e) Civil registration and vital statistics

39. Population census data serve as denominators for the computation of vital rates, especially rates specific for characteristics normally investigated only at the time of the census. Conversely, census results, time-adjusted by vital and migration statistics, can provide estimates of the future size, distribution and other characteristics of the population of the total country and subnational areas. Further, census data on fertility can provide a bench-mark check on the reliability of current birth statistics. It is consequently desirable that procedures for the collection of population census data, vital statistics and migration statistics be closely co-ordinated with regard to coverage, concepts, definitions, classifications and tabulations.

40. It may be noted that some countries have linked individual census returns for infants under one year of age with birth registration reports for the year preceding the census date as a means of checking on the completeness of one or the other type of investigation. Linkage of death reports with census returns has been used to compare the information on characteristics of the deceased as reported in the two sources. While the many problems posed in the past by the one-to-one matching of two types of records have not been entirely solved, they have been mitigated by developments in computer technology. Before undertaking either of the procedures, however, countries should consider carefully the possible advantages of using household sample survey returns, rather than census returns, in the operation. Moreover, such operations have to be carried out in complete accord with national laws and policies governing the confidentiality of information obtained in the census if public confidence in the census is to be maintained.

41. In the establishment of a vital registration system, census results on the geographical distribution of the population can be useful in the consideration of appropriate locations for registration offices.

6. Relationship of the population census to continuous population registers

42. Population censuses have been used in some countries as the starting point for the establishment of a continuous population register. Such an effort, however, has little justification from a statistical viewpoint unless adequate and tested facilities, including a comprehensive and complete civil registration system for live births and deaths, are available for continuously updating the population register. 8/ If a register is already in operation, results of subsequent censuses can be compared with register data as a check on the accuracy of both. As permitted by national laws and policies relating to the confidentiality of census and other data, information from each source can be transferred to the other, after investigation and resolution of discrepancies.

8/ Methodology and Evaluation of Population Registers and Similar Systems
(United Nations publication, Sales No. E.69/XVII.15).

II. PLANNING, ORGANIZATION AND ADMINISTRATION OF POPULATION AND HOUSING CENSUSES

43. The present chapter deals primarily with the operational aspects of population and housing censuses and the very lengthy and detailed preparations that must be made to take such censuses successfully. Because of the technical and administrative complexities involved, the principles of census management provided below should be considered as a review of points to be taken into account in planning and executing a population and housing census rather than as a comprehensive treatment of the subject.

44. A population and housing census (or a population census by itself) is perhaps the single most extensive, complicated and expensive statistical operation that a country undertakes, consisting of a complex series of interrelated steps. Some of these steps may be massive in scale, for example, the printing of the census questionnaires. Other steps must be carried out in a uniform manner in all parts of the country, for example, the training of the supervisory staff. And still other steps must incorporate both of these elements, for example, the actual enumeration. To ensure that the diverse operations occur in their proper sequence and in a timely manner, the entire census and its various component steps must be planned for carefully in advance. An apparently minor oversight in planning may lead to serious defects in the census results and to costly inefficiencies in the census operations. Careful planning is, therefore, critically important to a successful census, not only in countries with comparatively little statistical experience but also in countries with a well-developed system of statistics. Coupled with the need for careful planning is the need for appropriate organizational and administrative arrangements and procedures. Such arrangements and procedures are necessary to ensure that the extensive human and material resources that have been mobilized for the census are effectively and efficiently used and to ensure that the very tight time schedules and massive logistical requirements of the census are met.

45. It must be stressed, however, that at each stage of census planning and implementation the various administrative arrangements developed will need to be guided by sound technical considerations. The quality and timeliness of the census data will almost certainly suffer unless sufficient weight is given throughout the census to a wide range of subject-matter and statistical requirements. It is for this reason that the management of a large statistical operation, and especially a population and housing census, cannot be considered as a routine administrative assignment. 9/

46. Censuses do not all follow a uniform pattern but there are certain major elements that must be taken into account in all censuses. In general, census operations can be divided into seven phases: (1) preparatory work, (2) enumeration,

9/ For a discussion of statistical management generally, see The Organization of National Statistical Services: A Review of Major Issues (United Nations publication, Sales No. E.77.XVII.5).

(3) data processing, (4) evaluation of the results, (5) analysis of the results, (6) dissemination of the results and (7) systematic recording of census experience. It will be readily apparent that these phases are not entirely chronologically separate or mutually exclusive. For example, some census results are usually released before all data-processing activities are completed; the analysis and dissemination of census results overlap each other quite extensively; and the systematic recording of census experience should start at the beginning of the preparatory work and continue through all the subsequent phases. Furthermore, certain elements that are discussed below under "Preparatory work", such as the budget and staff, may have to be amended according to circumstances that arise at a later stage of operation. The elements of each of these seven phases are discussed below in terms of their implications for sound census management.

47. When the housing census and the population census are carried out together the planning, organization and administration of the two censuses should be considered as separate aspects of a single, integrated field and processing operation, that is, the separate technical requirements of each census have to be taken into account in planning and carrying out the combined operation. A combined population and housing census will be more costly and complex than each census considered by itself but it will be less expensive than carrying out both censuses independently. Moreover, the combined census will be capable of providing a greater wealth of cross-tabulations than would both censuses carried out independently. Each country will have to decide the trade-offs involved in light of its own needs and circumstances (see also paras. 22-25). However, from the perspective of over-all census planning and management the decision is not a critical one. Whether the census is a combined operation or a separate population or housing census, the basics of census planning, organization and administration as described below remain unchanged - except for the added cost and complexity of the combined operation.

A. Preparatory work

48. The preparatory work for the census is necessarily long in duration and involves many quite distinct activities. For purposes of presentation, these preparatory activities are divided into 14 somewhat arbitrary elements: (a) legal basis for a census (paras. 49-50), (b) budget and cost control (paras. 51-55), (c) census calendar (paras. 56-60), (d) administrative organization (paras. 61-64), (e) communications activities, including census publicity (paras. 65-68), (f) cartographic (mapping) work (paras. 69-81), (g) small-area identification (paras. 82-90), (h) living quarters and household listing (paras. 91-92), (i) tabulation programme (paras. 93-95), (j) questionnaire preparation (paras. 96-100), (k) census tests (paras. 101-103), (l) plan of enumeration (paras. 104-106), (m) plans for data processing (paras. 107-110) and (n) staff recruitment and training (paras. 111-116).

1. Legal basis for a census

49. Legal authority for the census is required for fixing primary administrative responsibility, for obtaining the necessary funds, for determining the general scope and timing of the census and for placing a legal obligation upon the public to co-operate and to give truthful answers and a legal obligation upon the enumerator to record the responses faithfully. In addition, the confidentiality of the individual information should be strongly and clearly established in the census legislation and guaranteed by adequate sanctions so as to provide a basis for the confident co-operation of the public. In countries which lack permanent legal authority for the taking of periodic censuses, it is important to act early to establish ad hoc legal authority or, preferably, legislation calling for a system of periodic censuses.

50. The principle of conceptual and organizational flexibility should be observed in drafting the census legislation. Thus, the inclusion of too rigid provisions regarding the type of data to be collected or the structure and relationships of the various parts of the census organization is undesirable. Necessary details should, rather, be contained in the census regulations promulgated by the census authorities. Moreover, provision will have to be made, either in the legislation or the regulations, for sanctioning the use of simplified administrative procedures, including the appropriate delegations of authority for the procurement of equipment and supplies and the recruitment of personnel during the operational phase of the census.

2. Budget and cost control

51. No universal system of census budgeting and cost control can be suggested since financial practices vary greatly among countries. However, a few generally accepted principles can be noted. Effective planning and control of the various census operations is not possible without a very careful financial estimate of the cost of each census operation, including all of its components, no matter how small.

52. Information on expenditures from the previous census, classified by census phases starting with the expenditure for different elements of the preparatory work and ending with expenditure for the dissemination of the census results, provides an important basis for estimating the budget of the census. Figures from the previous census will, of course, have to be modified in order to take into account changes in wage rates and the costs of equipment and supplies etc., planned changes in census content, methods and procedures and anticipated changes in the population itself (for example, total size, percentage urban, and average household size), all of which may affect the cost structure of the census.

53. To provide the information needed to monitor the costs of the current census and to have the information needed to plan for the next census, detailed and precise data will be needed on the following: (a) number and cost of census staff classified by function and manner of payment; (b) type of equipment and material used for the census, manner of acquisition (i.e., purchased or rental) and cost; (c) surface measurement of office space used and cost of office space classified

by use and type of cost (i.e., for construction or for rent); (d) type of services used for census operations. The usefulness of the above information would be enhanced if it could be recorded by sources of funding, namely, the expenditure: (a) from the official census budget; (b) from other funds of the census office (e.g., from a regular annual budget not specifically intended for census purposes, or from general funds of the governmental agency or department of which the census office is a part; (c) by other parts of the Government; (d) by non-governmental organizations. This information is needed not only for fiscal planning and control but also for examining the trade-offs in terms of costs and benefits among alternative ways of carrying out various census operations.

54. It is important that persons at the administrative and supervisory levels who will be responsible for the execution of each operation participate in estimating the budget items. Such an organization of the work presupposes detailed advance planning and "cost-consciousness" on the part of those responsible for a census.

55. The census plan as executed will certainly change in a number of respects after the making of the original calculations. Consequently, a perfect correspondence between the estimates and the final costs is not to be expected. Indeed, the development of the census budget is usually an incremental process in which rough initial estimates are replaced by more detailed and precise statements of resource requirements. Throughout the period of census-taking and compilation of census results, the budget will have to be re-examined and performance compared with plans. With detailed information on expenditure, the governmental and census authorities will be better able to control the development of census operations within the census budget as well as to assess and control the effectiveness and efficiency of these operations. This information is also very useful for studying possible improvements in census techniques and census methodology.

3. Census calendar

56. An indispensable element in the planning of a census is a calendar or time-table indicating the sequence and estimated duration of each of the component operations of the census. At the early stages of census planning, a provisional calendar of selected key dates should be prepared as an over-all framework for the census. The calendar should be revised and made more detailed as planning proceeds, with the aim of establishing final dates as soon as practicable.

57. Such calendars are essential, since they indicate the dates on which each of the numerous operations that make up a census are to be started and completed, and they serve as a guide for measuring the progress of each stage of the census operation. Serious delays in work, or errors in time estimates, can be detected by comparing the calendar target dates with the actual dates of each operation. A census calendar is a very efficient instrument not only in the timing control of each census operation but also in the control of the complex of all census operations that are interdependent. Therefore, when modifications in the census time-table are necessary, all related operations should be taken into consideration in order to avoid disruptions in the whole census programme. Obviously, the time schedule will differ for each national census depending upon the general census plan and the resources that are available.

58. The census calendar usually shows the various operations grouped into three broad sectors: (a) pre-enumeration, (b) enumeration and (c) post-enumeration. The basic date on which the census calendar and the scheduling of all other operations hinges is the starting date for the general enumeration of the population. For purposes of control, many operations which in fact overlap are shown separately in the calendar. Census calendars sometimes take the form of a chart or graph, in addition to a detailed check-list of operations.

59. In establishing the census calendar, it is necessary to consider the relationship of the population and housing censuses to one another as well as to other statistical projects. Although a joint population and housing census operation is likely, for the period of its duration, to constitute the major statistical undertaking of the Government, care should be taken that it does not unduly interfere with the other regular statistical activities that may be going on at the same time. A balanced statistical programme should avoid too many simultaneous, competing inquiries which might place too heavy a burden on the statistical services and on the public, with a possible resultant loss of both administrative efficiency and public co-operation.

60. It is often found useful to draw up a comprehensive diagram that shows the sequence, interrelationship and timing of all the various steps in the census programme. This critical path analysis shows the consequences that a delay at a given step would cause to other steps in the programme. It can therefore be a useful instrument against which the actual progress of the census preparations can be compared. It should be stressed, however, that the usefulness of such devices depends on how soundly they are designed, applied and understood.

4. Administrative organization

61. In planning the organization and administration of a census, it is important to consider the role and relationship of the various executive and advisory organs. National, subnational and local commissions and committees are frequently useful in the planning and preparations of a census. Such bodies may be composed of representatives of governmental agencies and of non-governmental users of the census data, particularly those involved in policy-oriented analysis of census results and analytical studies of the social, economic and demographic situation of the country. It is, however, important that their advisory and promotional functions be clearly defined and that the final responsibility for planning rest with the executive agency.

62. There are definite advantages in having an office continuously responsible for census work as an integral part of the statistical system of a country. Such an office assures continuity in census work and is the principal centre for the formulation of the programme and the initiation of preparatory work for the next census. Its permanency permits the development of specialized and experienced personnel and the maintenance of statistical and cartographic information essential for planning the next census.

63. At the pre-enumeration stage, the census office will need to be expanded to form the nucleus of the full census organization, which must be capable of directing the field organization during the preparatory work as well as during the enumeration. In order to provide immediate supervision in each area, field offices at various levels are needed for the later part of the preparatory work, including staff recruitment and training, as well as for the enumeration period. Supervisory personnel in such offices should be persons familiar with the particular area and with the local language, who are able to deal with local problems. This does not mean, however, that all supervisory positions must be filled by persons from the area. As the need arises, personnel may be transferred from the central office or from other areas.

64. Subsequent to the enumeration, the census organization is usually readjusted to meet the needs involved in compiling, evaluating, analysing and publishing the results and to provide the continuity desirable for promoting the continued use of census materials and the development of improved methods.

5. Communications activities, including census publicity

65. A comprehensive programme of communications for a population and housing census covers three distinct audiences: (1) major users of census data, (2) persons and institutions participating in the census operations and (3) the general public. Since the census is a national activity that is completely dependent upon the whole-hearted co-operation and assistance of the general public and many governmental and local organizations for its success, the entire communications effort should be developed as a co-ordinated activity in close conjunction with the other substantive preparations for the census. These communications activities are valuable not only for informing others about the census but also for providing census authorities with early and continuing information about the reactions of the general public in various parts of the country and of key persons, groups and institutions to census plans and activities.

66. Consultation with users of census data on topics, definitions and, particularly, on planned tabulations and the development of the census data base is an indispensable step to be taken early in the preparations for the census. These consultations will assist the census authorities in planning for a census that, within the resources available, will be as responsive as possible to user needs in terms of the collection, processing, tabulation, storage and availability of meaningful data. Such consultations can also serve to foster a wider and more informed understanding of and support for census plans and activities. The users to be consulted should be from governmental departments, ministries, universities, research institutions and various organizations (or individuals) representing the economic, social, educational and cultural life of a country. It is often more useful to hold separate consultations with different types of users with common interests such as administrators, policy makers, planners, demographers, researchers etc. rather than to hold a simultaneous meeting of all data users. Such combined meetings frequently prove frustrating to participants because there are substantial differences among users in their technical background and in their concern with the details of census content and operations.

67. In order to complete the preparatory work for the census and to carry out the census enumeration itself, the census office will have to expand its staff substantially. In addition, numerous governmental and non-governmental organizations outside the census office may be called upon to provide personnel, equipment, supplies, space, transportation or communications facilities etc. to help in the census work. As a result, large numbers of temporary personnel will have to be trained (see paras. 111-116 below) and the contributions of a diverse group of national and local organizations will have to be mobilized effectively. A well-planned communications programme can contribute to both efforts.

68. Arranging the publicity for the census is another of the important tasks in the census operation. This entails an educational campaign, the purpose of which is to enlist the interest of the general public and its co-operation. The aims, as a general rule, are not only to dissipate any anxiety regarding the purposes of the census but also to explain the reasons for the various questions on the questionnaire and to give some guidance as to the manner in which these questions should be answered. The publicity campaign may also be an important tool for increasing the completeness of census coverage, particularly among hard-to-enumerate groups. It is desirable that planning for the general publicity campaign start as soon as the census is authorized. The campaign itself should be closely synchronized with other census activities and full-scale publicity should not begin too far in advance of the date on which enumeration is scheduled to start. Plans for the publicity programme should be closely co-ordinated with those for the census tests (see paras. 101-103 below). The programme will have to provide the publicity needed to carry out the census tests. In addition, the programme can use these tests to study the impact of alternative publicity materials and methods. If either the cartographic or house-listing operations require extensive field-work and widespread contacts with the public, it should be recognized that personnel involved in these activities often provide the public with its first impression of the census. Training and publicity programmes should take this factor into account. The general campaign should be directed to all sections of the country and all segments of the population through the use of all available media of publicity. The general campaign may be supplemented by a number of specialized campaigns aimed at specific segments of the population.

6. Cartographic (mapping) work

69. Adequate maps are needed in all stages of the population and housing census, i.e., in planning the census, in data collection and in preparation and analysis of census results.

70. The determination, for the purpose of the census, of the national and internal boundaries of the territory and its detailed subdivision into enumeration areas is one of the basic and most important census operations and one which generally takes a considerable part of the time and effort invested in the pre-enumeration stage. The prevention of omissions and duplications in the enumeration depends to a very large extent on the proper delimitation of the enumeration areas; this delimitation, in turn, is dependent upon the accuracy of the detailed maps available. Reasonably up-to-date maps are also needed to set up enumerator assignments, estimate travel time and costs, establish field offices, assign geographical codes, determine the best route of travel to and within enumeration areas, measure distances and enable the field staff to locate an enumerator or to find a specific housing unit when a return trip is necessary. They also serve as a mechanism for showing the progress

of the field work. When presenting and analysing results, maps are used effectively to relate statistical data to the geographical area to which the census results refer. This makes the statistics easier to understand and makes them more readily usable by the general public.

71. Without maps, field staff have to rely entirely on written or verbal descriptions and directions or on local knowledge of the area boundaries. Reliance on verbal description or local knowledge leads very often to confusion and error because people tend to have mental images (or mental maps) of places and these images may not coincide with the area as it really is. For the same kind of reason, the supervisor's mental map of an enumeration area may differ markedly from that of an enumerator. Because census maps provide a realistic picture of the area, they are essential to the data collection operations, although they can usefully be supplemented by other descriptive material.

72. All available maps that are known to be accurate should be screened and utilized and new maps prepared as required. Several different kinds of maps are needed for census planning, such as: (a) national maps (maps of the entire country on a relatively small scale) showing major administrative divisions, major physical features and the location of cities and towns; (b) planimetric or topographic maps on a relatively large scale; (c) maps of major administrative divisions or regions showing levels of subdivisions and location of places; (d) city and town maps, which are normally large-scale maps showing all roads and streets; and (e) special maps illustrating the distribution of physical features, population, transportation and the like. Not all of these types of maps may be available or up to date or accurate. Nevertheless, whatever maps are available will be useful.

73. When existing maps and boundary information are not complete or some features are not shown accurately, it is necessary to introduce revisions. When maps require extensive revision or when poor quality line-work will not reproduce well, redrafting is necessary. Where detailed maps do not exist, it is necessary to sketch or draft them (such work can only be done in the field by trained staff). Aerial photography or satellite imagery may also be a useful source of information in these situations. It is usually not possible to finance such expensive undertakings within the census budget. However, census authorities may find it possible to use photographs or imagery obtained in connexion with various non-statistical programmes.

74. To carry out all the mapping tasks required for accurate and useful censuses (and other statistical activities), a formal ongoing mapping programme should be established. Failure to implement this important effort during early stages of the censuses can endanger the final results. It is necessary to start cartographic work sufficiently early to ensure that an adequate supply of maps is available three to four months before the census is scheduled to begin. Mapping tasks undertaken too late or with insufficient planning almost surely will result in lack of maps or in maps that are inadequate for the enumeration of critical areas. For population and housing censuses, the lead time should be at least two or three years even with an ongoing mapping programme.

75. The best census maps will be of limited value unless the field staff responsible for enumeration is trained to use them properly. Training may involve

direct instruction of the field supervisors by members of the geography staff, or it may involve the preparation of instructions on map reading and use of maps for inclusion in the manual for training enumerators.

76. It will be most helpful if the concerned governmental authorities freeze the boundaries of various administrative units at least six months in advance of the census date so that no further jurisdictional changes are effected until the enumeration is over. This helps considerably in delimitation of enumeration areas, in minimizing chances of omission or duplication and in quick dissemination of preliminary census results.

77. The time and expense involved in preparing and checking maps and in the careful drawing of enumeration areas are further justified by subsequent use of the maps for non-census purposes and particularly as frames for post-censal sample surveys.

78. In addition to the maps required for the census, a systematic, complete and up-to-date listing of localities is required. Such a listing is needed for the coding of place names and for determining to what extent data for localities will be tabulated. In some regions, the 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.

79. In countries in which particular types of living quarters predominate in readily identifiable areas, it may be useful during the preparatory work to consider these areas in relation to the boundaries of the enumeration districts being established for the census. Where the areas are clearly delineated, as is often the case, for example, with squatter areas, it may facilitate the preparation of subsequent housing programmes or the carrying out of special studies if the boundaries of the enumeration areas at the margin of these areas could be drawn so as to avoid as much as possible creating enumeration areas that incorporate living quarters of widely divergent types, such as conventional dwellings and improvised housing units.

80. There is widespread recognition that it is important for national statistical agencies to develop a continuing cartographic capability to serve their specialized cartographic needs. Such a capability can make a major contribution to the population and housing census and, through the census, to subsequent programmes of household surveys. The availability of appropriate, reliable and up-to-date cartographic materials is an important factor in the planning and control of field work and in the processing of census results. In connexion with these phases of census operations, the importance must be kept in mind of close co-ordination between, on the one hand, cartographic work for the population and housing census and, on the other hand, that for the census of agriculture and other statistical inquiries. A continuing cartographic capability can also contribute to the analysis and presentation of census results.

81. Remote sensing of the earth by aerial photography and satellite imagery appears to hold great promise for planning large-scale statistical undertakings, such as population, housing and agricultural censuses, and for certain types of statistical measurements; in light of this promise, all possible national applications of this new technology should be investigated by national statistical agencies.

7. Small-area identification

82. Two somewhat different methods are available to provide the census with a flexible capability for generating tabulations in terms of a wide variety of geographical aggregations, including those needed for the purposes of local planning and administration. The first method simply extends the traditional, hierarchical system for coding all major and minor civil divisions to cover at the lowest level the enumeration area (EA), sometimes referred to as the enumeration district. The second method, which at greater cost permits finer geographical specificity, is usually based on some co-ordinate or grid system, such as latitude and longitude. This method is often referred to as a geocoding system.

83. Particularly in the absence of a comprehensive system of street names, numbers or similar addresses, the first method, which uses the EA as the key unit for the production of small-area data, is to be preferred. Proper administration and control of a census requires that the EAs are well defined and their boundaries identifiable on the ground. As a rule, they are also traced on maps and they carry code numbers which can accompany the statistical information at data entry. It is therefore possible to make available from the census data base, subject to the constraints imposed by the need to protect the confidentiality of individual responses (see paras. 162-163 below), any recorded information in relation to any given EA or combination of EAs without having to resort to any special arrangements or having to incur very substantial additional expenditures.

84. The fact that census data, whether published or unpublished, are available by EA gives them useful flexibility. Geographical divisions used by various branches of the administration or by other data users do not always coincide and therefore require different regroupings. On the other hand, when changes are planned in administrative boundaries, tabulation of census data by the planned new entities is of course essential.

85. On the level of the basic area units, tabulation of population and housing characteristics by EA, which may be shown on statistical maps, is a useful tool for analysis. Furthermore, correlation analysis of different characteristics can be carried out using EAs as units when it is not feasible to study the relationship directly by cross-tabulating the individual data. Linkage of data from other sources, however, is not often possible on the EA level because of the difficulty of arranging such information by census EA. Comparison between successive censuses is of course possible only to the extent that the EAs remain unchanged.

86. On the next higher levels, the situation is somewhat different in urban and rural areas. Large urban municipalities are usually divided into units (quarters,

wards, barrios etc.), which may have well-known and relatively permanent administrative status. Data tabulated by such units are of great practical value for all planning and analysis. If such area units do not exist or if they are too large for fruitful analysis, other, intermediate units may be formed for statistical purposes. These should be made as homogeneous as possible. Possibilities for data linkage and for comparisons in time are clearly best for area units that have administrative status. Purely statistical areas that lack such status are the more useful the more widely they are recognized and the more permanent they are kept from census to census.

87. At a minimum, developing countries that are predominantly rural will certainly wish to be able to identify the village, which is usually the most important local unit in rural areas. In the past, however, the village has not uniformly been a higher level geographical unit than the EA so that while larger villages are divided into several EAs, one EA may also be identical with one village or be composed of two or more small villages. In the latter situation the EA codes cannot be used to generate village statistics. It may therefore be advisable to limit each EA either to one village or to a portion of a village or to an area not included in any village, bearing in mind that an individual enumerator can always be given more than one EA to enumerate. There are other problems connected with identification and delimitation of villages, and these must also be dealt with in planning the cartographic work. Due to the organic role it plays in rural life and development efforts in many developing countries, the village should not be neglected in census plans or in census statistics.

88. The statistical value of the village is further increased by the possibility often existing for data linkage with other sources. Particularly relevant is the possibility of collecting, as is done in many countries, village information of most varying nature, such as location, altitude, road connections, communications, facilities of various kinds or distances from such facilities, cultural or ethnic characteristics of the population, major industries, major crops etc. The village as a unit is relatively stable but in the course of time new villages are created and old ones may disappear or merge. A village directory and its cartographic base therefore require frequent updating.

89. Also in rural areas there may be need to create an intermediate statistical level between village and minor civil division if the former is generally too small and the latter too large for local planning purposes. In such cases, the intermediate units should be made as homogeneous as possible and changes in their boundaries over time should be avoided. On the other hand, areas smaller than EA or village may also be desired to be differentiated, particularly isolated settlements.

90. Countries may sometimes find it useful to have even greater flexibility in regrouping census data into different geographical aggregations than that provided by a coding system based on the EA. In these situations, the use of some system of geocoding may be considered (see para. 82). The two approaches to geocoding that are of most significance for census planning are (a) segment allocation and (b) area allocation to grid squares. With segment allocation, co-ordinates are assigned to nodal points (e.g., street intersections) to identify segments or

block faces. The grid system involves dividing the national territory into a uniform grid of squares using standard co-ordinates to identify the squares. Among the advantages of geocoding, particularly if based on the grid-squares approach, are its permanence, clarity and uniformity, as well as the possibility it offers to interlink statistics from a wide variety of sources. It must be stressed, however, that geocoding is more expensive than traditional methods of area coding and the technical prerequisites for it may not be present in many countries.

8. Living quarters and household listing

91. A list of living quarters, structures containing living quarters, or households, available at the start of the census, is an aid in the control of the enumeration particularly in the absence of adequate and updated maps. Such a list is also useful for estimating the number of enumerators and the number of schedules and other census materials needed in an area, for estimating the time required for the enumeration and for compiling provisional results of the census. It is also very useful for determining the enumeration areas and for establishing necessary links between population and housing censuses when they are carried out separately.

92. Consideration should be given to providing permanent identification to streets and buildings, which can be used for successive censuses and for other purposes. A listing of living quarters, particularly in densely settled places, cannot be made unless streets have names and buildings have unique numbers. Individual apartments in multidwelling buildings need to be numbered or otherwise unambiguously identified. Where these prerequisites do not exist, numbering immediately prior to the census would prove useful.

9. Tabulation programme

93. In most countries, the tabulation programme represents a compromise between the information that it would be ideally desirable to tabulate and the limits imposed by practical circumstances. It is essential that the programme be outlined sufficiently early so that the procedures and costs involved may be investigated thoroughly before a final decision is reached. The testing of questionnaires will help to indicate if it will be reasonably possible to gather the material desired for tabulation. The type of questionnaire and the method of enumeration may limit the kinds and amount of data it is possible to collect. Publication time and costs, and the data processing resources available, will determine the number and complexity of the tabulations that can be produced within a reasonable time. The basic tabulation programme, covering all tables to appear in the published census reports, should be firmly decided upon soon after the content of the questionnaire is fixed in its final form. This will permit prospective users of the census data to make firm plans and the census data processing staff to complete all systems analysis, programming and testing work in a timely manner.

94. It is important to plan the tabulation programme in such a way that final results can be issued within a reasonable period of time after the enumeration and before the information has become out of date for current needs. It is desirable

that the details of the tables to be prepared and the order of their preparation be decided early in the planning so that the processing of the data will not be delayed.

95. Special tabulations may be requested at any time after the census enumeration. Once the census data base has been produced by recording, editing and correction of the raw data, tabulation software packages allow fast and relatively inexpensive production of tables for selected subsets of the total data base or for additional sets of categories.

10. Questionnaire preparation

96. The type of questionnaire, its format and the exact wording and arrangement of the questions merit the most careful consideration, since the handicaps of a poorly designed questionnaire cannot be overcome during or after enumeration. Among the many factors that should be taken into account in designing the questionnaire are the method of enumeration, the type of questionnaire, the data to be collected, the most suitable form of the questions and their arrangement and the processing techniques to be employed. Many decisions regarding processing are dependent on the final content, form and arrangement of the questionnaires.

97. The method of enumeration governs to some extent the type of questionnaire (i.e., single individual, single household or single living-quarters, multiple household or multiple living quarters, combined population and housing) and the scope of the questionnaire that can be used, as well as the framing of the questions and the amount of explanatory material that must accompany them. Questions should be free from ambiguity and should not be offensive.

98. Special provisions will have to be made if two or more languages are used in the country. Several methods have been used to deal with this situation: a single, multilingual questionnaire, or one version of the questionnaire for each major language, or translations of the questionnaire in the various languages printed in the enumerators' manual. The problem is more serious in the case of non-written languages. Staff recruitment and training procedures (see paras. 111-116 below) will also have to take language problems into account. Information on the distribution of languages in the country is important for sound census planning and, if not available, will have to be collected at some stage of the census preparations.

99. If the housing census and the population census are to be carried out simultaneously it will be necessary to consider whether a single questionnaire should be utilized to collect information on both population and housing. If separate questionnaires are used they should be adequately identified so as to permit subsequent matching of the data for each set of living quarters with data that refer to the occupants.

100. Questionnaire design should be considered jointly with the planning of the tabulation programme. This is essential if the questionnaire is to be designed

to provide the information needed for the tabulations. It is also necessary because the feasibility of the tabulation programme is, to some extent, conditioned by the limitations imposed by the questionnaire. The final questionnaire must be drafted in time to allow for proper training of census officials, for adequate publicity on its content and for any delays in printing.

11. Census tests

101. The testing of various aspects of a census plan prior to the enumeration is a very useful practice for all countries; it is essential for countries without a long history of census-taking and for those in which fundamental changes in census methods are being considered. Census tests can be designed for different purposes and in different ways. To yield full benefits, tests should be employed for all stages of the census, including enumeration, processing and evaluation of results. They can give important information on the adequacy of the field organization, the training programme, the processing plan and other important aspects of the census. They are particularly valuable to test for weaknesses in the questionnaire or in the instructions or enumeration procedures that might affect the quality of the data. They can be designed to provide information on the relative efficacy of alternative methods of enumeration and on the average time required for enumerating a single household or a single set of living quarters, which information is useful in estimating the staff and cost requirements. In addition, they serve as practical training for the nuclear staff of supervisors and other officials.

102. The kind of tests usually first carried out during census preparations are questionnaire tests. Their purpose is to test the suitability of intended census questions, of their formulation and of the instructions given, as well as the suitability of the questionnaire design. They are also used for estimating the time requirements in enumeration. It is practical to carry out questionnaire tests on a small scale in several purposively selected places. Because they are relatively inexpensive, repeated rounds of questionnaire tests may be made until a satisfactory questionnaire has evolved.

103. A comprehensive test of all census procedures is often called a pilot census. Essential features of a pilot census are that it covers one or more sizable administrative divisions and that it encompasses the preparatory, enumeration and processing stages of a census, thus testing the adequacy of the entire census plan and of the census organization. In order to best serve this purpose, it should be undertaken in conditions as closely resembling the actual enumeration as possible. For this reason, it is often taken exactly one year before the planned census so as to conform with the expected seasonal patterns of climate and activity. It is generally unwise to consider the pilot census a source for deriving usable, substantive data. Apart from the sampling problems involved, such a use inevitably detracts from the central purpose of the pilot, that is, preparing for the main census.

12. Plan of enumeration

104. The complete enumeration plan should be prepared well before the enumeration begins. This involves (a) the determination of the enumeration method to be used and the basic procedures to be followed in the collection of the data and the control of the enumeration, (b) the procedures for the control of the quality of the data and (c) an estimation of the number of living quarters and the probable size of the population to be enumerated, so that the number of questionnaires and other materials required for the enumeration and the number of enumerators and supervisors needed can be properly ascertained.

105. The universal enumeration of population and living quarters should be made exclusively on a geographical basis, that is to say, the country should be divided into census enumeration areas and each area should be small enough to be covered by one enumerator during the period of time allowed for the enumeration. Other sources of information, such as registers of population or registers of properties, cannot normally be considered as adequate for the purpose of a census although they could be used for checking the completeness of the enumeration or the accuracy of the replies to certain questions.

106. Special attention should be given to the procedures to be followed for the enumeration of nomadic and semi-nomadic populations. These procedures should take account of the specific difficulties in locating these population groups, which are characterized by movement from place to place (see paras. 120-122 below). Special arrangements may also need to be made to enumerate homeless persons. Where their number warrants, additional information may need to be sought that would indicate the reason for homelessness.

13. Plans for data processing

107. Plans for data processing should be formulated as an integral part of the over-all plan of the census and those responsible for the processing of the census should be involved from the inception of the planning process. Data processing will be required in connexion with the results of census tests, compilation of preliminary results, preparation of advance tabulations, preparation of general tabulations, evaluation of census results, analysis of census data, arrangements for storage in and retrieval from a data base, identification and correction of errors etc. Electronic data processing is ordinarily used for recording and processing census data. Data processing has an impact on almost all aspects of the census operation from the selection of topics and the design of the questionnaire to the analysis of the final results. Therefore, data processing requirements in terms of personnel, space, equipment and software (computer programmes) need to be looked at from the point of view of the census as a whole and at an early stage in the planning.

108. The existing data processing staff will certainly need to be expanded somewhat and probably need some up-grading in terms of skills, particularly if new computer hardware or software will be used in the census. Any needed training should be completed early enough so that those benefiting from the training can play an active role in census planning and operations.

109. Decisions will need to be made concerning the location of the various data-processing activities within the country including the extent to which the processing work is decentralized. Acquisition of both equipment and supplies can require long lead times; estimates of both data recording and computer processing workloads must be made early to enable timely procurement. Closely related to the question of equipment is that of the provision of adequate space. Not only is census processing a space-intensive activity but also much of the equipment involved requires space that must meet comparatively rigid standards in terms of temperature, humidity, dust etc. In order to avoid possibly damaging costly equipment it is important to obtain and prepare the needed space so that it is available prior to the arrival of the equipment.

110. In addition to considering the processing equipment to be used in the census, decisions will have to be made on the software to be used in editing and tabulating the census data. Software for census editing and tabulation is expensive to develop. It requires skilled systems analysts and programmers, who are experienced with census processing, working in close collaboration with subject-matter specialists and statisticians, and considerable time to plan, write and fully test such programmes. For this reason, an increasing number of countries are finding it advantageous to consider adapting one of the several portable software packages available for census editing or tabulation for their own use. These packages can reduce the systems analysis and programming tasks involved very substantially, although at some price in terms of loss of flexibility. Each country will wish to assess its software requirements in light of its own needs and the current state of the art of portable software oriented towards census editing and tabulation. If one or more externally developed software packages are used, sufficient time will have to be allowed for training staff in their use and for making any needed adaptations to fit the packages to the processing environment and requirements of the specific census.

14. Staff recruitment and training

111. Early arrangements are necessary to secure the proper number and type of personnel required for each of the various census operations. For reasons of efficiency and economy, it is important that the staff be selected on the basis of competence. Consideration may also be given to the use of the same staff for successive operations, thus reducing the turnover of personnel. While the preparatory and processing work generally calls for office employees possessing or able to learn certain specialized skills (cartographers, coders, punchers etc.), the enumeration stage usually demands a large number of persons capable of going to their assigned urban or rural enumerations areas and of collecting the information according to specific definitions and instructions. It is essential that the enumerators and, to the extent possible, their immediate supervisors be conversant with the languages or dialects of the area in which they will work. It is only prudent to recruit and train a somewhat larger field force than is required for the enumeration itself as a certain amount of attrition is inevitable both during the course of the training programme and between the completion of the training and the start of the field work.

112. Once the cartographic preparations are substantially completed and the questionnaire has been sent for printing, perhaps the single most important means that the census authorities have for influencing the success of the census is the training programme. The contribution that a well-planned and executed training programme can make to the quality of the census results cannot, therefore, be stressed too strongly. Such a training programme must of course focus on the widely dispersed and difficult-to-supervise field staff (i.e., the enumerators and their immediate supervisors) but it must also cover others (e.g., the higher-level supervisors, editors, computer operators).

113. The entire census training programme should be designed to cover each phase of the work and provide an efficient and consistent means of effectively starting large numbers of employees in their work. The programme will need to correspond closely to the needs of the various operations and, where appropriate, may include both theoretical and practical instruction, with emphasis on the latter. In the case of the enumerators and their immediate supervisors, the training is most effective if it includes several opportunities for the trainees to participate in practice interviews and role-playing exercises. (In countries in which multiple languages are used, the method and content of the enumerator training programme will need to be suitably adjusted. For example, provision will have to be made for instructing enumerators in the correct formulation of the census questions in the vernacular if the questionnaire is printed in another language.) The training programme for editors, coders, operators of data-recording equipment etc. should also provide opportunities for the trainees to practise, under the supervision of the trainers, the operations they are expected to subsequently perform. The intermediate and higher-level technical staff may also benefit from special training programmes. For them, the emphasis usually should be on recent technical developments of relevance to the forthcoming census and on the interrelationships among the various aspects of census plans and operations.

114. The organization and conduct of training courses should be entrusted to those having the necessary qualifications to carry out this task successfully, taking into account not only their professional abilities but also their ability in teaching. This means that staff in charge of training should have certain qualifications that will enable them to stimulate the interest of trainees and to transfer the required knowledge. Otherwise well-qualified technical personnel who are unable to transfer their knowledge to the trainees in a satisfactory manner are unsuitable as instructors for group training activities. This must be taken into consideration when selecting instructors and it is recommended that objective criteria should be used. In practice, however, it is difficult to find the necessary number of instructors who have both the professional and teaching qualifications; for this reason, the instructors selected should themselves undergo training in how to organize and conduct training courses.

115. It is important that each training programme be made available in the form of a manual (booklet) and distributed to the census organizers and training instructors. This would be a valuable guide and would considerably help in the efficient training of census staff. It would also contribute to uniformity of training, which is an essential factor for a successful enumeration, taking into account the great

number of census instructors who will be engaged in training. Simple audio-visual aids (for example, film strips, posters, tape recordings) can also be used to help make the training more effective and uniform throughout the country.

116. It is very important to determine the time required to train staff for the various aspects of the census. This depends on several factors: the type of the function for which they are being trained, the level at which they will be performing, the complexity of the census, the educational level of the trainees, the number of instructors available and the funds available. Usually, all the courses last from one week to a month. It is strongly recommended that the training be carried out daily for a fixed period. The results are not as good if training is provided for a few days per week; this draws out the length of the course and previous work is often forgotten and has to be repeated. For this reason, it is also best to avoid completing the training long before the start of the actual work. However, any duration may be fixed for the course, provided that the main principle is not overlooked, namely, that it should be long enough to permit the assimilation of the syllabus.

B. Enumeration

1. Method of enumeration

117. There are two major methods of enumeration. In the canvasser (or enumerator) method, information for each individual (in a population census) and information for each set of living quarters and the occupants thereof (in a housing census) is collected and entered on the questionnaire by a census official designated to perform this operation in a specified area. In the householder method, the major responsibility for entering the information is given to a person in the unit being enumerated - usually the head of the household - although the questionnaire is usually distributed, collected and checked by a census official. In some countries, postal distribution and/or return of the questionnaire is used in conjunction with the householder method. This mail-out and mail-back procedure can be used in full or combined with on-site checking by a census official.

118. Each method has its own advantages and limitations. The canvasser method is the only method that can be used in largely illiterate populations or in other population groups that may be unwilling or find it difficult to complete the census forms themselves. On the other hand, in countries where literacy is virtually universal and educational attainment is relatively high, the householder method can often yield more reliable results at substantially lower costs, particularly if a mail-out/mail-back procedure can be used. However, the postal services can only be used to distribute the census forms when a comprehensive and up-to-date list of addresses is available or can be prepared. Another consideration is the emphasis to be placed in the census on obtaining responses, whenever possible, directly from the person concerned. The householder method does allow for, and the instructions may encourage, consultations among the family members when they complete the census form at no extra cost to the census organization. In contrast, with the canvasser method it may be prohibitively expensive even to encourage enumerators to go beyond the "first responsible adult" they encounter in

each household. In light of these considerations it may sometimes be desirable to rely on one method for enumerating most of the population and to use another method in certain areas or for special groups of the population. However, over-complex designs should be avoided.

119. The decision regarding the method of enumeration to be employed should be taken at any early stage on the basis of thorough testing of the various alternatives in terms of their costs, the quality of the data produced and their operational feasibility. Even where a method has been traditionally followed, it is well to reassess periodically its relative advantages in light of the current census needs and changing techniques. An early decision is required because the method of enumeration used affects the budget, the organizational structure, the publicity plan, the training programme, the design of the questionnaire and, to some extent, the kind of data that can be collected.

120. To carry out successfully the enumeration of nomads, it is particularly necessary to pay full attention to the preparatory work in order to determine the suitable enumeration methodology and enumeration techniques. It should be pointed out that there is no absolute methodology for the enumeration of nomads and conditions vary from country to country. The particular method suitable for a country undertaking a census of nomads should be determined only after a detailed preliminary study and after field testing. Some of the methods used to enumerate nomads and semi-nomads may be classified as follows: (a) group-assembly approach, (b) tribal or hierarchical approach, (c) enumeration-area approach, (d) water-point approach and (e) camp approach. Sometimes a combination of two or more methods may be used.

121. In the group-assembly approach the nomads are asked to assemble at certain places of interview on some fixed dates. This method can be adopted only through the administrative and/or tribal authorities. The tribal or hierarchical approach is a favourite method since the nomads usually follow what is dictated by the tribal or hierarchical chief. The enumeration work can be carried out as a kind of administrative census by contacting and collecting from the tribal chief, sometimes from memory and sometimes from a register, all the needed information on the followers. The other way is to contact the followers with the assistance of the chief or a representative and to collect the necessary data from the household directly. In this case, the unit of enumeration is not areal but tribal. The enumeration-area approach presupposes creating convention census enumeration areas and then contacting each nomadic household that happens to be staying in the enumeration area during the census. In the water-point approach a list of all water-points available to the nomads during the period of enumeration is prepared. Since during the rainy season numerous temporary water-points are created, a meaningful list of water-points may be prepared only with reference to the dry season. The enumerator is given the task of locating and visiting every nomadic household that may be using a certain water-point. In the camp approach of enumerating the nomads, a list of camps is prepared together with the approximate location of each within the country, and enumerators are sent to each camp to visit each household.

122. For more detailed information on the methods described above and for other methods of enumerating nomads, reference may be made to the study presented to the Conference of African Statisticians at its tenth session. 10/

2. Timing and length of enumeration period

123. The choice of the time of year in which the census will be taken is of great importance. The main consideration should be to select a period in which the census is likely to be most successful and to yield most useful data. This may depend on a number of factors. First of all, it is necessary to avoid seasons in which it is difficult to reach all inhabited areas because of rains, flooding, snow etc. or in which the work is particularly arduous, as in extremely hot weather. Secondly, a time should be chosen when most people are staying at their usual places of residence; this simplifies the census operations in both a de jure and a de facto enumeration and in the case of a de facto enumeration it can make the results more meaningful. Seasons of peak agricultural activity should be avoided because it is difficult to interview persons who work late every day and may even stay nights at their lands if these are far from home. Great traditional festivals, pilgrimages and fasting periods are also unsuitable times for census work. Since in most developing countries the bulk of the field staff is recruited among school teachers and older students, the census may be feasible only during school holidays, though the days of major festivals should be avoided.

124. In a country that includes areas of sharply conflicting seasonal patterns of weather or activity or in which potential census personnel is in very short supply, it may be necessary to enumerate different parts of the country at different times or to enumerate the nomads or other special population groups at a different time from the settled population. This, however, is generally not a very desirable solution because the nomads cannot always be clearly differentiated and because of the mobility of the settled inhabitants. It furthermore complicates the use of the census data.

125. When a census has been taken and the census date has been found on the whole satisfactory, the next census should be taken at the same time of the year, unless there are strong reasons for changing this date. A regular census date enhances the comparability of the data and facilitates analysis.

126. It is desirable to keep the enumeration period short in order to avoid double counting and omissions, which can occur in spite of a single reference date. On the other hand, the shorter the enumeration period, the more field staff has to be recruited, trained and supervised. This increases the cost and may lower the quality of the data. How these different considerations should be reconciled depends on the size and nature of the country and on the resources at its disposal. The length of school holidays is sometimes a restricting factor, although

10/ Economic Commission for Africa, "Study on special techniques for enumerating nomads in African censuses and surveys" (E/CN.14/CAS.10/10).

Governments of several developing countries, recognizing the great national importance of a census, have prolonged the school holidays in the census year in order to allow teachers and students to work on the census as long as required.

127. In recent censuses, most developing countries have allowed about one week to 10 days for the training of enumerators while the enumeration period has generally varied from a few days to two weeks. Short periods are often feasible in small countries while longer periods may be necessary in large countries with poor communications.

128. A method designed to allow sufficient time for enumeration and yet make the census simultaneous is to first enumerate the population over a longer period, say a week or more, and then, in one single day to canvass all households again, deleting and adding persons as needed to update the files. This procedure, however, is not practicable in very sparsely settled areas.

3. Supervision

129. Adequate supervision of the enumeration is essential. When the enumeration lasts only a few days, it is recommended to control the quantity and quality of the work accomplished after the first day of enumeration in order to facilitate the correction of inefficiencies and the maintenance of satisfactory progress during the enumeration period. Where the enumeration extends over more than a few days, periodic and systematic assessment should be organized.

4. Use of sampling in the enumeration

130. Sampling may be employed in the enumeration for collecting information on any topics which need not be tabulated for small areas. Questions designed to apply only to a sample of the population or of the living quarters may be included on the regular questionnaire or a special sample questionnaire may be used in addition to a complete enumeration questionnaire. For a discussion of the use of sampling in the enumeration, see paragraphs 167-218 below.

C. Data processing

131. No matter how thorough and accurate the census enumeration is, the usefulness, quality and timeliness of the census tabulations will suffer unless the collected data are properly processed. An important element of a successful processing operation is the close and continuing collaboration, at all levels, between the data-processing staff, on the one hand, and the subject-matter and the general statistical staff, on the other hand. At a minimum, the subject-matter and the general statistical staff will need to become familiar with and take a continuing interest in the processing plans and operations, while the processing staff will need to become familiar with and take a continuing interest in the substantive aspects of the census.

1. Method of processing

132. The choice of an appropriate method of processing is determined by the circumstances of each country. Rapid advances in electronic data processing, with consequent advantages for speed and reliability in producing detailed tabulation, have made it the standard method of processing in almost all countries in spite of the costs of purchasing or renting equipment, the problems of transportation and servicing and the difficulties of securing an adequately trained staff of operators, programmers and systems analysts.

133. In determining the type of equipment to be employed and the advisability of a new complete or partial machine installation, or of additions to existing equipment, consideration should be given to all the processing requirements of the programme of data collection of which the population and housing census is but one part. Only on this basis can a reasonable decision be arrived at. Decisions on the type of data-recording equipment and computer equipment should be made at least one year in advance of the scheduled date of enumeration in order to allow appropriate questionnaire design and proper preparation of instructions to enumerators, development of coding schemes, specification of data-handling controls and procedures and recruitment and training of data-processing personnel. Rapid processing of pre-test or pilot census data is particularly important for identifying improvements needed in the census questionnaire, instructions to enumerators or what other preparations may be needed. Therefore, arrangements for using appropriate equipment and software should be made well in advance of such tests.

134. In countries with little or no prior census experience or data-processing equipment, consideration is sometimes given to processing the census outside the country. However, it should be stressed that within-country processing of the census is far preferable to external processing for several technical and policy reasons. Within-country processing provides direct access to the census documents and an opportunity for the national data-processing and other census personnel to become more familiar with all stages of the census. It is also more consistent with most national policies relating to census confidentiality and the fostering of self-reliance. Moreover, population censuses in the past have often been the occasion for countries to upgrade or expand the computing facilities used for statistical data processing. Finally, it may be noted that the cost of computer hardware is continuing to decline, making it possible for nearly all countries to acquire at least a modest statistical processing capability. In any case, out-of-country processing should only be resorted to if all other alternatives are not feasible, including the use of other within-country data processing facilities outside the census or statistical office.

2. Stages of processing

135. The stages of processing and the order in which they come differ somewhat according to the processing method used but all methods have in common the necessity of providing for editing of the original information for missing and inconsistent data, transforming the information in the questionnaires into a machine-readable form and tabulating the results.

3. Specification of tabulations

136. Both as an aid to precision in specifying tabulations for the data-processing staff responsible for their production and as a device for ensuring completeness of the tabulation plan and avoiding unwieldy or redundant tables, it is advisable to prepare three types of specifications. The first identifies and precisely defines each conceptual unit for which one or more tabulations may be made; these are the intended tabulation units. The second covers, for each data record type and the corresponding tabulation units, the identification, structure and composition in terms of variables and their locations. The third describes, for each variable used to categorize the tabulation units, all the category sets used in the various tables (e.g., single years of age; five-year age-groups), identifies, for each such category set, the precise values or sets of values comprising each individual category and specifies the consequent number of categories in the set.

137. Using these definitions of tabulation units, record types, categorizing variables and their category sets, a tabulation chart should be prepared for each tabulation unit. The tabulation chart expresses the desired tabulations much more concisely than the table pro forma, and thereby enables comprehensive specification of the complete tabulation plan in relatively few pages.

138. Besides summarizing the tabulation plan, such a tabulation chart enables the identification of potential problems in computer data processing or publication. The precise specification of tabulation plans may also be used by the data-processing staff to design the computer tabulation programme and to determine the appropriate files, subfiles and storage media for efficient processing.

139. The precise definitions of the tabulation units, variables, record types, and category sets, together with the actual data files comprise the census data base. Viewing the census data base in this light, the importance of careful and efficient edit and correction of basic data is easily seen. The tabulation chart, which clearly shows the category sets that will be combined in the planned tabulations and thus the potential for contradictory or incompatible cross-categorizations, is of great help in identifying the consistency tests to be included in the edit rules. By showing the size and numbers of tables that are to be produced from each data file, the tabulation chart will also facilitate the choice and use of whatever tabulation software packages are available for the computer equipment to be used. Finally, it assists in the preparation of estimates of programming and tabulation time that will be needed for both staff and computer equipment.

4. Processing control

140. Careful planning and control are required to ensure an uninterrupted flow of work through the various stages from receipt of the census questionnaires through the preparation of the data base and final tabulations. The plan should provide for the computer edit to follow closely the coding/checking/recording of the data so that errors can be detected while knowledge about them is fresh and appropriate remedial actions can be taken.

141. Manual checking and correction of coding or transcription of data should be planned and computer editing and correction programmes should be prepared and tested well in advance of enumeration so that invalid or inconsistent data may be identified as soon as possible after encoding and recording, thus allowing sources of error to be eliminated as quickly as possible. Due consideration should be given to using edit software packages for identifying and correcting invalid and inconsistent data since these packages allow relatively easy modification of edit and correction rules to take account of actual data patterns.

5. Advance and final tabulations

142. Because of the urgent need for information on some census topics and the length of time required for final tabulation of census results, consideration should be given to the preparation of advance tabulations of selected topics. These are usually based on summaries of the raw data and may be issued as provisional results. Final tabulations may be based on all of the returns or on a sample. If some of the topics are collected on only a sample basis, proper weights will have to be applied in the tabulation stage to produce valid national estimates.

D. Evaluation of the results

143. Good census practice requires a careful consideration and evaluation of the completeness and accuracy of the census results. There may be errors in coverage and also in content, that is, mistakes in the reporting or recording of information concerning the characteristics of living quarters, households or individuals. The purpose of such an evaluation effort is twofold: first, to provide users with some basic measures of the quality of the census data and hence some indication of the confidence with which the census results can be used for different purposes and, secondly, to provide the census authorities with the information needed to plan and carry out improved censuses and surveys in the future. In addition to the general census evaluation programme discussed below, individual users of census data often carry out quite detailed but more specialized evaluation studies, generally of an analytical character.

144. The extent of either coverage or content errors can be estimated through the analysis of the internal consistency of the data, by examination of the reasonableness of the results and by comparison of the results (either at the aggregate or the individual record level) with data collected in other inquiries. A post-enumeration field check is an essential part of the process of evaluation, as are analytical comparisons with the results of previous censuses and with other sources. These methods of evaluation may be supplemented by other methods that focus on specific census operations (for example, quality control studies of the coding or punching work) or that are more qualitative in nature (for example, studies based on tape-recorded interviews).

145. The publication of census results should include an estimate of coverage error, i.e., the amounts of over-enumeration and under-enumeration, together with a full indication of the methods used for evaluating the completeness of the data.

Similarly, it is desirable to provide, so far as possible, an evaluation of the quality of the information on each topic and of the effects of the editing procedures adopted.

146. One of the important effects may result from the correction of inconsistent data and the addition of data which are missing from the questionnaire but about which reasonable assumptions can be made. If information on sex is not recorded, for example, an imputation, based on other entries on the questionnaire, can be made. If age is not stated on the questionnaires for a small number of persons, randomly selected ages, appropriate to the other characteristics of the individual, may be assigned. Similarly, if information on piped water is not recorded for a housing unit, an allocation based on other entries may be possible. If the housing unit is reported as having a flush toilet, then it can be assumed that it also has piped water. If any imputation is made, the topics affected, the method used and the number of cases should be clearly described in the census report.

147. Because evaluation studies, like data collection itself, can be expensive, it is usually desirable to establish a set of evaluation priorities for each census. These will be determined on the basis, *inter alia*, of the major uses to which the data will be put, the method of enumeration employed and problems encountered in previous censuses or anticipated in the present one. In addition to the issues discussed above, subjects suitable for inclusion in a general evaluation programme include, for example, the accuracy of age reporting, the coverage of homeless persons or other special population groups, the impact of proxy respondents on the labour force or fertility data or problems related to the need to conduct the census in more than one language.

148. The process of evaluation should not be permitted to delay the prompt publication of the principal results of the census. Evaluations of the completeness and accuracy of the data can be issued after the initial publication of the results.

E. Analysis of the results

149. In order to ensure the fullest possible utilization of census results by national and local governmental authorities, by academic researchers and by others, it is advisable to draw up a comprehensive and co-ordinated programme of analytical studies, phased over a period of several years. This would help allocate the resources in such a way that important planning needs are adequately met, undue duplication of research effort is avoided and priorities are observed as far as possible. In these studies, the data of the current census should not only be examined by themselves but also as complemented by relevant data from other sources and from earlier censuses in order to obtain a broader context, improve the estimates and establish trends.

150. The analytical studies to be included in such a programme will vary according to the needs and circumstances of the country. The programme may include descriptive summaries of results, policy-oriented analyses of census results and detailed analytical studies of one or more aspects of the demographic and social

situation of the country. Some of these studies may be undertaken by the census organization itself, but others - particularly the more time-consuming studies - can most effectively be carried out in co-operation with other research organizations. In any case, it is desirable to invite specialists from other governmental offices and experts outside of the Government to take part in drawing up this programme of studies and it is natural that they would play an important part in the execution of various parts of the analytical programme.

151. One important aspect to be considered in establishing a programme of analysis is the possible use of census results in achieving the goals and objectives of human settlements policies and strategies at the national and local level and in applying available resources effectively towards the improvement of human settlements conditions. For this purpose it will be necessary to analyse population and housing census results within the framework of other information available so as to achieve an integrated approach to the solutions of human settlements problems.

152. A permanent census office should be the repository of all census results; it would thus be equipped with the information needed for comparative studies, which will indicate long-term trends in the phenomena investigated.

153. Aside from studies that are part of the over-all census programme, additional analyses by research organizations, universities or other experts on their own initiative should be encouraged.

F. Dissemination of the results

154. A census is not complete until the information collected is made available to potential users in a form suited to their needs. The information may be included in published tables for general distribution, produced as tables in unpublished form for limited distribution or stored in a data base and supplied on request either on tapes or as computer print-outs.

1. Publication of tabular results

155. It is important that plans be made and sufficient funds allocated to ensure publication of the tabulations of widespread interest. The final tabulations should be presented and explained in a way that will make them usable by as many persons as possible. The data must be set forth by appropriate geographical and administrative divisions and by important demographic variables; evaluations of their accuracy and appraisals of their significance should be included in the census publications. A sufficient number of maps should be provided in the census publication to allow the identification of the geographical units for which statistics are presented.

156. Not all of the processed material need be published. Tabulations required by only a few users, such as certain government offices or specialized research organizations, can be supplied in unpublished form. Some data may not be tabulated until they are required at a later date. But it is important to

underline that data processing by computers provides the opportunity to produce a greater number and a wider variety of tabulations than was the case with previous tabulation procedures. The information stored in the census data base represents a rich source of information, which allows fast and relatively inexpensive production of additional tables as they are requested.

157. Where it is possible under the census law, consideration may be given to producing transcriptions of the information from a representative sample of the census questionnaires, for the use of qualified agencies and research institutes engaged in special studies beyond the programme of the census organization. Care must be taken, of course, to ensure that the information does not include such details as name or local address, from which individuals could be identified.

158. Every effort should be made to publish the principal results of a population census (such as those on age, sex and geographical distribution of the population) and of a housing census (such as a geographical distribution of living quarters, households, and population by type of living quarters) as soon as possible after the date of the enumeration; otherwise, their usefulness and the extent of their interest to the public will be diminished. Specific guidance, in the form of illustrative tabulations, for population census topics will be found in Part Two of the present document and for housing census topics in Part Three.

159. Target dates for publication should be determined well in advance and processing and reproduction programmes should be planned accordingly. In addition to traditional methods of printing, there are various methods of reproduction available (for example, the multi-lith or micro-fiche reproduction of computer print-outs) that are rapid, economical and legible, and these should be investigated.

2. Small-area data

160. The increasing activity in economic and social planning and its attention to subnational areas are placing new demands on statistical information in general and on population and housing censuses in particular. There is increasing need for tabulations not only by major and minor civil divisions and by other units of analysis such as metropolitan areas but even, beyond these, by small local areas.

161. As it is hardly possible to foresee all demands for small-area data at the time when census tabulation plans are made, steps should be taken to ensure that at any later time required data can be retrieved at low cost and in short time from a well-arranged data base. For a discussion of some of the issues involved in the establishment of a small-area statistics programme in connexion with the census, see paragraphs 82-90 above.

3. Privacy and confidentiality

162. All the information stored in the census data base allows the production of tables not only for very small areas (such as enumeration areas or villages) but for all individual units in these areas. Therefore, when a census data base is constructed, not only technical considerations must be taken into account but also the maintenance of confidentiality and the protection of individual privacy, which must be a primary consideration in designing the data-collection and data-processing programme. The identifiable microdata of a confidential nature, such as name and local address, from which individuals could be identified, should be eliminated from the data base.

163. The same care must be taken if a transcription of information from original questionnaires is needed (i.e., from a representative sample) for use of qualified agencies and research institutes engaged in special studies beyond the regular census programme. Such needs are considerably decreasing with almost universal use of computer technology but when such procedure is possible under the census law, individual privacy should be ensured and no exception should be authorized.

4. Acceptance of results

164. In countries with no prior census experience and without a well-functioning civil registration system, where population data are based on estimates, it is important to inform the users, particularly the governmental authorities, that the census results could differ from such estimates and to explain the reason for these differences. In some cases, the Government may not at first accept the census results, particularly in the case of the first scientific census in countries having little or no experience with population and housing data collection. Usually, these doubts about the census results focus narrowly on the total population of the country, major subdivisions or population subgroups, rather than on the bulk of the census data relating to characteristics of the population or data for local areas. Thus it may be possible to take these doubts into account by modifying the census evaluation programme or by adding appropriate qualifications in the text of the census reports or in tabular foot-notes. In addition, the Government may proceed with the processing and dissemination of the census as originally planned but decide to use population estimates for some official purposes. In any case, every effort should be made to process and evaluate the full census and to make appropriate use of as many of the census tabulations as possible.

5. Publication of the census report

165. It is recommended that, in addition to publishing the tabular results, every country should provide a methodological and administrative report giving the information necessary for appraising and interpreting the results of each census. This report should include specimens of the questionnaires, instructions for the enumeration and detailed information on the cost of the census and on the implementation of the census budget as well as information on the manner in which

the census was planned, organized and conducted, the important methodological and other problems encountered at the various stages of the programme and points to be considered in future censuses.

G. Systematic recording of census experience

166. The cumulative experience of past censuses in a country is definitely of great help in the preparation of a new census. Because of the lapse of time between censuses and the likelihood of changes in upper-echelon personnel even in a permanent census office, it is most useful to assemble complete records on the methodology of each census, an evaluation of the techniques employed and detailed records on costs and implementation of the census budget. These records should be arranged in such a way that information on each aspect of the census operation can be found easily; see paragraph 53 above for an indication of the cost data required.

III. USE OF SAMPLING IN POPULATION AND HOUSING CENSUSES

167. Sampling should have a role in population and/or housing censuses both as an integral part of the planning, execution, analysis and evaluation of the census and through the use of the census as a sampling frame for subsequent sample inquiries.

168. The most significant aspects of the use of sampling in connexion with the census are set forth below in three sections: features of acceptable sampling operations, sampling as an integral part of the census and the census as a basis for subsequent sample inquiries.

A. Features of acceptable sampling operations

1. Accuracy

169. The use of sampling in a census involves an awareness of the precision desired in a sample estimate. The higher the precision, the larger and/or more complex the sample and hence the more expensive. A distinction is to be made between precision of a sample estimate, as measured by the sampling error (which gives the difference between the estimates obtained from a sample and from a complete enumeration under the same general conditions of the inquiry) and accuracy, as measured by the difference between the true value (which is generally unknown) and that obtained from an inquiry, whether on a sample or a complete enumeration basis. For this reason, in the case of a sample inquiry, accuracy includes both sampling errors and non-sampling errors.

170. For the successful execution of a scientifically designed sampling plan, it is essential that strict selection procedures be followed. The procedures must be such that a known positive probability is assigned to every unit in the population. These probabilities are needed for estimating population values and for calculating the measures of precision of these estimates. Good selection procedures require that deviations from prescribed standards or instructions be minimized.

171. Although estimated results based on samples are subject to sampling errors in addition to whatever errors may be present in data based on a complete operation, the smaller scale of a sample operation may make it possible to employ interviewers of higher calibre, to devise and pose questions of greater detail and to minimize response errors.

172. Consideration should be given to the use of parallel samples, that is, interpenetrating networks of samples, ^{11/} to supply controls at the point of collection of the data and also estimates of the margin of uncertainty of the sample estimates.

^{11/} See Recommendations for the Preparation of Sample Survey Reports (provisional issue) (United Nations publication, Sales No. 64.XVII.7), sect. V.18.

173. Recognition should be given to the importance of computing estimates of sampling variances, at least for the major items of interest. Simplified methods, in conformity with the sample design, such as methods based on the use of random groups or on the summarization of basic data for individual primary sampling units could be used for this purpose. 12/

2. Census resources

174. Effective planning of sample operations consists of meeting the requirements of accuracy by making judicious use of whatever expert knowledge and equipment are available in a particular country. It is obvious that sample plans aimed at the same objective may vary from country to country, depending on the quality and quantity of census resources. In planning a sample operation as part of the census effort, it is important to bear in mind considerations of cost and of competent direction.

175. The question of cost in sampling is of crucial significance. Numerous factors govern the cost of sampling and it is essential that these be fully weighed before a decision is made to associate a sample plan with a complete count. One important factor, for instance, is the size and complexity of the sample, which in turn is governed by the objectives of the survey and the procedures that are regarded as most efficient. The cost of a sample operation can be substantially lower if only a few geographical and cross-classification details are required.

176. Sample operations should be conducted under the direction of a competent statistician who is conversant with both the theory of sampling and the practical difficulties of carrying out surveys. The advice of such a statistician is indispensable at all stages of the sample procedure, that is, from planning of the sample to estimation of population values.

177. In order to ensure that the sample is selected strictly according to the design and to avoid any possibility of bias in sample selection, it is strongly recommended that the actual selection of the sample units should be carried out either in the central office or in regional offices under the direct supervision of a sampling statistician.

B. Sampling as an integral part of the census

178. Depending on the types of problems to be tackled, a country may consider applying sampling methods in one or more of the following phases of a population census: tests of census procedures, enumeration of topics in addition to those for which universal coverage is required, post-enumeration field checks, quality control of data processing, advance tabulation of selected topics and final processing and tabulation. Each phase is discussed below.

12/ "Report of the eighth session of the Conference of African Statisticians, Addis Ababa, 21-30 November 1973" (E/CN.14/611), para. 226; M. H. Hansen, W. N. Hurwitz, and W. G. Madow, Sample Survey Methods and Theory, vol. I, Theory (New York, Wiley, 1953), pp. 439-440; R. K. Som, A Manual of Sampling Techniques (London, Heinemann), pp. 273 and 312.

1. Tests of census procedures

179. Planning the various phases of a census often involves choosing among several alternative procedures. Tests conducted on a sample basis provide the best means of determining which alternative to use. The results of such tests facilitate a more desirable allocation of available census resources than is possible otherwise and thus assist any country to undertake a census programme adapted to its needs and capacities.

180. The nature and extent of census testing depend on the information that is available from previous censuses or other sources. If, for example, prior housing statistics are lacking in a country, it will be difficult to assess in advance the variability of the statistical material to be investigated and also the quality of the interviewers. An intensive pilot survey will enable one to obtain an idea of these factors. Again, countries that expect to expand the scope of their censuses rather substantially in relation to their previous censuses should first determine the feasibility of the plan of expansion. This may warrant a broad experimental approach to the entire census plan.

181. If no previous information is available concerning the variability of the important characteristics to be investigated by sampling in the census, a pilot survey can be used to obtain such an estimate. The precision of the results to be obtained by subsequent sampling procedures can then be calculated in advance and the probable limits of error of estimation can be stated for each figure to be estimated. This important feature of sampling makes it possible to design the sample in accordance with the precision required for the uses that are to be made of the data or with the precision possible within the range of permissible costs.

182. When carrying out census tests, random sampling need not always be employed. Non-random, or purposive, samples may be used where, for testing the effectiveness of a projected course of action, it is not necessary to base the final decision on any quantitative measures derived from data obtained by means of the test and particularly where the biases introduced are not of very great significance for the problems investigated. The tests of many procedures require duplication of the coverage and procedures within a compact area. In such a case, it is seldom feasible to include a sufficient sample of such areas to obtain representative coverage. The results for the area or areas actually covered must be projected to the expected total on the basis of general knowledge of the representativeness of the areas. In such cases, purposive selection of one or a few areas is generally preferable to a random selection. Purposive samples are also particularly useful when it is necessary to test census questionnaires and methods in areas with particularly difficult conditions. On the other hand, when quantitative measures are needed for comparing efficiencies of different procedures (for instance, in examining the anticipated response errors arising from different systems of enumeration), random sampling must be used.

2. Enumeration of topics in addition to those for which universal coverage is required

183. The rapidly growing needs in a number of countries for extensive and reliable demographic data have made sampling methods a very desirable adjunct of any

complete census. Sampling is increasingly being used for broadening the scope of the census by asking a number of questions of only a sample of the population and/or of the housing units. Modern experience in the use of sampling techniques has confirmed that it is not necessary to gather all demographic and/or housing information on a complete basis; the sampling approach makes it feasible to obtain required data of acceptable accuracy when factors of time and cost might make it impracticable, or other considerations make it unnecessary, to obtain the data on a complete-count basis.

184. It is important to bear in mind, however, that national legal requirements may make it mandatory to collect certain information on a complete-count basis. Legislation in many countries prescribes complete population enumerations at particular times or makes certain political or administrative dispositions dependent on particular results from a complete enumeration. For example, the apportionment of seats in the legislature among the civil divisions of a country often depends on the number of persons actually enumerated in each division. The data needed for this and similar purposes cannot be collected by sampling.

185. Information that is collected for only a sample of the population and/or housing units may be obtained by one of two different methods. Either the same census interviewers may ask the questions or specially trained interviewers may be engaged for enumerating the sample. The first method may be used where it is fairly simple to obtain the information by conventional enumeration techniques; the second method is used where ordinary enumeration methods are not expected to elicit accurate answers to the questions and where the sample size can be kept small. In general, the choice depends on the nature and manner of asking the questions, which in turn are determined by considerations of cost and accuracy and of the nature of the data to be collected. It depends also on the nature of the staff available and on the facilities for training and supervision.

186. It is important to make certain that asking questions that are not asked of all persons does not give rise to legal, administrative and even political issues since census information is required under statute and usually under penalty.

187. The field staff for a sample inquiry in connexion with a census is often required to compile detailed information from the respondents and may have to make subjective decisions to place a respondent's answer under the correct category. For this reason, they are required to be of a high calibre, well trained and preferable with prior experience and/or knowledge with regard to population and housing statistics. Also, because housing censuses often take place in conjunction with population censuses, the scope of the housing data to be collected may have to be limited by the quality of the interviewers.

188. The suitability of particular questions for a sample enumeration depends on the precision with which results are needed for small areas, population groups and groups of living quarters and on the enumeration costs involved. Account has also to be taken of the desirability of having results of high precision on basic topics for areas of various sizes, since such results can serve as bench-marks for numerous subsequent inquiries.

3. Post-enumeration field checks

189. As the scope of the modern census is ever-increasing with time, the problem of obtaining census data of high quality is becoming both more important and more difficult. In the present state of census practice, no procedure is yet available that can keep the census enumeration entirely free from errors. It is extremely important, however, that departure from accuracy and completeness does not exceed reasonable limits.

190. Census enumeration extends to every census unit in the population and involves numerous questions; it cannot, therefore, be completely checked since, in that case, the cost of re-enumeration would be prohibitive and the burden of response imposed on the public excessive. An effective way of determining the types and magnitudes of errors in the census enumeration is the re-enumeration of samples of census units for certain questions.

191. Post-enumeration field checks serve two principal purposes. The one is to inform users of the data about the accuracy attached to census figures and the other is to aid census officials in the improvement of subsequent censuses. In so far as the checks serve the latter purpose, the task of testing for subsequent censuses is greatly eased.

192. As mentioned in paragraph 182 above, random sampling need be used only when quantitative measures are required for appraising the census data (for instance, in determining the amount of under- or over-enumeration) with the best possible precision. Non-random or purposive samples may be used where quantitative measures derived from the sample data are not of crucial importance for testing the effectiveness of a certain census procedure. However, in choosing between a random and a purposive sample, it is well to keep in view the requirements of future demographic and/or housing inquiries, including the next census, since a random sample, although it may be more expensive from the immediate viewpoint, may well provide a scientific and continuing basis for planning future inquiries of a related nature.

193. Quality of census data may be adversely affected by content errors and by errors in coverage.

194. Content errors are errors in respondents' answers, biases and errors on the part of the interviewer and biases and errors arising from imperfection in the design of the questionnaire. Although these content errors can be subjected to critical census tests preceding the actual census, experience has shown that post-enumeration field checks are necessary to determine the nature and extent of such errors in the census enumeration.

195. Special precautions should generally be taken in order to avoid errors in the collection of information from the sample selected for the post-enumeration field check. Some advantages of conducting the check as closely as possible to the general census are that (a) there will have been a minimal movement of population, (b) respondents will still have fresh in mind the information as of the date of the census and (c) the public will be prepared to co-operate with the

new inquiry because they will not have forgotten the publicity and other activities connected with the census. However, it should be ensured that the general census enumeration is completely over before the post-enumeration check starts and that the field personnel for the check no longer have access to the questionnaires completed during the general census. It may be useful to select the best of the supervisors and enumerators from the general census to serve on the post-enumeration field check; they should receive intensive training and should be remunerated on a basis that allows them ample time to obtain valid replies. When necessary, their work should be verified by cross-checks with other elements of information. However, one disadvantage of holding the post-enumeration check just after the general census using the same staff is that the fatigue from the census work may not allow the staff to do the post-enumeration check properly. Another problem arising from the same circumstances is that the independence of the post-enumeration field check may be adversely affected.

196. To accomplish its purpose, a true post-enumeration field check, particularly one instituted to check coverage errors, should meet three separate requirements, which are: (1) it should constitute a separate count, independent of the original enumeration; (2) it should be representative of the whole country and of all population groups; and (3) it should involve one-to-one matching and reconciliation of records. To the extent that any of these requirements are not met, the estimates of error based on the post-enumeration field check are themselves subject to error.

197. The ultimate sampling units for re-enumeration should be clearly defined and should preferably be operationally convenient geographical areas, taken from a comprehensive frame consisting of enumeration areas, preferably those used in the original census.

198. Representativeness in respect of the whole geographical area and of all population groups calls for the post-enumeration field check to be carried out in a well-designed random cluster sample, large enough to give at least an evaluation of the enumeration in the country as a whole and in its major civil divisions, since determination of quantitative measures of under- and over-enumeration is one of the important objectives of the procedure.

199. The one-to-one matching of census schedules to post-enumeration field check schedules is the essence of the re-interview method of census evaluation. Name-to-name matching is not an easy task in any country, especially in cultures where names lack uniqueness. Even identification of the household may be difficult in those parts of the world where street names and house numbers are practically non-existent. Nevertheless, since the efficacy of the post-enumeration field check as a remedial measure in census-taking rests on the identification of errors and their correction, comparisons must be made on a one-to-one basis to the degree possible.

200. In order to assess the content errors as well as to help in the matching process for evaluation of coverage errors, an intensive query with questions additional to those asked during the general census may be made during the post-enumeration check. Moreover, questions on supplemental topics not investigated during the census may be included in the post-enumeration check as a

means for collecting additional data, provided the decision is taken after a proper assessment of the feasibility of combining the two operations.

4. Quality control of data processing

201. Sampling can be used effectively for measuring and controlling the quality of census-processing operations. These include the editing of questionnaires, their coding, the recording of data on punched cards (or tape production) and their verification, some computations (rates etc.) and the tabulation of figures. Even in a country of medium population size, these operations involve millions of questionnaires and a far greater number of columns of figures and of perforations.

202. Under appropriate conditions, sample inspections and, in particular, quality control techniques make it possible to control effectively and economically the quality of census data processing and it is no longer necessary or expedient to locate and correct substantially all processing errors by carrying out each operation a second time by way of verification. This course results in a much lower census cost than if the control had been performed on a complete basis. Moreover, it is, in any case, not justified to increase the processing costs of a census beyond a certain point for improving the accuracy of census results since these will still be affected by defects in enumeration (e.g., incompleteness of enumeration, response errors etc.) and other errors independent of processing. When final tabulations are in view, attention has to be paid to the accuracy of figures in a series of detailed cross-tabulations, especially those concerning relatively small areas or small groups of individuals. This demands accuracy in small lots of data and imposes more stringent conditions in the application of statistical methods of quality control than if only larger areas or groups were to be considered.

203. For clerical processes such as coding, key punching etc. primary controls should be on the work of individuals, since the difference among individuals is a major component of variation in quality. The quality of work of an individual may vary significantly over time. Therefore, it is desirable to compute error rates frequently. In addition, each person should undergo a qualifying period at the beginning of the operation during which his or her work is verified intensively, in some cases at the 100 per cent level.

204. Every effort should be made to keep operational features as simple as possible. One person in each work unit should designate work to be verified; each verifier should not be made responsible for the application of sampling instructions. In general, a systematic pattern of selection with random starts is preferable to a random one. Measures of quality must be adaptable to simple record-keeping systems.

205. An inspection level of x per cent does not automatically ensure a cost saving of $100 - x$ per cent. Cost estimates must take into account 100 per cent inspection during the training period, fixed costs of handling inspection lots, 100 per cent inspection of rejected lots, costs of designing and selecting the sample and extra record keeping.

5. Advance tabulation of selected topics

206. A complete national census is a huge undertaking. Unless sampling methods are introduced, several years may elapse beyond the date to which the census refers before some of the tabulations of the greatest economic and social interest are published. This lag may be expected in countries that are large and that do not take censuses regularly and frequently, and also in the economically less developed countries where minimal or no funds can be devoted to modern tabulation equipment. The danger is, however, no less serious in countries where modern tabulation equipment is available in large quantities, since most of the increased capacity of such equipment has to be utilized to meet the heavy additional demands made by the modern census.

207. It is natural, therefore, that advance, provisional tabulation should be the most frequent application of sampling to census work and perhaps the first one to be made in many countries. Although it is true that, in most countries, interviewers prepare at the time of enumeration, summaries referring to the number of living quarters, households and persons enumerated and some other basic facts, there is nevertheless a definite need for early tabulation of some of the results that cannot be derived from interviewers' preliminary reports. The need for advance tabulation is evident even in a small country that takes censuses regularly. It should be mentioned at this point that advance sample tabulations can be used to the best advantage when they are obtained for fairly large areas and for the country as a whole.

208. If only a sample of returns is processed and used for tabulation, the advance estimates of the basic census results thus obtained would be of current validity. The population and the housing situation may be undergoing such rapid changes that the processing of an advance sample may present a more up-to-date picture than would a complete tabulation. An important consideration in selecting topics for the advance sample tabulation is their variability, since sampling errors may tend to obscure changes that have occurred.

209. Securing advance tabulations through sampling has certain disadvantages. The results tabulated for the sample units have to be integrated with those tabulated for the non-sample units to give the final results. These operations may increase the total tabulation time of the census and its cost beyond what they would be without the special tabulation of advance results. Precautions are necessary in order to minimize the delay that may be caused in the preparation of the final results. To that end, the census plan should carefully co-ordinate the special tabulation of advance results and the tabulation of final results. One solution is to use priority processing for the sample areas and to duplicate punch cards or summaries for them; the duplicates should be processed to give the sample results and all records should be processed to give the complete results.

210. If sampling has been used as an integral part of a complete enumeration to broaden the scope of the census by obtaining supplementary information, the same sample of individuals, households or other units will also provide a sample for advance tabulations of the census proper. Such a sampling scheme, if it is devised efficiently, with a view to securing additional census information by small

administrative units, may offer excellent opportunities of conveniently obtaining advance tabulations by the same administrative units.

211. Even when no sampling has been used in the actual enumeration, the sample design for advance tabulations may be comparatively simple because the complete census returns provide the sampling frame and the domain or domains of study. Advantage may also be taken of the efficiency of using small sample units (e.g. households or small areas) since the smallest units are actually the easiest to define in the census returns.

6. Final processing and tabulation

212. The principal limitations of complete processing and tabulation of all the information collected in a population census and/or a housing census are time and money. Consequently, processing and tabulation programmes may provide for the complete tabulation of those elements of information regarded as of sufficient importance for small administrative areas, while certain other characteristics may be processed and tabulated only on a sample basis. This procedure has been used in the past by some countries in an effort to ensure the timely completion of the census processing work. The arguments in favour of this approach are now less compelling than in the past owing to the speed of the data processing equipment currently available in most countries. However, savings might still be achieved through the use of sampling in connexion with manual processing operations, such as coding and data entry, particularly in large countries.

213. In considering the advisability of using sampling in connexion with the final processing operations, the following considerations may also be taken into account. There are certain population and housing characteristics about which information is needed only by large areas and for the country as a whole. Sampling makes it possible to obtain detailed tabulations for large areas, with reasonably small sampling errors and at a much reduced cost and in a shorter time than that needed for tabulations on a complete basis. However, since one of the purposes of a census is to serve local interests, the feasibility of sampling is determined to some extent by the size of the smallest localities for which separate tabulations are needed. In order to obtain data of acceptable precision for these, it may be necessary to use high sampling fractions in view of the great variability as well as of high intra-cluster correlations for certain characteristics. There may be instances where even the use of high sampling fractions fails to give results of acceptable precision; in such cases it would be inadvisable to use sampling methods.

214. Even greater savings in cost and time are achieved if cross-tabulations are prepared on a sample basis than if simple tabulations are so prepared. However, it should be borne in mind that sample tabulations imply some reduction of geographical detail and of detailed cross-classifications. Moreover, it is possible that such cross-tabulations may result in a number of cells that include a small number of units and, therefore, have high sampling errors.

C. The census as a basis for subsequent sample inquiries

215. A sampling frame may be a list of small areas, structures, households, people or groups of households. The census can be such a frame; in fact, the census can be the only frame for subsequent sampling in the many countries that do not have good maps, village lists, a register of population, a register of households or lists of living quarters. Before a sample selection is undertaken, it is necessary to ensure that the sampling frame is free from such defects as inaccuracy, incompleteness, duplication, inadequacy and obsolescence. Each of these five types of defects in a frame introduces defects of a different type in the sample procedure. Emphasis should be laid at this point on the importance of updating the frame to the date of the sample inquiry. Otherwise, the inquiry results would refer to the date at which the frame was last revised. It is desirable to investigate carefully those parts of a population and/or a housing census that are to be used as the sampling frame for a proposed sample survey, since some defects are not at all apparent until a detailed examination has been made. This objective may be accomplished by examining the relevant administrative machinery of the census and the way in which the census information is kept up to date; sometimes the investigation may entail a certain amount of field work.

216. Although this remedy is appropriate when the frame in question is a population and/or housing census already enumerated and processed, a much more effective approach towards avoiding the above-mentioned defects would be to give very careful consideration to the problem at the stage of planning the census. A census can serve as a reasonably acceptable frame if, in addition to careful planning, the various phases of the census are executed with proper care and if the obstacles to successful execution are fully recognized.

217. Maps and prior census information concerning small areas are very important for devising a good sample plan. Maps are particularly valuable if they unambiguously indicate boundaries of very small areas and the number of living quarters, households or inhabitants living within the boundaries. This prior information need not necessarily be very accurate or up to date if it is used for grouping or stratification.

218. For many subsequent sample inquiries, the main census results may be available for use as supplementary information by the national statistical office and possibly by others, in accordance with national laws and policies relating to the confidentiality of census data (see para. 49). The availability of individual records or punch cards, the data on which have been checked, makes it possible to select sample units from those that show characteristics relevant to the sample inquiry. Stratification and ratio estimation can thus readily be used, whereas they are difficult or impossible to employ when sampling is used as an integral part of the census, such as in tabulating advance results.

IV. THE UNITS, PLACE AND TIME OF ENUMERATION
FOR POPULATION AND HOUSING CENSUSES

A. Units of enumeration

219. Since individual enumeration is an essential feature of a population census, the primary unit of enumeration for the population census is the person. The household is the general framework within which most individuals are identified and it is also an additional unit of enumeration in its own right. Because it is also a unit of enumeration for the housing census, the careful identification of the household as a preliminary step to the enumeration can facilitate the efficient collection of the data and the control of its completeness in both censuses. In countries in which it is traditional to use the family as the general framework within which individuals are identified, the family may be substituted for the household. In the majority of cases, the composition of the family will coincide with that of the household.

220. In addition to persons identified within households, there are persons who are not members of a household. The latter group constitutes the institutional population, which is also investigated in population censuses.

221. For the housing census, the household is one of three units of enumeration; the other two units are living quarters (i.e., housing units and collective living quarters) and buildings. It is important to bear in mind that, in conceptual terms, these three units are clearly distinguishable. There is not necessarily an identity or exact correspondence among these concepts nor are the terms themselves interchangeable. Several households may live together in one set of living quarters and one household may occupy more than one set of living quarters. Similarly, several sets of living quarters may together occupy one building and one set of living quarters may occupy more than one building.

222. It is recognized that there may be difficulty in some countries in maintaining independent concepts of "household" and of "living quarters". However, the advantages in terms of the usefulness of the data that result from separate concepts outweigh the additional effort required in maintaining them.

223. In carrying out a census, it is essential that the units of enumeration be clearly defined and that the definitions be included in manuals of instruction for the enumeration and in census reports. In order to reduce the possibility of difficulties in applying the definitions recommended below, countries may find it necessary to expand the definitions and to illustrate them in terms of national conditions and circumstances. Post-enumeration field checks can provide a useful means of determining to what extent the national definitions of the units of enumeration have been applied in the field and the consequent effect on the census results.

1. Person

224. For census purposes, the "person" is each individual falling within the scope of the census. Although each person must be included in the count of the population, there will be some variation in regard to the persons for whom information is collected on different topics. The variations usually depend on the person's age, sex and/or relationship to the head or other reference member of the household. When it is recommended that information on a particular topic be investigated for less than the total population, the group of persons for which the topic should be investigated is indicated in the presentation of the definition and specifications of the topic in section C, chapter I of Part Two. In addition, each tabulation presented in section C, chapter II of Part Two is accompanied by a description of the population to be included in the tabulation.

2. Household /or family/

225. The concept of "household" is based on the arrangements made by persons, individually or in groups, for providing themselves with food or other essentials for living. A household may be either (a) a one-person household, that is, a person who makes provision for his or her own food or other essentials for living without combining with any other person to form part of a multiperson household or (b) a multiperson household, that is, a group of two or more persons who make common provision for food or other essentials for living. The persons in the group may pool their incomes and have a common budget to a greater or less extent; they may be related or unrelated persons or a combination of both.

226. The family that is sometimes used as a unit of enumeration in place of the household consists of related persons having a common budget although not necessarily living together. The family members living together can, for example, be supporting or be supported by one or more members living elsewhere.

227. For a more detailed discussion of the concepts of household and family, see Part Two, paragraphs 62-64 and 73-85. A more detailed discussion of the concept of household is also presented in Part Three, paragraph 112.

228. Households usually occupy the whole, part of or more than one housing unit but they may also be found living in camps, boarding houses or hotels or as administrative personnel in institutions, or they may be homeless. Households consisting of extended families that make common provision for food or of potentially separate households with a common head, resulting from polygamous unions, or households with vacation or other second homes may occupy more than one housing unit.

229. Homeless households are defined as those households without a shelter that would fall within the scope of living quarters as defined in paragraph 234 below. They carry their few possessions with them, sleeping in the street, in doorways or on piers or in any other space on a more or less random basis.

230. For certain topics investigated in housing censuses, the household may serve more efficiently than living quarters as the unit of enumeration. For example, tenure, if investigated in the census, should be collected with reference to households rather than living quarters. Information about household possessions that are not normally included as part of the equipment of living quarters (radio and television receivers, for example) should be collected with reference to households. Information on rent, an item of significance in relation to both living quarters and households, would of necessity be collected in relation to the household.

3. Institutional population

231. The institutional population comprises persons who are not members of households. These include persons living in military installations, correctional and penal institutions, dormitories of schools and universities, religious institutions, hospitals and so forth.

232. Persons living in hotels or boarding houses do not belong in this category but should be distinguished as members of one-person or multiperson households, on the basis of the arrangements that they make for providing themselves with the essentials for living. Personnel of institutions not living in dormitories or similar accommodations should be treated in the same way.

4. Living quarters

233. The principal units of enumeration in a census of housing are living quarters. Only by recognizing them as such can data be obtained that will provide a meaningful description of the housing situation and a suitable basis for the formulation of housing programmes.

234. Living quarters are structurally separate and independent places of abode. They may (a) have been constructed, built, converted or arranged for human habitation, provided that they are not at the time of the census used wholly for other purposes and that, in the case of mobile housing units, improvised housing units and collective living quarters, they are occupied at the time of the census or (b) although not intended for habitation, actually be in use as such at the time of the census. For a more detailed discussion of the definition of "living quarters" and of the concepts of separateness and independence as used in the definition, see Part Three, paragraphs 41-43.

5. Building

235. The building is regarded as an indirect but important unit of enumeration for housing censuses since the information concerning the building (building type, material of construction and certain other characteristics) is required to describe properly the living quarters located within the building and for the formulation of housing programmes. In a housing census, the questions on building characteristics are normally framed in terms of the building in which the living quarters being enumerated are located, and the information is recorded for each of the housing units or other living quarters located within it.

236. A building is any independent free-standing structure comprising one or more rooms of other spaces, covered by a roof and usually enclosed within external walls or dividing walls that extend from the foundations to the roof. However, in tropical areas a building may consist of a roof with supports only, that is, without constructed walls; in some cases, a roofless structure consisting of a space enclosed by walls may be considered a "building". For a more detailed discussion of the definition of building and related concepts, see Part Three, paragraph 17.

237. In some countries, it may be appropriate to utilize the "compound" as a unit of enumeration, either in addition to the building or as a substitute for it. In some areas of the world, living quarters are traditionally located within compounds and the grouping of living quarters in this way may have certain economic and social implications that it would be useful to study. In such cases it may be appropriate, during the census, to identify compounds and to record information suitable for linking them to the living quarters located within them.

B. Place of enumeration

238. In a population census, information about each person can be collected and entered on the census questionnaire either where he or she is (or was) present on the day of the census or at his or her usual residence.

239. In compiling the census results by geographical areas, however, each person can be included in either (a) the household (and hence the geographical area) where the person was present on the day of the census or (b) the household (and the geographical area) where he or she usually resides. This allocation is not necessarily dependent upon the place at which information was collected for the individual but it can be simplified by the proper choice of a place of enumeration.

240. If a "present-in-area" population distribution only is wanted, it is logical to enumerate each person at the place where he or she is (or was) present at the time of the census. If a distribution by usual residence only is required, it is more satisfactory to collect the information about each person at the person's place of usual residence. It should be noted, however, that it is not always possible to collect information about each individual at his or her usual residence, as for example, when an entire household is away from its usual residence at the time of the census. Some provision must therefore be made for collecting information about such persons at the place where they are found at the time of the census.

241. With the growing interest in information on households and families and on internal migration, it is becoming increasingly desirable to prepare tabulations on the basis of usual residence rather than on the basis of place where present, since the latter is often temporary and so is not useful for the investigation of the above-mentioned topics. Also, although it is comparatively simpler to enumerate each person where present on the day of the census and to use a

present-in-area population distribution, a usual-residence distribution is likely to be more accurate than a present-in-area distribution, if the time required for enumeration is so long as to permit considerable movement of persons during the interval.

242. If it is desired also to obtain information on both the usually resident population and the present-in-area population, then either each person present in each household on the census day or each person present and each usual resident temporarily absent can be enumerated at the appropriate household. A clear distinction must then be made on the questionnaire, as applicable, among (a) persons usually resident and present on the day of the census (b) persons usually resident but temporarily absent on the day of the census and (c) persons not usually resident but temporarily present on the day of the census.

243. Depending on the categories of persons enumerated at any given place, information may then be collected on the usual residence (address) of those only temporarily present and on the place (address) at which each temporarily absent persons can be found. This information can be used for allocating persons to the household and geographical area with which they are to be counted and for checking to be certain that no person is counted twice (i.e., at both the usual residence and the place where present). The procedures to be followed at the enumeration and through the subsequent allocation of persons must, however, be very carefully planned and strictly adhered to if the allocation is to be accurate.

244. With the exception of mobile housing units, living quarters and buildings have a fixed location and the place where they are to be enumerated has not. therefore, to be considered in taking a housing census. Information on households, however, and the persons in households can be collected and entered on the housing census questionnaire either where they are (or were) present on the day of the census or at the usual residence. The procedure followed in the housing census should be governed by that adopted in carrying out the population census if the two censuses are carried out simultaneously. If the housing census is an independent operation, however, the procedure to be followed should be carefully considered since it may have a significant effect on the validity of the results of the housing census.

245. Where persons and households are allocated to the place of usual residence, they should also be allocated to the living quarters that they usually occupy. The living quarters that they are actually occupying at the time of the census should be counted as vacant if they are conventional dwellings or they should be excluded from the census if they are of a type other than conventional dwellings 13/.

13/ By definition, all living quarters except conventional dwellings are required to be occupied in order to be included in the census.

246. Mobile housing units represent a special case as far as the place of enumeration is concerned. They should be enumerated where they are found on the day of the census; however, in accordance with the procedure adopted for the allocation of the population, mobile housing units may also be allocated to the area where the occupants usually reside provided that they are the usual living quarters of the occupants in the area of usual residence. Where they are not the usual living quarters of the occupants in the area of usual residence, the occupants would be allocated to their usual living quarters and the mobile housing unit would be excluded from the census.

C. Enumeration point of time

247. One of the essential features of population and housing censuses is that each person and/or each set of living quarters must be enumerated as nearly as possible in respect of the same well-defined point of time. This is usually accomplished by fixing a census "moment" at midnight at the beginning of the census day if there is only a single census day.

248. For the population census, each person alive up to the census moment is included on a census schedule and counted in the total population, even though the process of completing the schedule does not take place until after the census moment or even after the census day and the person may have died in the interim. Infants born after the census moment are not to be entered on a schedule or included in the total population, even though they may be living when the other persons in their household are enumerated.

249. For the housing census, each set of living quarters that has reached an established stage of completion and that is not scheduled for, or in the process of, demolition should be included on a census schedule and counted as part of the housing inventory even though the process of completing the schedule does not take place until after the census moment or even after the census day and the living quarters may have been scheduled for demolition in the interim. Living quarters that have attained the prescribed state of completion after the census moment are not to be entered on a schedule (unless special instructions are issued for recording living quarters under construction) nor should they be included in the total number of living quarters.

250. Where the amount of time required for enumeration in the census is considered to be so long that the population is not likely to be able to supply information as of a single moment in the past, it may be necessary to employ different points of time in the enumeration, even to the extent of using the night before the visit by the enumerator. If such a procedure is followed, it should be clearly explained in the census report and the total duration of the enumeration should be stated. For ease of reference and for the computation of intercensal indices, it is useful to designate a single date in the enumeration period as the official "census date". This date could be, for example, the day by which half of the population had been enumerated.

D. Time-reference period for data on the characteristics
of the population and of living quarters

251. The data collected about the characteristics of the population and of living quarters should be pertinent to a well-defined reference period. The time-reference period need not, however, be identical for all of the data collected. For most of the data, it will be the census moment or the census day; in some instances, however, it may be a brief period just prior to the census, as in the case of economic characteristics and of rental, or a longer period of time, as in the case of fertility questions and information on the period of construction of the building in which the living quarters are located.
