

taking
agricultural censuses

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**guidelines supplementing the programme for
the 1980 world census of agriculture**

**statistics division
economic and social development department**

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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FOREWORD

In Resolution No. 14/75 on the 1980 World Census of Agriculture, the 18th Session of the FAO Conference held in November 1975, besides urging member nations to carry out their national census of agriculture, requested FAO to (a) take steps to encourage the widest possible participation of countries in the census of agriculture especially in the developing regions; (b) to provide technical assistance to countries to enable them to conduct the census and to process the census data. Earlier, the Seventh Session of the FAO Statistics Advisory Committee of Experts held in March 1975, after reviewing the Programme for the 1980 World Census of Agriculture, recommended the preparation and dissemination of guidelines for use by developing countries on the taking of a census of agriculture. In compliance with these recommendations the FAO Statistics Division has prepared these guidelines as supplement to the Programme for the 1980 World Census of Agriculture, to promote and encourage the participation of all member countries in the World Census. It is hoped that countries taking their censuses within the framework of the FAO Programme for the 1980 World Census of Agriculture will find these guidelines useful.

These guidelines contain information based mainly on the experiences of selected international and national agricultural census experts working and/or having worked in the developing countries. FAO wishes to acknowledge with thanks the following national agricultural census experts - Mr. P. Gadegbeku (Liberia), Miss. M. Lomeli (Mexico), Dr. T.A. Mijares (Philippines), Mr. W.A.A.S. Peiris (Sri Lanka), Dr. A.A. Sarhan (Egypt), Dr. D. Singh (India) and Mr. S. Soenardi (Indonesia); and international agricultural census experts - Mr. P. Delorme (Cameroon, Chad, Central African Empire, Congo and Gabon), Mr. M.R. Ghazi (Guinea), Mr. R. Giri (Swaziland), Dr. J.S. Gutierrez (Brazil), Mr. J. Jansonius (Ivory Coast), Mr. P. Sahota (Ecuador), Dr. R.C. Seth (Haiti), Mr. A. Telang (Bangladesh), Mr. Duong Huu Nghia (Madagascar), Dr. M.D. Mostafa (Syria) and Mr. J.J. Wagner (Togo), for their cooperation in providing FAO with their valuable experience in taking censuses of agriculture. The task of putting together the various information received from these experts in the form given in this publication was undertaken by Dr. Daroga Singh, Director of the Institute of Agricultural Research Statistics in India, as FAO Consultant.

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1. CENSUS LEGISLATION

1.1 Census legislation or the collection of laws governing census activities is one of the first aspects to be considered when starting to plan the census, since it constitutes one of the most important instruments for facilitating the census work, all that related to the census taking. This can be a law of general nature granting a specific agency in the government the authority to gather wide ranging information needed. Usually, such a law would either be a provision in the constitution of the country or a specific legislation creating a statistical agency and specifying its broad statistical functions.

1.2 A law on statistics exists in most countries, with implementing regulations in which the special functions of a national agency responsible for providing the statistical information which the country needs are established in detail. This law specifies that it is compulsory to take agricultural censuses at a fixed interval of time, five or ten years' period. In addition to, or in support of this law, it is customary to issue a special decree containing a series of provisions on census activities. As the decree is a resolution, determination or decision of the chief of the state, or some other high government authority, it is widely respected by the citizens.

1.3 If no such law on statistics exists, the necessary steps must be taken to enact such a law. The census can provide a good opportunity for drawing attention to the country's need for appropriate statistical legislation, thus speeding up its promulgation. However, as this may take a long time, it is advisable to establish, in accordance with the legal procedures existing in the country, another legal basis for carrying out the census.

1.4 The decree, or other type of legislation, must be ready sufficiently in advance of planning the census. This is all the more necessary if no census type of activity can be started without the support of a corresponding law. In this case, it must be issued preferably three years before the start of the census. Any delay in promulgation of such a law will unduly delay the commencement of the census taking. Therefore, the most convenient date for its publication must be looked into carefully, so as to take full advantage of all the support which adequate legislation will afford the census.

1.5 Even when it is a question of legal documents which will be drawn up, or at least devised by legal experts, the authorities in charge of the census should pay careful attention to the points which are to be included, since it is necessary that all the stages of the census taking from planning to the publication of the results be considered. When this is done, on starting the census, organizations which might have some reluctance to cooperate in the census would offer to collaborate with the staff, make available vehicles or some other facilities with the result that at a given moment, various resources are made available to implement census operations efficiently. Consequently, it is very important that in the census regulation all census stages should be contemplated and the obligation to cooperate in all of them established. There are some aspects, information on which should be obtained sufficiently in advance, such as preliminary reports giving rough population estimates, lists of places, settlements, etc., which are supplied by the local authorities and for which it is very convenient to rely on the support of census legislation, if one wishes to have a favourable response.

Basic Law

1.6 The subject matter of the basic law and the supplemental ones should normally cover the following:

(i) Scope and coverage of the Census

1.6.1 It will indicate the broad areas on which the census organization is to obtain information. The scope should be as general as possible in the permanent legislation and leave certain details to the supplemental legislation. This will provide leeway or flexibility to

the census agency in planning out the operation and in including items of information pertinent to the time the census is taken. It should specify whether the census will include the whole country or exclude certain regions. This becomes necessary in some countries with thinly populated areas and with difficult channels of communication. Such areas are either excluded or certain census operations are postponed to some later date. The method of collection of data, whether it should be based on complete enumeration or it should be based on sampling method, can be included in the law.

(ii) Periodicity of the census

1.6.2 The periodicity of the information showing the changes occurring in the structure of agriculture in different periods of time, is an important aspect of the census undertaking. In some countries where the ten-year interval between the taking of two consecutive censuses is too long, because of the rapid change in the agricultural structure, quinquennial or more frequent censuses are carried out. These considerations clearly show the need for an introduction of periodicity in the census legislation, thus maximizing the use of precious experience after each agricultural census. Provisions regarding the periodicity of a census are usually in the permanent legislation. The advantage of having this kind of legislation is that it provides an obligation for the legislative or budgetary authority to provide the appropriation necessary and that the census is expected at regular intervals. The permanent census organization at the same time can plan well ahead or that the ad hoc census body can be organized early enough before the scheduled census. On the other hand, the periodicity established by law may not be literally followed where budgetary funding cannot be had. In any case, the periodicity indicated in the law provides a general guideline in the frequency of census taking. In countries where there is a practice of organizing several censuses, it may be desirable to indicate the periodicity of a particular census, such that one census can be taken after another or that they can be taken simultaneously. The law can indicate the periodicity or interval of five or ten years or by indicating the years ending in 0 or 5, etc.

(iii) Reference period

1.6.3 The agricultural census deals with the items of agricultural operations which are spread, many times, over the whole year. However, there are some items which may refer to a fixed date of the year. In the legislation it should be clearly indicated as to what should be the reference period or reference date in respect of various items of agricultural operations.

(iv) Responsibility of the census

1.6.4 The primary administrative body responsible for the census should be indicated in the basic law. The supplemental legislation or decree may, however, draw in other government agencies in the census effort either in a coordinating function or to provide such assistance or personnel as may be needed by the census organization. In this instance it is advisable to state in the supplemental legislation that the operation be in accordance with the plans drawn up by the census organization to prevent the possibility of the cooperating agencies or local governments in introducing innovations or gathering additional information for their own purposes which can disrupt the time table of census operations.

(v) Financial and administrative provision for the census

1.6.5 The census legislation should grant full executive authority over the administrative organization to the census agency. In the countries where the appointment of personnel is governed by specific civil service rules and regulations such authority may include full powers of recruiting and appointing the casual field personnel, free from the usual strict procedural or documentary supporting requirements of ordinary appointments. Likewise, the census legislation should vest on the census organization full authority over the budget.

Normally, the appropriation for a census would be embodied in the section on the national budget, the amount of which is passed on the recommendation of the census organization. The ideal census budget is one which grants the census agency authority to reallocate resources when unforeseen difficulties may arise specially during the enumeration and tabulation stages. When other agencies are called upon to participate in the census operation, the supplemental legislation can indicate an obligation on the part of those agencies to help the census organization. The legislation may indicate also whether their respective expenses will be borne by the agencies themselves.

(vi) Obligation of public for census

1.6.6 The obligation of the public in a census operation normally is included in the basic law but may be reiterated and treated more in detail in the supplemental legislation. Such obligation demanded of the public should carry with it a concomitant penalty for not cooperating. Punishable acts can be refusal to give access of the premises of the respondent, refusal to be interviewed or to furnish the data needed, or merely giving materially untrue information and even delay in the submission of returns. The penalty should be commensurate to the violation and must be of sufficient gravity to deter respondents from not cooperating. In nearly all the developing countries most of the farmers are unaware of the importance of statistics and do not clearly understand the usefulness of the agricultural census; they consider it an interference in their personal affairs for rather unfavourable purposes, since they are focussed on an increase in taxes and application of the land reform. For this reason, in addition to, and as part of, the projected publicity campaign, the decree should be made known to the public, so that they are at least aware that the data supplied are strictly confidential, that it is obligatory to give the information requested and that there will be severe sanctions in case they refuse to do so. It is not sufficient to print the decree partially in the questionnaire so that it will be read by some people at the time of the census. It should be made known well in advance through communications media, or should at least be sent to the different farmers' associations. In general, the governmental administrative procedures are slow and complicated. For example, in some places, in order to receive payment of subsistence allowances a certification is required from some public authority that the officer was in that place, but sometimes it may take so long to obtain the certificate that the officer is compelled to work too quickly in order to keep to the time limit fixed, which has a negative repercussion on the data obtained. Census procedures should be more speedy; since the work is carried out over a comparatively short period and a large staff is involved, appointments, the authorization of subsistence allowances and many other administrative procedures should be streamlined. This involves substantial modifications in the usual administrative procedures and the relative authorization should be contained in the document or documents which give a legal status to the census. It must be clearly stated that public and private agencies are obliged to participate and collaborate in the census. As far as possible specific mention should be made of the agencies who have to collaborate and in what form they must do so.

(vii) Identification, protection and obligation of enumerators

1.6.7 The identification, protection and obligation of enumerators can be additional matters that the supplemental legislation may provide. The proper identification of enumerators can be considered a concomitant requirement to the confidentiality of information and the obligation to cooperate. As a matter of policy, identification papers should be shown to the respondent to protect the public from impostors. In the same manner, adequate protection may be provided to the enumerator. This can take the form of insurance against accidents in addition to what they may get under the country's work-men's compensation statutes. One very important protection the law can give the enumerators is legal assistance in case action is filed by or against him as a result of his enumeration work. Specifying the specific obligations of enumerators in the supplemental law can make them more aware of their functions and more unlikely to abuse or neglect them.

(viii) Examples of census legislation

1.6.8 The examples quoted here concern legislative aspects of undertaking agricultural censuses derived from the census documents sent to FAO by a limited number of countries in connection with the 1970 World Census of Agriculture. The relevant law or decree promulgated in a country to undertake a national agricultural census is given as follows:

Country	Law or decree and date <u>1/</u>
Belgium	Decree of 22 May 1970
Colombia	Decree No. 1755 of 19 September 1970
Finland	Decree of 13 January 1950
Honduras	Decree No. 50 of 21 June 1973 (same Decree for Population and Housing censuses)
Hungary	Decree No. 2-1972/I.25
Italy	Decree No. 1392 of 9 December 1970
Korea, Rep. of	Ordinance No. 387 of 16 August 1969
Liberia	Sole Act
Luxembourg	Ministerial Regulation of 10 March 1970
Mexico	Decree on the 1970 National Censuses (same Decree for Population and Ejidal Censuses)
Pakistan	Agricultural Census Act 1958
Panama	Decree of 11 February 1971
Togo	Decree No. 2/Ministère des Finances, de l'Economie et du Plan/Ministère de l'Economie Rurale

Juridical Aspects of the Census of Agriculture

1.7 A description is made of some major characteristics of national decrees of a number of countries which participated in the 1970 World Census of Agriculture. The following ten topics have been selected as a basis for the presentation of the national census legislation.

1. Identification and juridical basis of the agricultural census decree
2. Authority for the promulgation of the decree
3. Census executing authority
4. Periodicity in carrying out the census
5. Number of articles
6. Scope of the census
7. Persons or institutions requested to furnish information
8. Obligatory participation
9. Confidentiality of information
10. Penalties for transgression of confidentiality and for not giving information or for giving false information.

1/ Material available in FAO. The other sources are given in footnotes as they arise.

Identification and juridical basis of the agricultural census decree

1.7.1 The decree promulgated for the carrying out of the agricultural census is often issued on the basis of a previous law and taking into account other directives. The Belgian decree is a representative case. The decree of 22 May 1970 was promulgated not only on the basis of the law of 4 July 1962 which authorized the Government to proceed with statistical investigations on the demographic, economic and social situation of the country, but also taking into account the directive No. 69/400 of 28 October 1969, concerning the Resolution No. 3/65 of 9 December 1965 adopted by the FAO Conference, the Treaty of Rome and the Communal law. In the case of Finland the law and the decree were issued on the same date. For Hungary, Pakistan and Liberia their agricultural census was based on a single act. However, Hungary differs from the other two because a special decree was issued by the Government after consultation with the Ministry of Agriculture and Food, the Planning Office, National Water Authority, Institute for Research in Agriculture and the University of Agricultural Sciences. This was done to make it possible to meet the requests of the FAO Programme for the 1970 World Census of Agriculture to include small holdings which were excluded in the coverage of holdings for the collection of statistical data. In the Republic of Korea the purpose of the ordinance No. 387 of 16 August 1969 was to ordain necessary articles of the agricultural census according to Paragraph 2, Article 9, of the Operational Ordinance of Statistical Law. In Italy the Decree No. 1392 of 9 December 1970 establishing the second census of agriculture was issued under Law No. 14 of 31 January 1969 which set up the financial basis for carrying out the censuses of agriculture, population, industry and commerce. The case of UDEAC 1/ countries is an example of international collaboration. In fact the four States of the Union, namely, Cameroon, Central African Empire, Congo and Gabon decided, after the meeting of 21 June 1967, to carry out the agricultural census jointly. This Resolution (No. 3/67-CD-516) appointed a Study Group for the purpose. This Resolution was followed by another consisting of 6 articles setting the financial basis for the census operation. (Appendix IV B).

Authority for the promulgation of the decree

1.7.2 In Honduras, Hungary, India, 2/ Pakistan and Panama the authority for the promulgation of the decree is the Government itself. In Finland and Korea it is the Ministry of Agriculture. In Togo the authority is the Ministry of Finance and Economic Affairs and Planning and the Ministry of Rural Economy. In Colombia as well as in Mexico and Italy the decree was promulgated by the President of the Republic and in the United States 3/ by the Congress. The Virgin Islands, Guam and the Commonwealth of Puerto Rico, as well as other areas are under the jurisdiction or control of the United States. In Australia 4/ and Liberia the census was promulgated by the Senate and House of Representatives and in Luxembourg by the Ministry of National Economy. In Belgium the promulgation of the general census of agriculture was made by Royal Decree. For the UDEAC countries the decision was taken by the Council of Heads of States.

Census executing authority

1.7.3 While the authority in charge of technical work is generally the National Statistical Office, or other similar office, the census executing authority varies considerably from country to country. In Belgium, Italy and Luxembourg the executing authority were the mayors, in Hungary, India and Korea, the Ministry of Agriculture, but in all these six countries the National Statistical Office was in charge of the technical work. In Finland the local authorities, and in Liberia the Department of Planning and Economic

1/ UDEAC: Union Douanière et Economique de l'Afrique Centrale.

2/ Government of India: All India Report on Agricultural Census 1970-71, 1975.

3/ U.S.A.: U.S. Bureau of the Census, Census of Agriculture 1969, Vol. V, Part 14.

4/ Australia: Census and Statistics Act 1905-1949.

Affairs, in cooperation with the Department of Agriculture and the College of Agriculture and Forestry of the University of Liberia, nominate an Agricultural Census Committee for the execution of the agricultural census. An Agricultural Census Committee was also established in Togo composed of the Director of Agricultural Services, the Director of Statistics, the FAO expert on agricultural statistics and the Chief of the Division of Economic Statistics. In Pakistan, the Census Commissioner was the executing authority in Collaboration with the Agricultural Census Advisory Committee which included official representatives from the Ministries and Departments of the Central and Provincial Governments, which are concerned with statistics, planning and agriculture as well as one representative of the farmers from each province. In Iraq 1/ a Census Advisory Committee was formed under the chairmanship of the President of the Central Statistical Organization. The Committee consisted of eleven officials representing the Higher Agricultural Council, Ministries of Agriculture, Agrarian Reform, Irrigation, Economy and the Central Statistical Organization. In Colombia, Honduras, Mexico and Panama the National Statistical Offices were both the census executing authority and the authority in charge of technical work.

Periodicity in carrying out the census

1.7.4 In promoting the World Censuses of Agriculture every ten years, the FAO has always stressed the necessity for a continuous flow of statistical information at regular time intervals. The periodicity of the information showing the changes occurring in the structure of agriculture in different periods of time, is an important aspect of the census undertaking. For some countries where the ten-year interval between the taking of a census is too long, because of the rapid changes in the agricultural structure, quinquennial or more frequent censuses are carried out. These considerations clearly show the need for an introduction of periodicity in the census legislation thus maximizing the use of precious experience after each agricultural census. Periodicity in carrying out the census does not exist in the legislation of countries such as Italy, Liberia, Pakistan, Philippines 2/ and Honduras where the agricultural censuses are promulgated on a time to time basis. In Belgium the agricultural census is carried out annually as stated in the Royal Decree of 6 May 1965. In Hungary where the census of State farms, cooperatives and Institutions is undertaken annually, the participation in the 1970 World Census of Agriculture was established by a special decree. In the United States the Bureau of the Census conducts agricultural censuses covering the years ending in 4 and 9 as stated under the title 13, US Code. In Uruguay 3/ Law No. 4294 of 7 January 1913 fixes the time lapse between each agricultural census to five years. The Law of 13 January 1950 on agricultural statistics in Finland, under Article I declares: "A general agricultural census covering the whole country should be taken every 10 years, for the first time in 1950, and annual statistics are drawn up yearly in accordance with this law. An account of harvest prospects during the summer months is also made annually in a way determined in detail by the Ministry of Agriculture". In Colombia the Law No. 2 of 1962 stated that the agricultural census should be carried out every ten years starting 1970. In Finland and Colombia the same time interval was indicated but with the possibility of a shorter lapse. "The National Census of Agriculture must be held at least once every ten years", is stated in the Decree No. 7 of 25 February 1960 which set up the basis of Panama's National Statistics. In Korea the census will be carried out in the years ending with zero (Art. 4) and may be integrated with other smaller agricultural surveys after 5 years, if deemed necessary by the Minister of Agriculture and Forestry.

Number of articles

1.7.5 A decree may consist of several articles or sections containing directives. It may be broad or concise but does not necessarily affect the quality or clearness of the decree. The difference in the number of articles included in a decree between the countries under

1/ The Agricultural Census in Iraq 1971, Regional Institute for Research and Training in Statistics for the Near East.

2/ Philippines: Commonwealth Act No. 591, 19 August 1940.

3/ Uruguay: Censo General Agropecuario 1970, March 1973.

study are described below. Three classes of decrees according to the number of articles may be formed as follows: less than 11 articles, from 11 to 20 articles and 21 articles or more. In the first class are Liberia with an act composed of 6 articles, Hungary where the decree is composed of 8 articles, Finland and Honduras with 10 articles. The second group includes Luxembourg and Sweden 1/ having 11 articles, Pakistan 14, Belgium 17 and Korea 18. The third class includes Panama with a decree consisting of 23 articles, Italy with 24, Colombia with 27 and Mexico with a total of 33 articles.

Scope of the census

1.7.6 The analysis of the various decrees shows that the legislative authority who drew up the decree may have a great influence in the formulation of the census scope and coverage. In some cases decrees include detailed questions to be inserted in the questionnaire. In others, only general directives are given. In other cases the legislative authority does not intervene at all, thus allowing full liberty of interpretation by the census executing authorities. The Finish Decree on execution of the law on agricultural statistics is an example of detailed census scope. The first three articles which give a complete picture of the questions to be asked in the census questionnaire are shown below:

“Article I: The general agricultural census comprises a statistical investigation of the conditions of cultivation, forestry units, ownership and tenancy, properties, utilization and yields of cultivated land, drainage, soil, use of fertilizers and substances to improve the soil, handling and storage of fertilizer, AIV silos, arrangements promoting labour effectiveness, garden cultivation and yields, the number of livestock according to type of animal and their production, number and use of most important machines and tools, use of labour in the household, fishing and its yields, fur farming and the most important home crafts. In connection with the agricultural census, information is also obtained on the indebtedness of the agricultural industry and on the division of the produce of the farm between that for sale and that consumed on the farm. The Ministry of Agriculture may either increase or reduce the number of question to be asked.

Article II: The annual agricultural statistics should be drawn up, both with regard to weather conditions, growth in productivity, areas of arable land and yields, garden cultivation, livestock and slaughtering, fishing, dairying and, if it seems necessary, wages of agricultural workers. Statistics should also be drawn up on the activity of dairy cattle testing societies and information should be sought about harvest prospects and associated details during the summers months. The Ministry of Agriculture may either increase or reduce the number of questions to be asked.

Article III: The general agricultural census comprises all holdings with an arable area of at least 2 ha. and also smaller holdings or other properties on which any reasonably intensive form of production connected with agriculture is practiced, such as commercial gardening or poultry keeping, rearing of fur animals or bees or on which home crafts or fishing for sale are practiced.

Almost the same approach as Finland was followed by Pakistan. In Article 4 of the Pakistan Census Act a list of information to be collected is shown, namely:

- “(a) Land ownership and land tenure
- (b) Land unit and sub-division of land
- (c) Land utilization
- (d) Crop acreage and production
- (e) Livestock and poultry
- (f) Employment in agriculture

1/ Sweden: Svensk Författningssamling 1968, No. 111, 29 March 1968.

- (g) Agricultural population
- (h) Agricultural power and machinery
- (i) Irrigation and drainage
- (j) Fertilizers and soil dressings
- (k) Wood and fishery products
- (l) Agricultural credit
- (m) Agriculture and silviculture
- (n) Fruit and vegetable products
- (o) Such other matters as the Central Government may, by notification in the official Gazette, specify."

The case of Belgium is partly different because the scope of the census is not shown in any article of the decree but in an annex forming part of the decree itself. The annex is indeed a very detailed questionnaire covering all aspects of Belgian agriculture. On the other hand, Sweden gives an example of general indications giving short directives on the information to be collected during the census. The Article 4 of the Swedish Decree No. 111 of 1968 states:

"Directives for persons engaging in activities mentioned in para. 1 are responsible for providing information on:

1. Register category, area and land use concerning property, or part of property, where the activity is carried out;
2. buildings and other structures;
3. machines;
4. livestock and poultry;
5. manufactured products and their use in the activity;
6. manpower used.

Individual persons shall also provide information on age, year of access, education and previous activity, as well as on the type and extent of his own labour input in this and other activities."

The Mexican Decree is very laconic asking information on "physical, technical and economical" characteristics of all agricultural holdings (Art.s 8 and 9). The case where the legislative authority did not intervene at all in the scope and coverage of the agricultural census in the formulation of the census legislation is in Colombia, Hungary, Honduras, Liberia, Panama and Togo.

Persons or institutions requested to furnish information

1.7.7 With the exception of Belgium and Luxembourg where the articles concerning the range of questions also define the census scope, there are only minor differences amongst the others, on this subject. In these two countries there is a merging of the two concepts, i.e. the census scope and the information requested. In Finland, Article 2 of the law on agricultural statistics (not the decree) states "Every private person, estate, company cooperative, association, society, institution or other establishments, as also government departments and establishments of the state, municipality or parish are liable to render the information deemed necessary for the agricultural census...". In Pakistan the same problem has been solved by a short statement which is, at the same time, very comprehensive. In fact in Article 2 of their census legislation we find: "For the purpose of collecting information, the Central Government may require any persons within its jurisdiction to give answers to such questionnaire...". Also in Liberia the topic has been solved very concisely. Article 2 of the Census Act states: "The Census shall cover the whole country and shall include individual farm households, farms operated by public or private organizations and farms used for experimental purposes by school and Government Agencies". In the Latin American countries, namely Colombia, Honduras, Mexico

and Panama the directives are similar and with the exception of Panama, all include in their articles, the characteristic of the obligatoriness of information. Article 3 of the Colombian Decree No. 1755 is a representative example: "Shall give information on all natural or juridical persons having, under whatever title, agricultural holdings situated within the national territory".

Obligatory participation

1.7.8 The legal obligation to cooperate for the taking of a census is a common denominator of all countries. The reason is that the undertaking of an agricultural census is considered a recognized task of national interest with which all the citizens of the State have to collaborate. The necessity of an active participation of all persons and institutions involved in census operations, apart from the "civic" side of the matter, is rather technical. In fact, a refusal of collaboration, in terms of refusal to give information or giving false information, will endanger all the census work whether in the case of a complete enumeration or in a census conducted on a sampling basis. The legal obligation to cooperate in the census does not concern only farmers or other juridical persons but, in some countries as in Mexico and Panama all literate persons may be compelled to collaborate in the census as enumerators, supervisors, etc. Article 5 of the Mexican Constitution underlines the civic importance of the participation in the census operations stressing its obligatory and gratuitous character. This is a case of participation without remuneration encountered in this report. In other countries generally the census operation does not need the obligatory collaboration of the population because it is conducted by the staff of the National Statistical Offices or other census committees. An example is the Article 2 of the Norwegian 1/ Decree which states: "The census is to be administered by the Central Statistical Office with the assistance of the municipalities. In the individual municipalities, the census will be administered by the local councils or by the mayor in municipalities where no local council is established. The census is to be carried out by persons whom the local council or mayors consider suitable for the purpose".

Confidentiality of information

1.7.9 One of the most important points for the success of a census is the absolute confidentiality of the information provided by the respondents. This is the main reason for which the need of confidentiality of the individual information in the census legislation, with the assurance of its use for statistical purposes only, should be firmly and clearly stated. The validity of this need has been confirmed by all legislators who have introduced it with different degrees of emphasis in their national census legislation. Five countries, namely Colombia, Hungary, Pakistan, Panama and the Philippines, have been chosen to illustrate the different approaches to resolve this delicate point. Colombia - Article 6: "In conformity with Art. 75 of the Decree 1633 of 1960 the data ... (...) have a strictly confidential character and cannot be divulged either to the public or to official entities except in a global form or in the form of numerical summaries which make it impossible to deduct any individual information which might be used for fiscal or criminal purposes or any purpose other than the statistical investigation of the National Agricultural Census. Thus it is forbidden to census civil servants to divulge any information in their possession; on the contrary they will be submitted to the punishment provided for in the penal code." Hungary - Article 4: "The census and the data of the questionnaires concerning small farms are to be used only for statistical purposes." Pakistan - Article 11: "No person shall have a right to inspect any book, register or record made by a census officer in the discharge of his duties as such, and notwithstanding anything to the contrary in the Evidence Act, 1872, no entry in any such book, register or record shall be admissible as evidence in any civil proceeding whatsoever, or in any criminal proceedings, other than a prosecution under this Act or under any other law for any act or omission under this Act which constitutes an offence under such other law." Panama - Article 10: "The individual data obtained from the Census

1/ Norway: Ministry of Finance and Custom Duties, Ministry Case No. 43 of 13 December 1968.

are strictly confidential. Data may be published only in a group of at least three persons.”
Article 11: “The individual data obtained from the Census cannot be used as evidence in any civil proceedings or in fiscal investigations or any purpose other than statistical enquiries.” Philippines - Section 4: “Data furnished to the Bureau of the Census and Statistics by an individual, corporation, partnership, institution or business enterprise shall not be used as evidence in any court or in any public office either as evidence for or against the individual, corporation, association, partnership, institution or business enterprise from whom such data emanate; nor shall such data or information be divulged to any person except authorized employees of the Bureau of the Census and Statistics, acting in the performance of their duties; nor shall such data be published, except in the form of summaries or statistical tables in which no reference to an individual, corporation, association, partnership, institution or business enterprise shall appear...”

Penalties for transgression of confidentiality and for not giving information
or for giving false information

1.7.10 Penalties are enforced on two kinds of contraventions: in the case of respondents, for non-participation or for giving false information, and transgression of confidentiality on the part of enumerators and authorities concerned. The affinity of the subjects and the ascertainment that several countries deal with both items in the same article, brings us to deal with them together. The penalties may be clearly stated in the decree itself or submitted to the judgement of a court or to the administrative authorities. Such penalties are of an economic order, expressed in fines of different values, or of penal and administrative order or of a combination of these three cases. In Finland the census law deals only with the penalties for not giving information or for giving false information disregarding the penalties concerning the transgression of confidentiality. Point A of the Finnish Census Law on agricultural statistics states that “Any person who without valid reason fails to render information in accordance with this law is punished by a maximum of 50 days”. If any one who is liable to render information or a false report, or if anyone violates the provisions of Paras. 3, Article 3, is punished, insofar as heavier penalties for the act are not laid down elsewhere, by a maximum of 100 days”. No fines are foreseen in Finland, while in Malta 1/ fines are foreseen as shown in the Notice quoted below: “Any person who without lawful excuse (the proof whereof shall lie on him) fails or neglects to furnish the information required by this Notice may, under the Act referred to above, be liable to a fine (multa) not exceeding M£50 and, in the case of a continued offence, to a further fine not exceeding M£2 for each day during which the offence continues”. In Luxembourg two articles deal with the matter of penalties. Article 9 deals with the individual who refuses to give information or gives false information submitting the case to Article 7 of the Law of 9 July 1962. Article 10 deals with confidentiality and states that “It is firmly forbidden to the civil servants and all other persons collaborating with the census work to reveal the information in their possession, the Article 458 of the Penal Code will be applied without prejudice of eventual disciplinary sanctions”. In the Philippines, Section 4 of the Commonwealth Act states “Any person violating the provisions of this section shall, upon conviction, be punished by a fine of not more than six hundred pesos or by imprisonment for not more than six months, or by both”. In Panama fines from 5 to 100 balboas are charged to individuals not giving information or giving false information. Enumerators or other census staff are liable to the same fine for transgression of secrecy. If the transgressor is an employee of the Bureau of Statistics and Census he may also be dismissed from Office according to Article 14 of Decree No. 7 of 1960. Finally, in Italy, the confidentiality of information and the penalties for transgression or for giving false information were both regulated by the law No. 2238 of 21 December 1969 and not by the Census Decree itself.

1/ Malta, Notice on the basis of Statistics Act 1955.

2. CENSUS COMMITTEE

Establishment of the Committee

2.1 Whether a country has a long tradition of census taking, or has a permanent census organization or not, the establishment of a committee to act as the nuclear planning group would be needed for the preparation of a census. This committee may be known as "National Agricultural Census Committee". The Committee has to be established well ahead of time, invested with the necessary authority, provided with material support and staffed with competent personnel. It should be an organ created by the regulatory text establishing the census. It should start functioning at least two years ahead of the actual operations of the field work of the census and cease to function after the completion of the final census report.

Composition of the Committee

2.2 While the composition of the Committee would depend on the head of census office, as a general rule all the various aspects of the operation should be represented. This Committee should consist of all important federal government agencies which are either directly or indirectly concerned with census taking or are possible users of census results, as well as non-governmental organizations interested in the census. Ministries responsible for agriculture, cooperation and district administrations, the Ministry of Finance or Budget, and the statistical agencies entrusted with the task of carrying out the census, organizations of farmers, industry and trade particularly concerned with agricultural products, should be usefully represented on the Committee. It is essential that the committee members be ranking officials who have an academic background and/or experience so as to be able to contribute much to the planning. Its chairman could be the chief of the agriculture department or the national agricultural census commissioner to facilitate coordination among members. The number of members can be variable depending on the scope and coverage of the census, but care should be taken that the group is not so large as to become unwieldy.

Main responsibilities and functions

2.3 The main responsibilities and functions of the Committee would depend on the particular purpose of its creation. Generally the main responsibility would be the overall planning and direction of the census, subject to the review of the head of the office. It is expected that the Committee evaluates the past census and studies recommendations made to solve problems encountered. The Committee would be liaising with other agencies involved in agriculture or which may be called upon to participate in the operation. Drafts of questionnaires, manuals, budgetary and personnel requirements, logistical needs, operations plan, pre-test and pilot surveys, and post-enumeration survey plans, method of enumeration, use of samples, etc. would be prepared by this Committee.

Frequency of meetings

2.4 There is no hard and fast rule in the frequency of meetings of the Committee. Initially, it would perhaps be necessary for the members to meet more frequently, say once in three months, and later at lesser intervals. Generally, meetings should ideally be held at a time when the members have had the time to put in enough study of the subjects to be discussed. Time which can be put to more useful purposes would be wasted when members are not given enough opportunity to participate in the discussions. This usually happens when drafts of plans are presented to the members hurriedly in the meeting.

Establishment of sub-committee and its functions

2.5 Due to the broadness of the functions and activities of the Committee, sub-committees may be created, each under the area of coordination or supervision of a member of the Committee thereof. Functions of these sub-committees would be the preparation of plans for a specific aspect of the census preparatory work. This will include the gathering of data, conduct of research, development of concepts and definitions, coordination with other offices, etc. Each sub-committee could consist of one member, or more, depending on the nature of the

work assigned. Membership can be given to less senior officials than those appointed to the mother Committee. Sub-committees can be on areas like concepts, questionnaire preparation, communication, transportation, logistics, recruitment, training, publicity, printing of forms, etc.

Establishment of Regional Committees

2.6 For administrative reasons, large countries get divided into several administrative divisions and these divisions have their own agro-economic characteristics. It would be desirable to establish regional census committees in such broad administrative divisions. The main functions of such regional committees should be, besides coordinating the census activities of the region, to make recommendations for items of information to be included in the questionnaires in the area and regional tabulations that may be made.

Other boards/committees

2.7 In the case where various agencies are called upon to participate in the census effort, coordinating boards could be necessary to effect an efficient operation. Normally such boards are established for the field operations phase at the district/administrative sub-divisions. It is desirable that a national coordinating board would have its local counterparts where plans from the top are filtered down to the lowest level. The national coordinating board's membership should be at the departmental level or its equivalent, for such a board shall be responsible for committing the department's participation to the census operation and in seeing to it that its field branches carry out the policies and plans as laid out. The local counterparts can be at the regional to the lowest administrative unit. Primarily, their function is to coordinate the implementation of the policies and guidelines adopted by the national board and to provide the assistance required by the census field office. These boards would be useful in resolving boundary disputes, providing protection to the enumerators, providing transportation and communication facilities, and in publicizing the operation. An added fringe benefit the census organization gets would be the sense of participation acquired by the agencies and the statistics consciousness it brings about.

3. BUDGET AND EXPENDITURE CONTROL

3.1 Planning and control of different phases of the census operation are dependent on careful cost estimates of each activity of the census undertaking. Every component of work involved must be included in the cost estimates. As a matter of policy, persons with working knowledge or those with administrative or supervisory responsibility for carrying out any phase of operations should participate in the budget preparation. For instance, the personnel of the census unit in charge of undertaking the census should prepare cost estimates regarding field operations and manual processing. Likewise, cost estimates for data processing and publication should be prepared in consultation with personnel from the data processing and publication units respectively. The cost of processing data will depend upon whether it is to be done manually or mechanically. Therefore, an expert with relevant experience should be involved in providing the estimates of cost of processing census data. If no census has been conducted in the past, a pilot census successfully conducted will provide good guidance to the estimation of different cost components. A good guidance for budget estimates may be derived from the records of previous censuses which might have been kept on file or have been included in the Administrative Report of the past census. With this information, the only thing one should do is to know the current conditions on wages, salaries and prices of materials/supplies required. Dovetailing this with sample size and workload estimates, a sound budget estimate could be evolved.

Preparation of the budget

3.2 Budget for any statistical operation should be prepared in accordance with the rules and regulations of the government. It should conform with the standard set forth by the authorities empowered to approve and appropriate the necessary funds. It should be detailed enough to permit easy examination and/or review and subsequent approval by officials concerned.

3.2.1 Presentation and adoption of cost estimates vary depending on the form or style adopted or practices followed by the country. Generally, a well prepared budget reflects in detail the following: 1) plan of operation, 2) timetable, and 3) workload estimates.

Plan of operation - the operation plan shows the goals towards which the activities are directed and which comprise three major phases: (i) pre-enumeration, (ii) field operation, and (iii) post-enumeration.

(i) Pre-enumeration phase. This phase includes budget preparation. The budget should consider estimates for activities covering planning and other preparatory work like determination of concepts and terms, and questionnaire's content; preparation of table formats; training programmes and instruction manuals for field operations; determination of manpower requirement; logistics; preparation of processing instructions; preparation of administrative control and reporting forms; choice of design and/or determination of sample size and conducting pre-tests and pilot census; printing of questionnaires and other forms; preparation of maps and other instructional materials; training of central office key personnel, etc.

(ii) Field operation phase - the budget for this phase should reflect estimates for recruitment and training of field staff, and supervisors; number and employment period of each type of workers; distribution and collection of questionnaires; post-enumeration survey (PES); and shipment of accomplished questionnaires to the respective branch offices or central office.

(iii) Post-enumeration phase - the cost estimates for this phase should reflect cost for total man-days required and workload of activities involving manual processing (editing-coding); receipt and control of documents; electronic data processing (key punching, etc.); analysis and publication of census results and publication of administrative report.

Other costs to be covered in the preparation of the budget are administrative and miscellaneous services. These include cost estimates of travelling, transportation allowance and per diems of permanent employees; supplies and materials of office staff involved in the operation; accounting control forms; communication expenses; and rental and/or purchase of equipment needed.

3.2.2 In large countries with socio-economic conditions varying from region to region, it will be more realistic to prepare a budget for each region separately and then pool them together to give the country estimate of the expenditure. For example, in large countries, transport and communication facilities may not exist uniformly in all the regions. Separate estimates of travel and transport costs will have to be made for individual regions.

Timetable

3.3 The relative importance of a well-planned timetable to budget preparation should not be overlooked. For the purpose, a network analysis is found useful. For big operations like censuses, PERT (Program Evaluation and Review Technique) adequately provides realistic time reference and target dates, indicating crucial tasks and effecting contemplated alternative courses of action to be taken at a point of time and inter-related resources and activities. For example, a delay in the arrival of training materials in training centres would mean reassembling of hundreds of census field workers for training. Time schedule, therefore, should be such that the shipment is given ample time so that all materials should have arrived at the respective destinations in time. In addition, the time schedule should also consider climatic conditions and transportation facilities as these would have a bearing on budgetary estimates. The time set for training and enumeration should be such that it could be done uninterruptedly. Likewise, questionnaires and other materials should not be exposed to the danger of getting wet and destroyed, such as during the rainy season.

3.3.1 Workload estimates - estimates of workload usually reflect units of work, like the number of households to be listed, the number of sample households to be interviewed, total distance to be travelled and mode of transport, the number of records to be punched, etc. The field operation workload estimates will be the basis for workload estimates of manual processing (coding and editing); likewise, for keypunch workload, the basis will be the available entries in the questionnaire assuming that the questionnaires are completely filled out.

Content of the budget

3.4 To be meaningful, a budget has to present all the financial estimates by components and by fiscal years. The major components usually consist of (a) salaries and honoraria of personnel; (b) travel expenses, (c) expenses of hiring and purchase of equipment, (d) expenses on printing and stationery, and (e) office expenses.

3.4.1 The staff requirements of the census are such that a fairly small technical group of persons is required at the beginning mainly for preparatory work. Subsequently, an army of enumerators and supervisors is required for the actual enumeration, followed by the recruitment of personnel required for data processing and finally for writing of the reports. In estimating the expenditure on salaries of personnel for every fiscal year, this distribution of the number and type of persons who would be working on the census has to be provided for. Generally, the primary enumerators and field supervisors would be working temporarily for the census and some honoraria may have to be paid to them. This amount is generally substantial, and care needs to be taken to see that it is budgeted for in the appropriate fiscal year.

3.4.2 Travel expenses need to be judged systematically, particularly in relation to the supervisory staff and mode of transport. Census operations demand extensive travel for supervision and any shortages in funds required for travelling adversely affect the quality of the census.

3.4.3 Data processing needs have to be estimated in relation to the workload involved, and expenditure involved in purchase and hire of computer and punch card machines, etc. should be provided for in the appropriate fiscal year. Requirements of transport vehicles should also be estimated and expenditure on them included in the budget.

3.4.4 By its very nature, the agricultural census has a huge printing programme. The number of questionnaires to be printed runs into thousands and considerable other material, such as the Instructions Manual, has also to be printed. The printing requirement of the reports to be published also runs into several hundred pages. All this will have to be anticipated and appropriate expenditure included in the budget.

3.4.5 Expenditure on other office expenses such as hiring of office space and furniture, purchase of pencils for enumerators, purchase of fuel, etc. should be included under this broad head.

3.5 Simultaneously with the financial budget, it is desirable to prepare a "performance" budget". This budget would show in physical terms the quantum of work involved in every phase of the census operation. The quantum of work should be measured in terms of units appropriate for a particular activity. For example, for salaries the unit would be the number of persons to be employed, for punching the number of key depressions to be performed, etc. This budget could conveniently be divided into the five broad divisions of work mentioned above. The budget for each division should show the details regarding the specific activity included, and of work should show the volume of work to be performed for every measurable item of work, the expected rates of performance and the cost per unit of work to be carried out.

Review of the budget and frequency

3.6 Since planning and scheduling of the census operation are prepared years or months in advance of the actual operation, a periodic review of the budget for any change of plan and schedule of operation would be appropriate whenever complete information becomes available. During the preparatory work, which is done years before the actual operation, a review of the budget at least every three months would suffice, as submission of the budget is usually made once a year. Whenever significant changes are made in the plan and timetable, all key personnel should be duly informed. General review and coordination of the changes in the plan are of great importance especially for big operations like census. To effect better control of costs during the operation, a continuous review of the progress of work should be provided to ensure that day-to-day operations are proceeding smoothly as planned. Any over-expenditure, therefore, can be detected and checked promptly. This is needed especially during the purchase of materials and supplies, printing of forms, field enumeration period, and manual processing of accomplished questionnaires. For this purpose, a monthly review would be good enough. Any slack occurring along any line of activity will have a chain reaction in the subsequent activity of the programme, affecting both timetable and cost.

Preparation of expenditure control

3.7 A large operation such as a census operation involves a large amount of expenditure which necessitates some control procedures to ensure efficient use of funds as required by the funding agency. A system that would be practical, easy to implement and control should be devised and implemented. To arrive at a system which would be applicable to the agency, its organizational set-up, size of each conglomerate staff unit, degree of centralization or decentralization, etc., should be considered.

3.8 Once a system has been established, written guidelines on fiscal policies and procedures of the office should be prepared. For a census office which usually operates through its field men at various administrative levels, an efficient cost and control system would ensure an easy flow and control of funds from the central office to these field offices.

3.9 One way would be for the central office to issue fund allotments for a census administrative area, such as a regional office. The region would then sub-allot this amount to the different areas under its supervision for their operational expenses, broken down into salaries and wages, travelling expenses, per diems, communication services, transportation services, other services, supplies and materials, rentals and equipment. By means of a checking account, field men would be able to draw an amount depending upon the needs of the office for the quarter but not beyond the cash ceiling allowance for that particular item of operating expenses.

3.10 In the meantime, the budget staff of the central office would keep an account of fund disbursements and reflect all types of expenditure incurred in a ledger account which would show on a current basis the amount spent for a project together with the unspent balance. The adoption of a coding system whereby every type of expenditure would be identified with a code number would make computerization possible. With this control system, it would be easy to determine the various cost items in a census operation.

3.11 A necessary pre-requisite for instituting expenditure control is availability of information on expenditures incurred and the output of work corresponding to them. It is desirable to develop therefore a system of progress reporting at regular intervals of time. The progress reports should be obtained from every unit of the census organization once every month. They should be precisely in the form in which both the expenditure budget and the performance budget have been prepared. It would also be desirable to include in the form information regarding the outputs expected to be achieved in the subsequent month and for the year as a whole. These data can then be matched with achievements of the relevant period.

Aids for expenditure control

3.12 A critical examination of the information regarding the expenditures and the achievements could provide quite a revealing picture of the execution of the census operation and could suggest possible methods of improving the tempo and the quality of work. There are fortunately several aids available for assisting in arriving at a proper evaluation of costs. Two of the well-known methods are available in net work analysis. These are (i) Bar charts and (ii) PERT (Programme Evaluation and Review Technique).

Examples of control devices

3.13 Bar charts provide a simple and reasonably effective method for exercising control over expenditure and performance. For preparing the bar chart a detailed breakdown of every activity envisaged in the census operation should first be made. The time required to carry out that activity should then be noted. The approximate expenditure in the calendar months on the activity should be estimated. A simple bar chart showing calendar months on one axis putting the activities in sequence and the months in which they would be performed on the other axis, can then be prepared. The expenditure every month expected to be incurred on the activity should also be recorded against the appropriate month. On the basis of the progress reports received the actual progress should then be compared with the basic bar chart. Corrections in the programme activities can thus be carried out in time. The bar chart could also be revised from time to time to conform to changes in the activities that have already taken place.

3.14 An effective device not only for control over costs but for planning and execution of a census is found in PERT. This provides a systematic approach for determining realistic time references and deadlines, pinpointing tasks which are crucial to timely completion of the census and determining the effects of contemplated shifts of resources upon inter-related tasks and activities. Several text books giving details of the procedures to be followed are available.

3.15 The techniques employed in analysing PERT results are especially suitable for applications on a computer. If a computer is available locally, it might be possible to computerize the whole exercise for frequent reviews. This would materially assist in ensuring timely completion of the various complex tasks involved in conducting the agricultural census. The very fact that such reviews are being taken generally puts the staff on its toes and thus automatically results in more efficient execution of work. Simultaneously, errors in planning of the work are discovered and their effect on the ultimate programme of work can be anticipated well in advance.

4. CENSUS PUBLICITY AND PROPAGANDA

4.1 The agricultural census taking is a complex operation in which the entire governmental agencies dealing with the rural area get involved. Items of information collected in the census deal directly with the economy of the farmer. There are some items, such as extent of cultivation, land tenure, etc., which are of a very sensitive nature and the farmer will be generally reluctant to answer to such questions and supply correct information unless he is fully convinced that the information supplied by him will not be used for any other purpose but for implementing some welfare programmes for him and other fellow farmers. Such reluctance on the part of the farmer is likely to be stronger in the country where the census is conducted for the first time.

4.2 The success of the census and the quality of the information will largely depend upon the cooperation of the farmer and his willingness to part with the relevant data. Every effort has to be made, particularly in the country where agricultural census has not taken roots, to seek the cooperation of the farmer and farmers' organization on the one side and the governmental agencies dealing with rural development programmes on the other.

Organization of publicity campaign

4.3 The role of the national, regional and local agricultural census committees in promoting the census has been separately dealt with in Chapter 2. An important function of these committees would be to help in planning an effective publicity campaign and propaganda for the census against the prevailing social and economic background, means of communication, etc. This publicity has to be directed to educating the farmer, who is to supply the information sought to be collected through the census. He is frequently illiterate, has his own prejudices and does not perceive the objectives and relevances of various inquiries correctly. He is liable to connect the purpose of an agricultural census, which is a comprehensive technical inquiry, with the possible enhancement of agricultural taxes, with the compulsory procurement of agricultural produce and even confiscation of land. To dispel these fears and to make him see that the inquiry is primarily for his own benefit is the essential purpose of the census publicity and propaganda. It should be explained through a proper medium that he can easily understand how the agricultural census is an essential basis for formulation and implementation of various development programmes, such as irrigation projects, soil conservation, use of fertilizers, improved varieties of crops and animals, modern agricultural implements, marketing and storage facilities, etc., which aim at increasing the production of his enterprise and thereby contribute to raising his standard of living. It should also be explained in simple language as to how inaccurate information supplied by him will adversely affect the planning of various welfare programmes intended to improve his living conditions. In other words, it may be emphasized how the accurate data help the government in planning the economic programmes for his betterment and how the planning based on inaccurate data harms him as well as the country.

4.4 It is important also to convince the farmer of the confidential nature of the information that will be supplied by him individually and assure him that this information will not be used by any organization or law courts for any purposes such as levying of taxes, procurement of produce, etc. He should also be told that his individual identity will not be known to anyone else except to the census organization, which will release the census information only in aggregate.

4.5 If the agricultural census is taken on a sampling basis, only a small fraction of farmers will be interviewed. There is likely to be suspicion in the minds of both groups of farmers, those to be interviewed and those not to be interviewed. It is essential that this suspicion is removed from the mind of the farmer. He may be explained in simple language as to how he has selected for interview and not his neighbour.

4.6 The agricultural census cannot succeed in collecting the facts about a country's agriculture unless the respondents are brought to view it in a favourable light and are prepared to cooperate whole-heartedly by providing correct information. Well-planned publicity is essential for it.

Types of media

4.7 What types of publicity media should be used in a country will largely depend on its socio-economic structure and availability of the publicity means. If there is a well organized agricultural extension agency which is closely concerned with the agricultural operations and is in close contact with the farming community, it can be a very good medium of conveying the message of agricultural census to the farmer. An educated farmer can be supplied pamphlet indicating the purpose of the census and in turn he can talk to other fellow farmers. To reach illiterate and remote populations, radio and television talks and messages broadcast by important personalities well known to the farmer are valuable. Lectures and lessons in rural schools on census topics are also helpful. Well-designed and colourful posters of various sizes suitable for being exhibited inside and outside buildings are effective in attracting the rural people. Cinema films and slides exhibited on mobile vans in rural areas are very useful, although somewhat costly, means of familiarizing farmers with the aims and purposes of agricultural census. They can also be informed through village meetings, conferences of farmers' associations, etc. Educating and informing local leaders, panchayat presidents and secretaries, village headmen, and elders and other persons of influence would be an important medium for reaching the farmers and securing their cooperation.

Time, duration and frequency of campaign

4.8 The publicity for the agricultural census should start at the time of the pilot census. Although the pilot census is conducted in a limited area, the campaign should be made widely to make the farmer ready for the main census. At the time of the first campaign, the general aims and purposes of the census should be publicized. The procedure and meaning of various census questions and how to answer them correctly should be explained at the time of actual census. Since the main person in the census operation is the farmer, he is to be convinced about the importance or his answers to the various questions when he is actually interviewed for the purpose. Any campaign much in advance of the actual interview will have limited influence on the understanding of the questions and their correct answers.

4.9 Once the farmer is convinced of the usefulness of the census, he may like to know the final results also. It is desirable to keep him informed about the findings of the census undertaking. This should be done through the radio and newspaper media just before the final results of the census are released for general use.

4.10 One of the main functions of the National Census Committee should be to undertake the responsibility of preparing a coordinated plan and time-table for publicity in connection with the agricultural census in all its aspects and at all levels, with the aid of publicity experts. The regional and local census committees should be the agents for publicity and propaganda in their respective areas. These committees can take help of all possible publicity media effective for the individual regions.

Other procedures to be adopted to enlist support and cooperation of farmers

4.11 Next to the farmer, the aim of the census publicity should be to create a general awareness among those who are in his constant touch. These persons can greatly influence the thinking of the farmer. Cooperation of the local government officials, like agricultural extension agents, land record officials, school teachers, etc., can be enlisted for this purpose. Cooperation of educated public can be obtained through the media of newspapers, magazines, club and other periodicals on a variety of topics connected with agricultural census. Distribution of pamphlets and leaflets about the census and printing of picture post cards and postage stamps prominently mentioning the census date are also useful. Preparation of a small pocket census manual and distribution of copies to all government officials concerned with the rural development activities will also be useful. A well publicized census will render its implementation much smoother and more efficient than if the census is launched without adequate publicity.

Examples of media

4.12 As mentioned earlier, different countries adopt different media of publicity depending on what is most effective and at the same time least costly. In the United States of America, three pamphlets were issued during the 1970 Census of Agriculture to all the farmers much in advance of the commencement of the census, informing them respectively the programme of the census, their roles in the census operation, and how the census data would be used. In some of the countries of Latin America, the publicity for the agricultural census was given through free distributions of comic literature among the school children. The theme of the comic was the conversation between the school boy and his father explaining what the agricultural census is and how it would be useful to him.

4.13 In Iraq, the publicity committee for the 1970 agricultural census was formed from the representatives of the Iraq news agencies, television and those working in the information media of the Ministries of Agriculture and Agrarian Reform, the General Federation of Farmer's societies, Agricultural Department of the Ministry of Planning, and the Central Statistical Organization. This committee organized the following programme:

- 1) A press conference during which announcements were made to newsmen underlining the importance of the census. Questions asked by the pressmen during this conference and answered by the authorities were recorded and shown on TV, as well as being presented in full by newspapers.
- 2) Comprehensive symposia were held in the administrative districts under the auspices of the governors and were shown on TV.
- 3) Symposia supervised by the publicity committee were held by farmers in the administrative units. Comprehensive brochures were printed and distributed.
- 4) Religious men and preachers at mosques explained the usefulness of the agricultural census during their lectures and sermons.
- 5) A weekly programme was arranged on Baghdad TV.
- 6) A special programme for the agricultural census was produced in all languages by the Baghdad broadcasting and television station, in addition to other periodic broadcasts.
- 7) Agricultural census slogans were aired on radio and TV stations.
- 8) Neon signs advertized the agricultural census.
- 9) Local press published daily news of the agricultural census.
- 10) One day during the period of the census was selected as "Information Census Day" all over the country. A special programme was arranged in the districts where farmers held symposia under the supervision of the heads of these districts. In the preparatory and secondary schools (nation-wide), the first lesson for that day was on the general purpose and scope of the agricultural census.
- 11) Speeches were delivered on TV and broadcast by their Excellencies the Ministers of Planning, Agriculture, Agrarian Reform, and Irrigation; President of the Higher Agricultural Council; President of the Central Statistical Organization, and Head of the Federation of Farmers' Societies.

- 12) A new series of stamps were issued for the occasion.
- 13) Leaflets and candies were dropped from airplanes in rural areas.
- 14) Special news bulletins were issued to the press and the news agency.
- 15) The broadcasting station of the Baghdad International Fair gave publicity to the agricultural census.
- 16) The cinema administration shot a special documentary covering the operations of the agricultural census, which was shown in movie houses all over the country.

5. STAFF RECRUITMENT

National agricultural census commissioner and supporting statistical staff

5.1 The staff requirement for agricultural census can be conceived of two categories of personnel, (i) the personnel needed for planning and executing the census operations including drafting the final report, and (ii) the personnel for collection and supervision of field data. The first category of personnel consists of the individuals trained in sampling and census methodologies with adequate experience of conducting agricultural surveys. They should have at least a degree in mathematics or statistics and formal training in statistical methods and sampling techniques. As has been mentioned earlier, the head of the census organization should be the National Agricultural Census Commissioner. He should have long administrative experience and should be fully familiar with the national agriculture. If he has participated in agricultural census and surveys in the past, it should be considered an added qualification.

5.2 In case of large countries, regional agricultural census commissioner supported by trained and experienced statistical personnel should be appointed in each region. Since the regional census commissioner is the counterpart of the national census commissioner, he should have almost similar qualifications and experiences as those of the national census commissioner.

5.3 Since sampling method has to play a significant role in improving the efficiency of implementation of agricultural census, the national census commissioner must be helped by a sampling expert, particularly when he himself is not an expert in sampling. A similar aid may be granted to the regional commissioner as well.

Tabulation staff

5.4 The tabulation staff will be an integral wing of the technical staff attached to the national and regional census commissioners. If the tabulation has to be done mechanically with the aid of an electronic computer, a large number of coders and key punch operators (KPO's) will have to be recruited. These coders and KPO's must be high-school and with some experience in coding and punching work. To recruit such a large number of staff may sometimes be difficult and it will, therefore, be advisable to seek the help of other organizations in the country, which have mechanical tabulation facilities. During the tabulation period, the help of a few electronic computer programmers will also be needed. It may be emphasized here that, if the census data is to be mechanically tabulated, this decision should be taken much before the planning of the field work so that questionnaires/proformas may be devised accordingly. This step will make some of the items of the census self-coded in the field and thereby reduce the coding work considerably.

Field staff

5.5 The field staff required for the agricultural census is fairly large. It is obvious that the success of the census in providing useful results depends largely upon the proper selection and training of the staff, considering that the agricultural census is a comprehensive technical inquiry. At the base of the hierarchy is the field enumerator whose work is monitored by local supervisors. For control of the work and technical guidance, regional supervisors are provided under the national and regional census commissioners responsible for the census.

Enumerator

5.6 The field enumerator is the key person in the agricultural census, and its success in making available a proper record of the country's agricultural structure depends largely on him. He must be enthusiastic about the value and importance of the census in relation to national development. He must set about his task with a sense of high purpose in order to overcome farmers' prejudices and suspicions so that the farmer gains confidence in providing correct information. He should be able to explain to people the real objectives of the census and how, by providing the government with true facts about agriculture, the farmer would be helping in the formulation of development plans and policies beneficial to him and to the nation at large.

5.7 The enumerators should be persons familiar with the local agriculture and social conditions and should, therefore, be residents of local areas if possible so that they can converse easily with the respondents in the local dialect. The enumerators should have a minimum of high school education, preferably having studied agriculture. Farmers' sons, with their experience of agriculture, have been discovered as good substitutes. Village teachers and agricultural extension workers are also found useful as field enumerators. Population census enumerators, if such census has been conducted recently, can be recruited for this purpose.

5.8 A number of important characteristics are found in successful enumerators. They need to possess tact, conscientiousness, devotion to work and resourcefulness in handling communication problems with landholders. They are persons who will act, and by their attitude, maintain the respect and confidence of the household. They must be willing and able to work full-time until the job is completed. They should not engage in other activities while they are employed as enumerators. They are persons who will work carefully and diligently when their supervisor is not present, and who will keep the required work records.

5.9 It is important to recruit only the most capable persons as enumerators. Simple tests designed to measure the applicant's ability to read and apply instructions, understand maps, communicate with people, record information on questionnaires/proformas accurately, and perform simple arithmetical operations are suggested for use in selecting qualified candidates. They should be interviewed by a team consisting of land record officers, agricultural extension specialists and agricultural statisticians, who have experience in agricultural statistics and censuses.

5.10 In difficult areas with poor communications and transport facilities, special attention should be given to recruiting the enumerators due to the special nature of those areas and their householders. Careful interviews should be administered for recruitment of enumerators by a team consisting of individuals of administrations from such difficult areas and from the Ministry of Agriculture. Tribal and nomad householders should be approached tactfully. They require special consideration if accurate data are to be obtained from such a group of households. The census enumeration is a hard job. It will be, therefore, desirable to avoid the recruitment of too old or too young people as enumerators.

Supervisor

5.11 The enumerator's work is monitored by local supervisors and, for control of the work and technical guidance in regions, provincial supervisors are provided under the census commissioners responsible for the census. Supervision of the enumerator's work is an essential requirement for the success in any census.

5.12 This supervision helps prevent carelessness and permits the detection of errors that can be corrected while the enumeration is still in progress. Supervisors need to keep records regarding the progress of enumeration and take appropriate action whenever the work is not performed in accordance with a predetermined time schedule. They must encourage enumerators to perform satisfactory work. Experience shows that five to ten enumerators for one local supervisor, and ten to fifteen local supervisors under a provincial supervisor is a satisfactory scale and fully justifiable for the field staff.

5.13 Local supervisors would be persons with about the same qualifications as enumerators except with a higher level of education and some administrative experience. Supervision of the agricultural census is more difficult than that of the population census because the questionnaire is more complex and the work is confined to rural areas. It is desirable that supervisors be drafted from government administration, so that they can be relied upon to do their work with the requisite sense of responsibility. They need to have knowledge of local conditions, customs, travel problems, language, dialects, etc. They should possess, at least, the same characteristics as those of enumerators. They could be selected on the recommendations of agricultural extension specialists and agricultural statisticians. A team of senior officers engaged in the census should interview them for testing and screening. The provincial or regional supervisors are responsible for all technical and administrative matters in the regions and therefore they must be experienced officers with sound technical knowledge of agriculture and of census work with a proper understanding of the census plan.

5.14 Experience shows that supervisors have to work with the enumerators from the start of the enumeration and be present at several interviews with each enumerator. They could then detect deficiencies and take immediate remedial action. When the enumerator has completed one phase of his work in a locality, the supervisor needs to review his activity and ask him to complete any deficient work.

5.15 Supervisors need to give special attention to checking the accuracy of testings along boundaries of the enumeration area. They have to travel into these regions to ensure that the administrative classification is the same as that given to them. These visits will help them in allocating enumerators to various districts and suggesting any needed variations in the publicity, financial and/or administrative work.

5.16 The principal administrative and professional staff need to be highly skilled and qualified persons. They should be recruited from personnel who are familiar with agriculture census methods and procedures, and government work. A thorough training of all this field staff is important.

5.17 The usefulness of the agricultural census as a benchmark and a basis for agricultural statistics is very important. After the census is completed, therefore, it would be desirable to project suitable statistical surveys from the groundwork laid down by the census, possibly utilizing census field staff, transport, and other facilities before these are disbanded. In formulating plans for the agricultural census, this possibility needs to be kept in mind. It is valuable to use a group of this staff as supervisors and enumerators as long as they have undergone training for the agricultural census.

5.18 Finally, the success of the collection and supervision of census data will depend upon how well the work has been organized, what is the quality of field enumerators and supervisors and how the government and public machineries have been mobilized to meet the stupendous task of census operation.

6. CARTOGRAPHIC PREPARATION

6.1 The unit of enumeration in the agricultural census is the agricultural holding. The identity of the household must be established before any data is collected from the householder. The identification must be linked with some unambiguously defined and specified area unit as the coverage of the agricultural census is usually determined with the help of geographical area covered. Whether the census is based on complete count or on a sample basis, the first pre-requisite is that the entire area of the country to be covered in the census should be unambiguously divided into identifiable parts. These parts are generally known as enumeration district (ED) or enumeration block (EB). The size of these blocks should be such that all enumeration work in a block can be handled by a single enumerator.

6.2 In many countries, a village is a well identifiable unit. Frequently village maps showing its boundaries clearly are available. In such situations, a village can be, with certain modifications, adopted as enumeration district. However, in countries where no such map exists, the delineation of enumeration units is one of the principal preparatory work for census taking. For such delineation, maps and/or sketches have to be prepared. For census taking, the cartographic preparation should be designed with the following objectives:

- (i) To provide cartographic information which will become a basis for formation of the necessary enumerator force to complete the enumeration process within the prescribed time.
- (ii) To indicate proper symbolism and notation on the map suited to census taking. This means that only information which will facilitate the succeeding phases of the census operation should be entered on the maps and/or sketches.

Timing of cartographic preparation

6.3 Since the fundamental function of a map in census taking is to facilitate the census field operation, the timing of its preparation is critical. Among the considerations which should be taken into account in the determination of the time of the cartographic preparation are as follows:

6.3.1. Cartographic information vital to the enumeration process should still be useful at the time of the census taking. The period between the beginning of the cartographic work and the start of the enumeration process should be as close as possible so that possible changes in information, useful to the census taking, are minimized. However, such a period should be long enough to accommodate the conduct of quality checks.

6.3.2. The final use of the maps influences the length of time to complete the cartographic preparation. For census work, maps are prepared for sampling purposes or simply as interviewer's aid in the enumeration process. The requirements in terms of accuracy and information to be included differ. In general maps to be used as sample frame require a relatively high degree of accuracy with respect to the variable which will be used for sample estimation. Very often this variable is the area of the enumeration district; such maps are usually prepared from aerial photographs. For the above reason, the cartographic preparation entails more time and more resources in terms of facilities and well-trained personnel. Some countries in Latin America have devoted no less than two years to such cartographic preparation. On the other hand, maps and/or sketches intended as guides in the enumeration process may be completed in shorter time and may require less resources. In agricultural censuses the enumeration area may be large but the area occupied by the households to be interviewed is small.

6.3.3. The time needed to complete cartographic preparation also depends on whether the maps are originals or reproductions. It may be possible to compile the necessary information for the delineation of enumeration districts from existing maps. The time required for such preparation may be considerably shorter than that required to compile the needed information directly from the field. Hence it is desirable to explore the feasibility of using existing maps for census purposes. However, whether the maps will be prepared from existing ones or based on newly collected information, the time of preparation should include the conduct of quality checks. Quite often the time needed for quality checks of reproductions may be longer than that required for originals or newly-prepared maps and/or sketches. For the former such time depends on the date of the preparation of the existing maps; possibly the older the maps the longer the time required for verifications and other quality checks. The extent of the area to be covered on such quality checks will also influence the length of time to be devoted to the cartographic preparation.

Exploration of existing map resources

6.4 Considerable time and resources could be saved if existing maps could be used for census taking. Maps and Photographs may be available in many government offices. It is desirable to explore the feasibility of using existing maps. A catalogue of existing maps should be prepared. Such a catalogue should have the following information:

- (i) office responsible for the preparation
- (ii) purpose for the preparation
- (iii) area covered
- (iv) scale
- (v) in what form available
- (vi) cartographic information useful to census taking

6.5 Government maps which are generally available are as follows:

6.5.1. Topographic sheets - The most important maps available in various government branches are large-scale general maps that are published in sections called topographic sheets. The scale of these topographic sheets are large enough which enables the user to recognize every important and significant spot. The land is usually surveyed on plane-table sheets, 1:20,000 or 1:25,000, or photographed on an even larger scale. Published maps are usually reduced in scale. The scale used depends on the financial capacity and varies according to the development of the country. Most European topographic sheets are on the scale of 1:25,000 to 1:100,000. Less developed countries use smaller scales. The maps of some parts of Canada have a scale of only 8 miles to an inch, large tracts of land of Brazil have maps only on the scale of 1:1,000,000. Even some parts of the United States have published topographic maps on a scale of no larger than 1:500,000.

6.5.2. Other government maps - It may be possible to compile cartographic information needed for census work from the various maps prepared by and ordinarily obtainable directly from the various government agencies concerned. Maps are being published by government offices involved in surveys such as geological surveys, coast and geodetic surveys, land surveys, topographic and hydrographic surveys, and services, such as conservation and reclamation services, armed forces services, forest and wild life services, etc.

6.6 Besides the above government maps, other maps are published for purposes of communication, tourism, land-use, etc., as follows:

6.6.1. Communication maps - All forms of transportation, railways, roads, steamers and airways need maps to show their routes to the public. Quite often such maps are diagrammatic, that is the presentation is too simplified. Some of these maps are totally utilitarian in nature as in the case of railroad maps. However, many are good landscape maps, showing patterns of vegetation, types of farming, etc. Maps prepared by airline companies and some road maps usually include scenic and historical interests, recreational spots and other information to induce travel.

6.6.2. Land-use maps - Such maps show the actual and possible uses of land, including both agricultural and non-agricultural (industrial, urban, recreational, mining and lumbering). The possibilities of use of such maps for census work are great.

6.6.3. Economic maps - These maps are concerned with the production, transportation and distribution of goods, and are necessarily small-scale maps. Economic maps are likely to pattern a single product or a group of products and mostly are statistical in nature.

6.6.4. City and tourist maps - Although such maps are primarily intended to motivate tourism, their utility for census purposes should not be overlooked. Besides tourist attractions, such maps also show the road system of the city and other tourist areas.

6.7 The preparation of such maps differs considerably from country to country and even from agency to agency.

Compilation of cartographic information useful for the preparation of maps and/or sketches

6.8 The compilation of cartographic information should start from the most recent to the earliest prepared maps. In the course of the compilation, the information known to exist no longer, should be eliminated. Such compiled information whether used or not for census purposes, may be maintained for future reference. Feasibility of using the compiled information for cartographic map preparation may be studied carefully as guides for interviewing in census work. After the identification process, the estimation of additional field work needed to up-date features significant to interviewing should be done. The costs involved should also be estimated. If the saving in terms of costs is considerable without undue sacrifice in the utility of the resulting maps for census taking, then the cartographic preparation can be continued. If, however, the efficiency of the census taking will be prejudiced, it may be worthwhile to prepare new maps based on newly collected information.

Provision of sketches showing boundaries of areas

6.9 Many agricultural censuses have been conducted through the use of sketches. The basic advantage gained through the use of sketches in census taking is that only geographic features relevant to the enumeration process can be indicated. The resource requirement is usually much smaller than that for the regular cartographic work. The basic equipment for sketching is uncomplicated and consists of about 6 by 12 inch drawing paper attached to cardboard pad, a pencil, an eraser and an ordinary 12-inch ruler.

6.10 Important considerations in the preparation of sketches in censuses are given below:

6.10.1 Equalization of the size of enumeration district. Sketches should determine the boundaries of the enumeration district. If a census of human population has been conducted recently in the past, some rough sketches must have been prepared for determining the enumeration district. These sketches can be fruitfully used for agricultural census. The enumeration district in agricultural census may, however, differ from that in the population census and a small modification may become necessary. The main consideration in modifying the sketch is to make the workload of enumeration equal to all the census enumerators. Quite often existing smallest administrative units of the country can be used as basic enumeration areas. The size of such units may vary considerably. Sketches of such units may, however, be modified to facilitate the fieldwork of the census.

6.10.2 Demarcation of the boundaries of the enumeration district. If administrative divisions are used as enumeration areas, the boundaries of such units are defined in maps usually available in the administrative offices in the locality. The same boundaries can be used and marked correspondingly on the sketches. However, if the enumeration areas are arbitrarily formed, the marking of boundaries will depend on whether such sketches will eventually be used for sampling purposes or will be used simply as interviewer's guide. In general, it is always preferable to use as boundaries easily recognizable geographic features like roads, rivers, bridges, city churches, schools and other structures which are more or less permanent in nature.

6.10.3 Location of strategic position on the sketch. Field sketching for census purposes provides a quick and easy way of obtaining a pictorial guide for interviewing. The suggested procedure is as follows:

- a. From a strategic position in the locality such as a tall building or the top of a hill, an ocular survey of the general feature of the area should be made.
- b. After the ocular survey the establishment of reference lines should follow. The direction should also be indicated by the conventional symbol. The boundaries of the area can also serve as reference lines.
- c. The general lay-out of key points should be marked on the sketch pad.
- d. To include further details is to proceed from large features to small ones.
- e. Field sketches should be done in pencil only, and inked later.
- f. Imposition of grids on the sketch pad will facilitate the preparation of the general lay-out.

6.10.4 Significant geographic features relevant to the facilitation of the census work. If the household approach is used, it may be difficult to mark all the households in the area. Two or more households may be occupying the same dwelling units or new dwelling units were formed between the preparation of the sketches and the beginning of the census field work. Hence it is desirable to include significant features like churches, schools, artesian wells, etc. to indicate the location of household areas.

6.11 The general rule to be followed is to include only the more significant features without undue loss of details necessary for efficient field work, enumeration, control and supervision and post census activities. Conventional symbols and notations should be used to mark these features on the sketch. In the absence of standard symbols, such features should be represented by figures which resemble the said features. For example, in the case of a church building, a feature of the church may be indicated on the sketch map.

Supplementary preparatory activities

6.12 (i) There are other preparatory activities necessary to supplement the cartographic preparation. Among these are preparation of lists of local administrative units or of prominent geographic entities of a permanent nature in the country and the compilation of complementary information such as size of units or entities in terms of agricultural population or people engaged in agriculture, ethnic groups of its population, and areas of agricultural land. Like the cartographic preparation, these supplementary preparatory activities should be aimed at an efficient census field work. (ii) The results of such supplementary activities should be availed of within the determination of delineation of enumeration areas which are more or less of equal interview load. Quite often enumeration areas of unequal interview load can be conducive to an inefficient census enumeration. This is specially true if the same length of time is allotted to each enumeration area. It is possible, however, to perform delineation of the country into enumeration units of more or less equal interview load. One such method of delineation is through the computation of indices of agricultural activities. In other words a hierarchy of administrative units according to the level of agricultural activities should be prepared.

6.13 Finally, a good symbol for cartographic preparation is one which can be understood without any explanation at all. The interviewer should not be preoccupied with two sets of instructions in the course of the enumeration: that of reading what the sketch or map features signify and that of accomplishing the questionnaires.

Preparation of the list of enumeration districts for future use

6.14 As discussed earlier, a complete list of the enumeration districts is the basic need for organizing an agricultural census; whether it is based on complete enumeration or on sampling basis. An agricultural census should provide an opportunity to prepare such a list and maintain it for future use.

6.15 The census itself is not an end. The census results can be used for planning agricultural development, for demarcating the country into homogeneously agro-economic zones, for filling the gaps in agricultural information by organizing agricultural surveys, etc. These ends can be achieved provided a complete list of enumeration districts along with their broad characteristics, such as geographical area, area under cultivation, agricultural population, number of agricultural households, number of livestock is maintained and, as far as possible, kept up-to-date.

6.16 In the developing countries, because of ethnic and economic reasons, the concept of village is very well known. Each village has its own characteristics. This is the reason that in many countries, like India, Pakistan, etc., the village is considered as the unit of economic planning and a complete list of villages, along with the basic characteristics is maintained and kept up-to-date. Even in other countries, some kinds of village concept exists. The agricultural census should recognize this historic fact and take advantage of the existence of village concept in planning its programme. One of the objectives of the agricultural census should be to compile the list of the villages, prepare the sketch maps indicating clearly their boundaries and give their basic characteristics. In fact, as discussed earlier, it will be advantageous to treat the village as enumeration district, particularly in developing countries.

6.17 Maps and other details accumulated at the time of agricultural census are of great value for subsequent sample surveys and should be carefully preserved. Census totals, averages, etc., provide useful ancillary data for stratification and for improved method of estimation. Because of the wide range of uses of the census data in designing subsequent sample surveys, it would be desirable to conduct the census on complete count basis at least for the basic items such as size, land use, cropping pattern, etc.

6.18 Many countries have already started mechanization of the data with the help of electronic computers. The list of villages/enumeration districts once prepared can easily be maintained by the computer. It can be stored in the computer's memory on tapes/discs depending on the computer model and retrieved whenever needed.

7. CENSUS QUESTIONNAIRE

7.1 Once the decision on the scope and coverage of the census has been taken, a questionnaire can be built-up in order to secure the relevant information in an orderly and coordinated manner. The census questionnaire is the most important document in the entire census programme since through it the desired information is obtained. Any inefficiency in formulating the correct type of questionnaires will lead to collection of incomplete and inaccurate data. The agricultural census happens to be a complicated and comprehensive enquiry. Considerable thought should be given to formulating the questionnaires and in doing so, advice of all the experts on the subject available in the country should be utilized.

Considerations in the development of census questionnaire

7.2 Generally two methods, (i) mail method and (ii) interview method, are followed in obtaining the census data. In many of the developed countries where the farmer is literate and maintains farm accounts, the mail method is resorted to. For example, in U.S.A., census data are obtained through the mail method. In the developing countries, where the majority of the farmers are illiterate and do not keep any farm accounts, the interview method is used. The format and arrangement of items of information will largely depend on the nature of the enquiry. To distinguish between the two methods of enquiries, mail and interview, the difference between questionnaire and proforma/schedule may be understood. In the questionnaire method, the sole responsibility for supplying the correct data lies with the respondent himself while in the proforma and schedule type of enquiries, major responsibility is on the enumerator to extract the right information from the respondent. In the case of mail inquiry questionnaires, the questions should be self-explanatory with small footnotes if it is considered necessary. A small instruction note is also distributed to the respondents. It is for the respondent, with the help of the explanatory footnotes and instructional notes, to interpret each question and reply accordingly.

7.3 In the case of the interview method, generally proformas/schedules are preferred. Here no direct questions are put to the respondent. To get the right answer to a question a number of indirect questions will be put by the interviewer. He may also have to give background explanations in the dialect in which he is interviewing the respondent in order to communicate in his own language the proper meaning of the original questions. It is a good practice to provide a field note book in which he jots down the data and other information that he secures through his conversation with the respondent so that he can summarize this material or use it otherwise in order to put down on the main proforma an explicit answer at the end of the discussion on each item after verifying his result with the respondent by explaining the details. Instead of a separate notebook, space may be provided on the proforma itself. e.g., on the back of the sheets, for recording the data from which the final answer to each specified question in the proforma is to be built up. Ascertaining the area of an operational holding will illustrate this point well. The respondent is hardly expected to understand the meaning of the term "operational" but the term is intended for the interviewer who must understand its exact connotation for filling in the right answer. He can then find out from the respondent all land with which he is connected in one capacity or another, irrespective of its location in the village or locality in which he resides, or in any other area and then strike a balance by adjusting all land which he may own but does not use himself, having leased it out to someone else, land which he may have leased in from someone and again sub-leased out to somebody else. He may have to interpose suitable statement reassuring the respondent of the confidential nature of this information and that it is intended to provide correct data on the pattern of land use, cropping pattern, tenancy system, etc. Obviously, in the interview method, the responsibility of obtaining accurate information lies with the interviewer. This is the reason that the interviewer has to be thoroughly trained in the interpretation of concepts. He is also given tips in the interview methodology. In addition, a detailed instruction manual is supplied to each of the interviewers to be consulted in case of doubt. The contents of the instruction manual will be described in a separate chapter.

7.4 The terms questionnaire, proforma and schedule are synonymous in literature. However, whether any distinction is made or not, the format of the questionnaire will depend on the method of inquiry, whether it is by interview or by mail.

7.5 The size and form of the questionnaire are the first points which may be considered. The questionnaire should not be too large and should be easy to handle in the field. Its size and shape should be such that the enumerator can easily handle it in the field while writing the answers.

7.6 It is often argued that once contact has been established with the farmer maximum advantage should be taken in collecting the necessary census information as it is much costlier and more time consuming process to meet him. However, this argument is not valid for many reasons. Frequently the data requested is not readily known to the farmer. Occasionally he needs to consult his books and other members of his household and this takes time. Furthermore, if the questionnaire is lengthy, the farmer, who at the outset is prepared to reply to the questions, after he has been interrogated for a certain time becomes gradually less cooperative and in the end even hostile and this results in unreliable data from him. It is, therefore, very important that the questionnaire should not be too lengthy. However, it is difficult to establish the ideal length of a questionnaire because this depends not only on the number of questions it contains, but also on their degree of complexity which is reflected in the length of time which the farmer needs to answer them. Not only the farmer is affected adversely by the length of the questionnaire and duration of the interview, but the enumerator also, since he becomes tired and records the data indifferently.

7.7 The definitions and concepts to be used in the questionnaire should be carefully studied and care should be taken to see that they are not too elaborate to be understood easily by the farmer and the field staff of the census. An endeavour should be made to follow the recommendations of international programmes, for purposes of comparison at the regional and world level. Only when it is quite certain that these recommendations do not apply to the country's conditions, they may then be disregarded.

7.8 Frequently, in order to maintain the comparability between two successive censuses, certain definitions are maintained which are not very accurate. This is not advisable because it is better to lose the continuity rather than maintain an error.

7.9 When, after carefully studying the subjects to be included and the corresponding questions, it is observed that the questionnaire is too lengthy, various possibilities may be considered. The first is to use a very simple questionnaire with basic items which may be applied to all the farms. The questions to be included could be: total area, cultivated area, area occupied by permanent crops, number of head of cattle, swine and/or sheep, and/or goats according to the importance which each type of livestock has in the country. This basic questionnaire would really consist of a sort of list of holdings. The list would constitute a sampling framework on the basis of which the farms are chosen to which the other more extensive questionnaire which includes the items suggested in the world census programme will be applied. Moreover, the simple questionnaire allows for a series of important basic results to be obtained quickly.

7.10 The second possibility is to distribute the questions in two questionnaires, but most probably there will be a series of items which will have to be obtained for all the farms and others which refer to more sophisticated subjects relating to cropping techniques which are not applied in all the farms or to available resources which do not exist in most of the census units, and which may be included in a second questionnaire. For example, it is almost certain that in small farms agricultural machinery is not used, nor are labourers hired for farm work, nor is there an irrigation system, so that these items could be included in the second questionnaire. In this case the first questionnaire would be of an acceptable length and the second would be rather small. This procedure is used also to widen the scope of the census, the first questionnaire applying to all the farms and the second to a sample of them. In addition to considerations on the subjects which need to be studied more in depth, the reliability of the results of the sample has to be taken into account when deciding what questions are going to be included in each of the questionnaires. To make the work of the field staff easier an endeavour should be made to set out both questionnaires in the same way.

7.11 The third possibility is to use different questionnaires for different regions of the country when these differ considerably as far as their crops and cropping practices are concerned. In this case various items could be discarded completely from the questionnaire of one region and its length reduced considerably. For example, if one region is known to be almost exclusively a livestock production area and owing to its physical characteristics has no permanent crops, the questions regarding crops may be reduced and those relating to livestock expanded, if this is considered advisable. This may, however, involve printing a different set of forms to meet the requirements of different regions.

7.12 Once it has been decided what subjects are to be included in the questionnaire, proper attention must be paid to their sequence, that is to say, they should be set out in logical order so that it is easy for the farmer to go on supplying the information requested. All the questions on one subject should be grouped together and enough space left between them so that they stand out distinctly and can be easily located.

7.13 The questions should be formulated in a clear simple language, using, wherever possible, the vocabulary familiar to the farmer. This is not always possible because in the majority of countries there are regional differences, and expressions which are very common in one part of the country may be unknown in another. However, when there are terms commonly used by the farmer, although these may not be very correct idiomatically, they should be employed in preference to others. Similarly, measurement units may sometimes vary from region to region. It is desirable to record the data in local units and later on convert it into standard units in the census office.

7.14 At times it is advisable to use questions, which, though not to be tabulated, serve as a sort of control or introduce another question so as not to discomfort the informant. For example, the area on which fertilizers were used could be asked directly, but it is preferable to ask first whether fertilizers were used and then on how many hectares they were applied.

7.15 Whenever the answer to a question can be classified in several categories this may be printed in the form so that there is no need to write the whole answer but only mark an 'X' in the appropriate box.

7.16 Careful attention should be given to the quality of the paper used. Thin paper should not be chosen because during the field work the questionnaire has to stand up to very unfavourable climatic conditions and also to constant handling during the distribution of the documentation and the subsequent tabulation of the data.

7.17 Another aspect to be considered is the colour of the paper. When an agricultural census is taken at the same time as population census, it is almost indispensable that different colours be used for the two sets of questionnaires, so that they can easily be distinguished and errors avoided in handling the census papers. The same reasoning applies when two types of questionnaires are used for collecting information, one of which will be answered only by a sample of farmers. In general, since a large quantity of forms are handled in a census, it is advisable to use different colours for each of them. Light colours which do not strain the eyes and on which it is easy to read what is written should be chosen.

7.18 The size of the print should be large enough so that it may be easily read even when the light is not adequate. This occurs frequently when the farmers are interviewed in the evening, since in many rural areas there is no electric light. Often, in order to obtain questionnaires of a satisfactory size, the print used is too small which is inconvenient particularly in view of the fact that the field staff frequently do not wear glasses even though they need them.

7.19 Endeavour should be made to use a different type of print for the questions and for notes or instructions to the enumerators. The questions must be distinguished easily since most of them will have to be read aloud to the farmer. However, very heavy print should not be used as the questionnaire will look too overloaded.

7.20 The space for the replies should be carefully calculated so that there is enough room for them to be entered and the lines should not be printed too close together. If this point is disregarded it may happen that the enumerator in correcting some of the answers given by the farmer rubs out the preceding answer with the result that he has to repeat the question and lengthen the interview unduly or the data is omitted or made illegible if he has not realized what was happening, which is still worse.

7.21 The questionnaire must be uniform in style, that is to say the readings should all be printed with the same type of lettering, the explanatory notes with another type or in brackets and in a certain position with respect to the question, after or below it. Similarly code system, if any, should be printed at one place in each form.

7.22 Each question should be numbered so as to be able to refer to it easily in the instructions and elsewhere. The same applies when the answers are noted down in different columns; each column must bear a number or letter.

A working group on census questionnaire

7.23 Bearing in mind that the information obtained in the census will be used for the country's agricultural planning, it is very important that a working group be formed whose first task will be to study the subjects which should be included in the census and specifically the questions which the questionnaire should contain. The group will have to be formed by staff who are involved in the agricultural planning work, in the collection of statistics or in some form of utilization of the information on the agricultural sector, so that they really know what the information needs are and can visualize how the data obtained will be used. They should hold responsible posts, in their respective departments and should be able to spare time for the formulation of questionnaires. It is not advisable for the group to be too large. A basic group of 3 to 5 senior and experienced officials could be formed. The group can be assisted by specialists from the different ministries according to the subjects which are taken up for discussion. For example, when aspects of irrigation and drainage are considered, experts from the ministry in charge of the country's hydraulic resources should be present. If the census data are to be processed on electronic computer, an expert on mechanical tabulation may also be associated with the formulation of the questionnaire.

7.24 For assistance in the study of the subjects to be included, reference can be made to the international recommendations contained in the 1980 World Agricultural Census Programme published by the Food and Agriculture Organization (FAO), which has taken the basic needs of information on the agricultural sector into account.

7.25 Furthermore, in the majority of cases reference can be made to the last agricultural census taken in the country. Starting, therefore, with the questionnaire used in the previous census, each of the subjects included therein could be carefully examined, the content of the questionnaire compared with international recommendations, and each of the questions on each subject examined, studying the difficulties which arose and the use which was made of the information obtained.

7.26 As the economic planning in a country becomes gradually more refined and agriculture also undergoes changes, the information needs also change and subjects which were not included in the census taken 10 years earlier because they were considered of no value, may now be important. For example, the application of fertilizers and the use of improved varieties of cereals was a practice which was perhaps not very widespread 10 years ago, but which has become so at present. It may, therefore, be necessary to include various questions on this subject. The contrary may also occur, that is to say that subjects considered useful in the previous census are no longer of any value. The questionnaire must meet the need of the present as well as that of the future.

Use of questionnaires developed in other countries

7.27 It is also advisable to study the questionnaires used by other countries, especially those of the same region, because it is quite likely that their information needs will be similar, as well as the problems which have to be faced in order to secure the information; it may be possible to profit by their experiences, utilizing some ideas and approaches not only as regards the subjects, but also the presentation, taking care, of course, to examine whether these innovations are applicable to the country. It is not always easy to obtain the questionnaires used in other countries, and therefore it is necessary to promote greater international collaboration, as well as the practice of including in the census publications the questionnaire or questionnaires which have been used to obtain the information contained therein, since in this way it is easier to make them known.

Tabulation programme

7.28 One way of judging the adequacy and relevance of the various questions in the questionnaires is to conduct pseudo-tabulation. Through such tabulation it may be possible to know whether all the statements targeted from the census can be obtained or not. It is therefore very important to design the tabulation programme before or at the same time as the questionnaire. Each question appearing in the questionnaire could then be studied in order to decide whether it could supply any of the figures appearing in the tabulation programmes.

7.29 It is also necessary to analyse whether the information as noted down on the questionnaire can be processed easily. For this purpose full collaboration is necessary between the group in charge of designing the questionnaire and that dealing with the processing. Often one can go to the other extreme and in designing the questionnaire the main attention may be given to ease of processing thereby making the questionnaire too complex and too full of a large number of printed codes. This may cause difficulty to the enumerator in the field work. However, it is important that, in order to facilitate tabulation of the census information, all the questions which are feasible to code, should be coded beforehand in the questionnaire, at least all those questions the answers to which will be marked with 'X'. Most of the questions in the agricultural census are not worth being left uncoded for subsequent coding.

7.30 When information is required regarding crops, it is preferable to give a list of those which are of interest so that they can be pre-coded, because when a very short list is printed and the enumerator notes down many crops in the space allotted to "others" the coding takes too much time and sometimes it is decided not to finish it. Generally the crops of the country are known and can be listed.

Pre-testing of census questionnaires

7.31 Although the members of the group who designed the questionnaire may be very competent and have devoted long sessions to discussing it, it is essential that its functionality be monitored by means of a series of tests or trials which will help to perfect it. It will be desirable to refer the draft questionnaires to the main users of the census data, for their opinion. After incorporating their comments the questionnaire can be revised.

7.32 Once the questionnaire has passed through these revisions a full test should be organized directly with the farmers to determine, among other things, whether the respondent understands the questions, whether the order in which they have been placed is acceptable, and how long it takes to obtain the information. The questionnaire can be tested in typical places purposely chosen for the purpose. Members of the group can act as interviewer or else they can just observe the interviews being done by the staff dealing with the collection of continuing agricultural statistics. Even though it is claimed that the presence of an observer influences the behaviour of both the farmer and the enumerator, distorting the results of the interview, this influence does not seem too noticeable and it is, therefore, preferable to run this risk rather than do away with the observers, since the enumerators may concentrate

too much on noting the data and not catch all the details. It is very important that specialized staff themselves should have an opportunity to observe how the respondent reacts to the inquiry and how he is able to interpret the various terms and concepts used in the census. The main objective of this test should be to finalize the concepts and definitions, the arrangement and sequence of the questions, the appropriateness of the language, format of the questionnaire, spacings between two questions, adequacy of space for writing answers, etc. For finalizing these, a large number of farmers need not be interviewed. It may be possible to finalize the various aspects of the questionnaires by interviewing 5 to 10 typical farmers.

7.33 The final test should be carried out in different agricultural zones of the country. Staff who are likely to be employed as enumerators later on should be used as interviewers and the technical staff as observers. They should be asked, on the basis of their interviews to give their opinion on the questionnaire. The opinion of the interviewers and that of the observers should be jointly discussed to finalize their comments on the questionnaire.

7.34 After taking into account the comments of the interviewers of enumerator type, the questionnaires should be very carefully revised, and an endeavour made to detect any inconsistencies in the information, illogical replies showing that the questions were not understood by the farmer and the enumerator, too many blank answers, etc. Sometimes instead of testing only one questionnaire, two or three different models which have different formats or which include different items or which formulate the question in a different way are tried out. On the basis of the results of the test it is hoped to find the most practical one. As mentioned, it is very important to keep a record of the duration of the interviews which would also serve to fix the work load for each enumerator.

7.35 Another procedure which is used to test the questionnaire is to apply it to a sufficiently large probabilistic sample of farmers and tabulate the information obtained by comparing it with available figures from other sources. In the developing countries this method is not so practicable for generally there are no sufficiently reliable figures with which the sample results can be compared. Moreover, the discrepancies observed may be due to sampling errors and not to shortcomings in the questionnaire.

7.36 In the pre-test and pilot census discussed in Chapter 11, all the steps of the census taking are examined. This again gives an opportunity of looking into the suitability of the questionnaires. In this test an attempt is made to reproduce all the conditions under which the census will be taken. In general, no special observers are used and only supervisors as a part of their normal duties will observe some interviews and give an assessment. The data collected in the pilot census are analysed on the same pattern as that expected to be done in the main census. The results of the pilot census may then be compared with some similar results available from some other sources. This is relatively easy to do if the pilot census is carried out in some small politico-administrative division, municipality, magistracy, etc.

7.37 All these questionnaire tests should be completed sufficiently in advance of the actual census in order to allow sufficient time for making necessary amendments to the questionnaires, which these tests reveal. In view of the large number of questionnaires required, sufficient time must be allowed for printing them as well as for printing the manual of instructions.

8. TABULATION PROGRAMME

8.1 The field work and tabulation of census data are the two principal components of the whole census operation. The two are interlinked. The quantum of field work will determine the quantum of tabulation. A balance has to be determined between the resources that have to be spent on the two components. It has been the general experience that in a well-formulated sample survey enquiry, about two-thirds of the total expenditure goes to planning and conduct of the field work while one-third is spent on the tabulations of survey data and writing the report. Therefore, in preparing the budget this point must be kept in view. With poor planning, it often happens that disproportionately larger sum of the total budget is spent on the collection of data and very little funds are left for processing and tabulation and as a result either the tabulation is considerably delayed in the search of additional resources or considerable part of data remains in the questionnaire without tabulation. It must be realized that each observation taken through the complicated field inquiry costs considerably and if it remains unutilized because it is not processed, it is criminal waste of national resources. Each observation so collected should be considered national wealth and ways and means must be found to utilize it. The first and important step in organizing the tabulation of census data would be to ensure that there is a regular flow of census questionnaires from the field. The receipts of these questionnaires should be properly monitored and periodically reported to the head office of the census. The complete returns from all enumerators in all localities should be passed on to the supervisors regularly as they become available. To simplify control measures, questionnaires should be grouped, otherwise any control will be time consuming. Alphabetical or geographical indexing and proper filing are essential. Control should also extend to the removal of questionnaires from folders and records of such removals should be kept. As regards passing through various processing stages, they should be periodically checked to detect any delays, misplacement of questionnaires, etc.

Development of the tabulation programme in relation to the preparation of questionnaire

8.2 Generally, guidelines that have been set up for different phases of census taking could be adopted by all countries. However, guidelines for setting up a tabulation programme would have to be modified depending on a country's needs. These needs are related to such factors as its degree of statistics development, type of statistical organization and stage of economic development and planning.

8.3 The first consideration in preparing a tabulation programme are the items of information needed in a country. These items of information would determine the contents of the census questionnaires, which was discussed in Chapter 7, dealing with questionnaires. Thus, ideally the tabulation programme is planned ahead of the questionnaire. If not possible, it should be planned at least concurrently with the questionnaire. This would ensure that items of information needed in the tabulation plans would be included in the inquiry. At the same time, it would eliminate the wasteful inclusion of items of information in the questionnaire, which are not to be a part of the tabulation plans. As mentioned earlier, an activity of data collection without its processing amounts to misuse of the national resources.

8.4 The main purposes of carrying out an agricultural census are:

- (i) to provide data on the structure of agriculture useful for planning, policy formulation and evaluation of programmes;
- (ii) to improve the quality of current agricultural surveys and obtain a better coordinated, better integrated system of agricultural statistics by providing benchmark data, as well as a frame for current agricultural surveys;
- (iii) to produce internationally comparable figures on the state of food and agriculture of the various countries of the world.

8.5 The main users of census data are:

- (i) officials of the national government involved in planning, policy making, programme evaluation;
- (ii) officials of the local government;
- (iii) agencies involved with current agricultural surveys;
- (iv) international organizations like FAO which are concerned with the state of agriculture in countries of the world and in the world's food supply situation;
- (v) business and research organizations.

8.6 In setting up a tabulation programme for an agricultural census, consideration should be given to the type of information needed by the country as well as by international agencies. Communication between the producers and users of statistics should, therefore, be established. One way of gauging this need is for producers and users to hold meetings. The organization of inter-agency committees would be a big help, even as early as the preparatory stages of the questionnaire. The importance of forming a group of experts drawn from the users' organizations for formulating the questionnaires has been discussed in detail in Chapter 7.

8.7 Another way would be to send out questionnaire forms or have consultations with professionals who know the economic situation and its problems and who have the expertise in identifying data needs. In these meetings and consultations it would be well to assess past census tabulations and pick out those to be retained. New data needs will also be presented and discussed.

8.8 A third way would be for the agricultural census office to observe and take note of the type and frequency of requests received by the census office from various agencies. This would indicate a demand for such data which may not be available from other sources.

8.9 On the other hand, those officials of the national government and of the regional offices as well as local officials in charge of formulating agricultural development plans, as well as persons planning agricultural surveys should also be made aware of the statistical data which a census could supply.

8.10 Reference has been made in Chapter 4 dealing with 'Publicity and Propaganda' to the fact that the objectives, scope and coverage of the census should be widely brought to the notice of the public so that they are aware of the utility as well as the limitation of the census results. Otherwise, it may happen that after the field work has been completed demand for additional information may come forward. For example, if the census has been conducted on a sampling basis it may not always be possible to tabulate the data for smaller regions, which an agricultural planner may demand subsequently. The public in general and the agricultural planners in particular may be educated much in advance of the distinction between the sample census and complete count census.

8.11 After the items of information to be tabulated have been decided on and have been included in the questionnaire, the manner of arrangement and presentation of these data into tables for analysis and publication are to be determined. One should bear in mind that the table format should be such that the meaning and significance could readily be grasped by the user.

8.12 Tabular presentation may vary from one country to another especially in matters of detail. However, it is a common practice of those in charge of tabulation to first determine the items or characteristics to be classified and the groupings to be used. This is usually done by the subject matter specialist who prepares the formats of the tables. He decides on the various classifications to be used and if a computer is available, works side by side with the systems analyst, who has to convert these requirements into machine language.

8.13 In determining the classification to be used it would be well to examine tabulations from the previous census, and results of current surveys to see whether these classifications are still relevant to users of census data.

8.14 One basic classification used during censuses is size of farms. Tabulations using this classification would show distribution of land resources, characteristics of farms by size, useful as basis for government policies on agricultural land, and land reform programmes. Size classification has been used in past censuses so that for continuity and comparability this classification should be retained. Furthermore, attention is now being drawn towards operators of small farms, with a number of studies and projects aimed to give them assistance.

8.15 Farm size, as directly related to productivity has its limitations. This is because total area of farms includes those areas not utilized for production. Another possible classification of farms is size of cropland. This classification has a direct advantage over that based on total size of land. Size of cropland is directly associated with farm inputs and with production. Use of cropland area would reduce the wide variability obtained when total size of farmland is used.

8.16 There may be a need to distinguish crop farms from poultry farms and livestock farms. This is because each type requires different inputs. Furthermore, number of heads, rather than area would relate to productivity for both livestock and poultry farms.

8.17 Size of farms should be used to classify crop farms while number of heads should be used to classify poultry and livestock farms.

8.18 If these classifications are used there would be a need to define each type of farm so that farms with diversified activities could be classified.

8.19 An important item of information, which takes up a large number of tabulations in a census, is crop production. Various classifications of crops are being used by different countries. Major classifications of crops into two, such as permanent and temporary crops, would be advisable for the reason that these classifications conform to land use classifications. Another practical reason is the need to tabulate each group under different column headings. These are number of trees, bearing and non-bearing for the permanent crops, and area harvested for the temporary crops.

8.20 Some countries may further classify crops into foods and non-foods or into foods, feeds and crops for industrial use. The detail of classification would again depend on its importance to a country.

8.21 After the classification of various items of information has been decided on, the items of information to be cross-tabulated with these groups have to be studied. These cross-tabulations will have to be examined for their meaning and relevance.

Amount of tabulation for various levels of administrative units and the limitations imposed by sampling procedure

8.22 Due to the increased demand for tabulations at the smallest administrative unit, one should be aware of the limitations to such statistics produced and this would depend on the sampling methods employed.

8.22.1 Complete enumeration - If data were collected by complete enumeration of all holdings, it would be possible to tabulate all data for even the smallest geographic areas. In fact, even rare characteristics of holdings could be presented.

8.22.2 Sample enumeration - In many countries a complete enumeration of holdings may not be feasible. Instead a sample enumeration is employed. In such a case the results would be subject to sampling error. The tabulations to be prepared would have to be more limited for the lower levels of administrative units. The amount of tabulations to be produced for the lowest administrative level would depend on the sampling scheme, sampling variance of characteristics and level of reliability that is desired.

8.23 A study made earlier, either based on past census results or a more recent survey, would provide the percent error of major farm characteristics. This would serve as a guide in deciding which tabulations would be prepared for various administrative levels at a desired level of reliability.

8.24 Tabulations and cross-tabulations recommended for national and international use cover number, area and fragmentation of holdings, land tenure, legal status of the holder, land use, important food and cash crops, major kinds of livestock, use of agricultural machinery, and selected crop cultivation practices. All countries are urged to make every effort to provide the corresponding tabulations. Details of these tabulations have been presented in Chapter 4, "Tabulation programme" of the publication "Programme for the 1980 World Census of Agriculture" brought out by the Food and Agriculture Organization of the United Nations, Rome.

Procurement of computer software packages and the preparation of computer programmes

(1) Computer software packages

8.25 With the increasing use of electronic computer it is expected that most of the countries will resort to computerization of data of the 1980 Census of Agriculture. If this is so, the timely release of census reports will depend on the expertise of the technical personnel of the data processing staff. Systems analysis and design of any computerized data processing project should go hand in hand with the planning, designing and preparation of the questionnaire and the required statistical tables. This will enable the systems analysts and computer programmers to determine what programmes to prepare and what software packages to use.

8.26 An agency which gathers and processes voluminous and repetitious data, usually has machine installations supported by software package programmes. The latest trend in electronic data processing is the development of software packages by computer hardware manufacturers and service companies. Some government agencies have special groups undertaking the development of these packages for distribution to interested users at a minimum cost.

8.27 Among the many factors to be considered in deciding what computer software package to procure for tabulating data for a census project are scale, timing, complexity and the nature of the information processing requirement of the user. Also to be considered are the type, configuration and capabilities of the computer installation the office has or is planning to have. In acquiring a software package, its cost and utility should not be overlooked. The package should be flexible and adaptable to the different tabulation needs of the organization to maximize the benefits. The availability of trained technical personnel who are capable of handling the package efficiently, should also be looked into. If none are available, arrangement for training the personnel of the census office in data processing should be made much in advance of the flow of field data. In this case, time, cost and benefits to be derived have to be determined so as not to delay the release of statistical reports.

8.28 The Computer Methods Laboratory of the International Statistical Program Center, U.S. Bureau of the Census, has developed a census tabulating system called CENTS. It was specifically designed to tabulate population census data. It was introduced to users, mostly to developing countries by giving technical training to its data processing personnel. Not only has its use been extended to other censuses or survey data, but it also has undergone several revisions with added features. With a few parameters it has the capability of producing computer printouts of 20 or 40 statistical reports in one running depending on the storage capacity of the computer installation. It has greatly reduced programming time. Its latest version is COCENTS which is the same programme written in COBOL.

8.29 The COCENTS package does not restrict a user to one computer manufacturer because it is written in a universal programming language. When it comes to cost of acquisition of computer hardware, a user could switch from one brand to another and still get the advantage of using COCENTS. It also has added features in which data could be retrieved not only in binary format but also in extended decimal or zoned format. It eliminates writing a programme to convert input data to binary coded data which is used as input of CENTS. COCENTS, however, has to reckon with a longer execution time in running than CENTS because it is written in a high level language. It does not mean, however, that it is better to prepare or write detailed programmes to tabulate statistical data because both CENTS and COCENTS have the advantage of reducing programming time tremendously and programmers could devote more time to writing efficient programmes for input data preparation.

8.30 With the availability of many software packages in the local market, data processing management could choose one which could best serve the needs of the country. Service companies or agencies should present the software packages. They have developed for data processing personnel who are in the best position to evaluate them as to their cost, utility, capabilities and compatibility with the computer hardware installation and its configuration. Proposals could then be properly weighed and carefully studied before a software package is procured.

(ii) Preparation of computer programmes

8.31 For an EDP System to be efficient and effective, planning should be very thorough so that revisions or last minute changes can be avoided. Frequent modifications not only delay the release of census results, but also create tension among the data processing personnel as well as the management.

8.32 Programming work must start as soon as the design of the system is completed and at least six months before the start of the field operations. As an activity it must have its own timetable and progress should be evaluated from time to time. It is the responsibility of the systems analyst to define all problems and give the specifications of the different programming jobs to the computer programmers assigned to do the work. Only then can work at hand be assessed. The complexity of each programme can be compared against the level of training and experience of the technical personnel. Usually more complex programmes like editing are assigned to more experienced programmers and the less complex ones to new or less experienced programmers. Each programmer assigned to do a specific programme in the system takes care of all activities like analysis, preparation of detailed block diagrams, coding, compilation, testing, and debugging with test data. As soon as programmes are declared productive, they must be properly documented. Manual of procedures should be prepared to guide the computer operations in running the programmes. All these different activities should be properly coordinated by the systems analyst assigned to the project. This will ensure the smooth flow of work from the time the data is encoded up to the time the statistical tables are generated.

Pre-testing the planned tabulation programme

8.33 Once the questionnaire to be used in gathering data is finalized, designing of record formats to be used as input for tabulations should follow. This means that all requirements have been considered and that tables have been grouped according to how many are to be done using software package and how many have to be done by writing COBOL or other high level language programmes.

8.34 Testing of computer programmes for tabulations must be done even before the start of data gathering to ensure that all of the programmes will be operational and productive, once data for computerized processing are available. Whatever problems are met during the testing could be remedied right away and not during the system implementation.

8.35 When computer operations are in full swing, test data should be prepared by the programming personnel so that all conditions are satisfied, and all possible errors are provided for. It is not advisable to use live or actual data at this stage, because "bugs" in the programmes could not be easily detected. During execution time,

a programme reported as productive may not work as expected. Problems of this nature may be true not only to one but to several programmes in the system. This could be avoided by being thorough in the preparation of test data as well as in the testing procedures. In case the system is designed in such a way that estimates of totals of different administrative levels are used, test data with these different levels of aggregation should be prepared.

8.36 Printed output of test runs at all area levels should be generated so that the validity, reliability and reasonableness of tabulated data could be verified and at the same time tables can be cross-checked for consistency. Manual tabulation could be done with the same test data so that comparison could be made with the computer outputs. This step could, however, be restricted to only a small quantity of records so as not to delay important operational activities.

Evaluation of tables

8.37 The agricultural census involves vast organization and expense, and the data are used for a variety of purposes. It is, therefore, very important to know the extent of the accuracy of the data. It is not only desirable as information for particular users, but as a guideline in planning future censuses.

8.38 All the tables should be systematically reviewed before they are published. The purpose of such a review is to eliminate major errors in census tables and to minimize the effects of minor errors. Some of the possible approaches are the use of external check data, consistency over time as shown by comparison of census results with those of previous surveys or available statistics, and internal consistency among the various items of the census. It is also possible to use post-enumeration surveys for this purpose. If large discrepancies are discovered, the verification of the original data is necessary to pinpoint the source of error.

8.39 In order that the review of tables does not cause delay in the publication of the data, it is advisable to collect the existing statistics on the same subject for a quick review of the tables as soon as they are out of the computer. Of course, the quality checks taken during and after the field enumeration should be used extensively in the final evaluation of the tables. To facilitate the evaluation of the tables, efficient control of the field operations during the census enumeration is essential. Such control will minimize the sources of error which, in turn, results in reducing the possibility of errors in the final census tables.

Problems arising from resources

8.40 Availability of funds - During the planning stage, a census budget is usually prepared and submitted for approval. However, cutbacks in funds requested, due to certain unforeseen economic drive, particularly in developing countries, would necessitate changes in plans. The problem would then be to fit the plans to the available funds. Sometimes rising costs, different rates in operations from those estimated, would affect financial resources during the operation. For this reason, allowances for such a situation should be made during the planning stage of the budget requirements.

8.41 Capability and number of personnel - A big problem is the lack of personnel which would affect the time schedule. For developing countries that are just starting to computerize their operations, this lack is especially felt for trained personnel involved in programming and machine processing. In planning a timetable for a census, this particular operation should start even before field training, or as soon as the questionnaire has been finalized.

9. INSTRUCTION MANUALS

Aim of manual

9.1 The quality of data collected during a census depends to a great extent upon the quality of field work performed by the enumerators and the supervisors. A description of the method of their recruitment and training has been given in Chapters 5 and 10. Bearing in mind that the field staff has to understand clearly all the details of the procedures to be followed and learn a large number of concepts and definitions, it is almost impossible for them to become fully conversant with them during the short period the training course lasts, and in spite of the fact that they have to learn most of the basic details almost by heart, they need to rely on printed materials, the manual which will enable them, on the one hand, to revise on their own what they have been taught in order to master the subject better and, on the other hand, to consult those points about which doubts may arise as they proceed with their work. The manual of instructions may, therefore, be considered as fulfilling two main purposes. The first is to serve as an instrument of study in training courses and the second to furnish the basic material for consultation during the census taking.

Basis for uniformity

9.2 In addition, by means of the manuals the criteria and procedures to be followed are clearly established, and in this way the necessary uniformity is achieved in the census. It is obvious that the majority of the staff could carry out the census work and resolve on their own the problems which arise during the census, but it is essential that they all proceed in the same way and they must, therefore, follow the same rules and guidelines, as otherwise one would end up by not knowing what has been obtained. There should be only one definition for each type of agricultural information to be collected. Without an instruction manual, it is difficult to achieve and maintain data comparability.

9.3 The preparation of the manuals is sometimes neglected (since nearly all employees from previous censuses are available), and only a summary revision is made without endeavouring to make a substantial improvement based on the experiences of past censuses and surveys.

Timeliness of preparation of manuals

9.4 The manuals should be prepared sufficiently in advance and made available at the beginning of the staff training course, since, as already mentioned, this is one of their objectives. It is wrong to wait for the preparation of the manual until the first training course, the one for the census executives, is held with the intention of including all the elucidations which might emerge during the course, since generally in between there will not be time for this and the following courses will have to be held without manuals. This situation is all the more undesirable since the training of each type of census officers in the field will be a responsibility of the higher level officers who have just received their training, and it is therefore essential that they should be able to rely on a printed document which will serve as a basis for transmitting faithfully the instructions to be followed in the census work.

Authors of manuals

9.5 The manuals should be prepared by people who are perfectly conversant with the subject, not only from a theoretical but also from a practical point of view, as they know which subjects require more detailed explanations and which are easy to understand particularly when numerous examples are necessary and also that these are realistic. Through their experience in the field they will know the problems which arise most frequently during the census taking and will be able to furnish practical solutions or guidelines for resolving them.

9.6 At times the technical staff of the agency responsible for the census is newly trained and although they master the technical aspects they have no field experience. In this case, they should consult widely the employees who have participated in previous censuses so as to learn about their experiences and take advantage of them in drawing up the manuals. As already mentioned, if the first step to be taken is the updating of the manuals of the preceding census, it is advisable to consult also the staff who revised the completed questionnaires so as to know what questions gave rise to greater problems and examine the causes at the root of these problems, so that if there are mistakes ascribable to the instructions, these may be corrected. This information should exist in the records maintained by the executing agency of the census. In many developing countries, however, this is not so and recourse has to be made to verbal information from former officers, who may even have already left the organization. The experience gained in pilot census and pre-testing can be fruitfully utilized in revising the old manuals to a large extent. It should be borne in mind that nearly always the staff who participated in the census is heterogeneous and the manuals must not be written assuming that they have a high level of education; on the contrary, they must be prepared with an eye to the staff having the lowest level of education. During the training course, the inclusion of explanations contained in the manual which may appear very elementary for some type of staff is justified.

Presentation

9.7 The following points should be borne in mind. The language must be clear and simple so that it is easily understandable. Idioms should be avoided, since their meaning may vary according to the different regions of the country. As much as possible, words which can be interpreted in many ways, or words which differ in meaning from one locality to another should be avoided, or the desired meaning should be emphasized.

Format of the manual

9.8 The manual should not be too big. It should be of small size so that the enumerator can keep it conveniently in his pocket, and will thus always have it with him. Care, however, should be taken that it covers all the points.

9.9 For rapid printing of the manuals it is customary to reproduce the typewritten sheets by means of a reduction process; this system causes problems since at times the printing is so small that it is difficult to read. It must be borne in mind that the size of the print used in the manual is an important factor so that it can be consulted easily. It may be recalled that in many cases the field training is carried out in places where the light is not good and reading of small print becomes difficult.

9.10 The chapters and paragraphs should be separated, making the title stand out by large lettering and preferably with some drawings enabling the subject dealt with in each chapter to be identified. When the chapters are very long, drawing or illustrations should be used so that they may serve as points of reference and make it easier to locate the subject.

9.11 It is also customary to leave a very wide margin on the left of the sheet in order to highlight the points which are dealt with in each paragraph which will enable the subjects to be found more quickly. When a small sized manual is desired, or when there is a shortage of paper, this system may not be very advisable.

9.12 As already stated, the census officer will not be able to memorize the whole manual, but he must be perfectly familiar with it in order to know how to consult it rapidly in case of doubt, and for this purpose the illustrations and marginal subject headings of the paragraphs are of great assistance.

9.13 Also, in order to facilitate the consultation work, the manual should have an index of chapters and their different paragraphs. These have to be numbered and one way of doing so, which is very convenient and is often used, is to use for the paragraphs the number of the chapter to which they belong followed by a full-stop and the progressive number corresponding to the paragraph, for example: Chapter 1 General Information; 1.1 What is an agricultural census?; 1.2 Objectives of the census; etc.

9.14 The margins should be wide so that the field staff can write down the notes which they deem necessary to clarify further the points which they find confusing. During the training course the staff can be encouraged to do this, since the majority of them have been taught not to write on books; they therefore hesitate to do so and write their notes in notebooks or on loose sheets which are easily mislaid.

9.15 It is essential that the paper used for the manuals should be of good quality, thick so as to stand up to frequent handling without becoming torn or damaged, and that the print should be clear and not become smudged or stained with use.

9.16 Bearing in mind that the staff will be working in the field most of the time, exposed to the inclemency of the weather, the title page should be resistant; moreover, it should be of a colour which attracts attention so that it can be located easily among the census papers (if it cannot be carried in the interviewer's pocket).

Contents of the manual

9.17 With regard to this point, as basically three types of field staff exist, namely the area chief, the supervisor and the enumerator, the content is different for each of them. However, as there are a series of items which are common to all the census officers, such as the purposes of the census, basic definitions, explanation of the legal basis, etc. in many countries it is customary to prepare only one manual including a part with the common items and a part for each level of officers in which detailed instructions pertaining to each category of staff are given. In this way, it is easy for everyone to read the part relating to his work, since it has been observed that when separate manuals are printed and only refer to items contained in the manuals of the immediately subordinate officers, these are not consulted. Sometimes three separate manuals are drawn up but are printed together forming a single volume. In both cases the system has advantages and perhaps the main objection to it could be that it is sometimes too voluminous and the pages tear off easily.

9.18 Whichever form is chosen, one or various manuals and for whichever census officer the manual is being prepared, the order of the items must be logical. At the beginning there will of course be an explanation about what the census is, its legal bases and the reasons for taking the census. This explanation must be within the grasp of the census officers and provide them with the necessary elements so that they in turn have arguments to give the farmer whom they are going to interview and any other class of person (or authorities) whose collaboration they are requesting.

Census operation

9.19 A clear understanding of objectives, procedures and definitions affecting census work promotes efficiency in the census enumeration process. There should be provision for such information in the enumerator's manual. Possible considerations for such clear understanding will be discussed below.

9.19.1 Objectives and nature of the census. In general, regardless of the development of a country, the objectives and nature of agricultural census are the same. It should be made clear to the enumerator that an agricultural census is an inventory of the agricultural resources of a country. Information on the primary producing unit, the farm or farm holding (or simply holding) are collected. The most ideal inventory is to include all holdings producing crops and livestock products, regardless of size and location. However, economic and practical considerations limit the coverage to farm holdings meeting certain specifications. It should be clearly stated whether the limiting specifications are based on area, or certain number of livestock, or a minimum quantity or minimum value of agricultural output or agricultural production intended for sale and/or for consumption.

9.19.2 Organization responsible for the census. In an extensive operation as that of a census too many problems may arise if the guidelines are not well defined and if there is no idea of organization. It is, therefore, indispensable to include in the manual the corresponding organization, mentioning the office responsible for the census, its various regional offices involved in the census work, as well as the officials in charge, and the position within the organization of the bodies which are especially created for census purposes, such as census committees in the different politico-administrative divisions. This description of the census organization, in particular that corresponding to the census which is about to be taken, will enable each officer to understand the role he has to play in this structure. First of all the work which the census officer has to carry out will be explained in a general way, so that he understands the fundamental purpose of his work and each step can then be described in detail in the body of the manual. A report on the forms which he must fill in and the material he will receive should be included so that when he delivers the material he can check that it is complete, or if this is not so, he can take the necessary measures to complete it.

9.19.3 Legal aspects. The legal responsibilities and entitlements should be mentioned in the manual. As in many countries a law on statistics exists and in some of them a specific decree will have been promulgated to facilitate the census work, the corresponding chapter should be based on these documents. The field staff should be provided with a copy of the decree in question so that they feel that they have sufficient authority to carry out their work, but stressing that they must always try first of all to convince the farmer who is unwilling to give information and only in extreme cases use the argument of the sanctions.

9.19.4 Confidentiality of census data. Emphasis should be laid on the obligation which the census officers contract to maintain the confidentiality of the data they obtain, and some additional precautions have to be taken in this direction such as keeping the completed papers in a safe place, carrying out the interviews without witnesses, that is to say, not in the presence of anyone who may be accompanying the census officer or the farmer, unless the latter so wishes; and other precautions deemed necessary may have to be taken. Furthermore, a report should be included on the obligations which the census officers have to perform in their capacity of civil servants working specifically in the census, such as to be kind and courteous with the respondents, not to discuss political or religious matters, not to ask the producers for food or anything else, not to sell anything, etc.

9.19.5 Definitions and concepts. A chapter will be devoted to the definitions and concepts which are utilized in the census, and which must be thoroughly understood and memorized by the field staff. Among them are census unit or farm unit, producer, crop year, period of reference, and many others.

9.19.6 Map-making and reading. An important aspect which should be explained in great detail and very clearly is that of map-reading, because the majority of the staff is not accustomed to using maps, making sketches and performing other map-making work, which they certainly will have to do and which will be even more difficult since census maps in general are not very good. Although this is a subject which might be considered in common for the field staff, it presents slight differences for the various census officers, since they do not all have to perform the same map-making work.

9.19.7 Administrative aspects. Often the administrative aspects are not described in detail in the manual; as they are of vital importance for the census officers because they are closely related to the remuneration they will receive, it is advisable to devote a chapter to this subject, which moreover will take up a great deal of their time. Even though during the training course points are dealt with such details as how the salaries are paid, the checking of subsistence allowances, etc., and the administrative forms which have to be filled in are described; generally these instructions are not set down in writing and problems arise creating some discontent among the staff who did not understand the instructions properly and who do not receive their wages punctually, which has an adverse effect on the census work. For this reason it is advisable to include these

subjects in sufficient detail in the manual. The work schedule should be specified, which may be very flexible but will involve working on Sundays and holidays, and likewise the frequency of meetings with the chiefs. It is not advisable to call the staff, above all the enumerators, too frequently to the regional office or to some meetings which the supervisor or area chief may call at other places, since the journey to these places will probably take up too much of their time; it is preferable to meet in the working areas.

9.19.8 Period of work. The period of work for which each type of staff is hired should be fixed, since many problems arise when officers contemplate the possibility of the period of work, especially the census taking, being extended and their receiving extra remuneration. When they see some slight possibility of this occurring they tend to work more slowly at the outset and when they realize that there will be no extension to finalize the census, they speed up too much and may neglect somewhat the quality of the work. It is therefore very important that the duration of the census be fixed in a realistic way which can be strictly observed and it is stated quite clearly in the manual that the periods fixed have to be respected.

9.19.9 Supply of questionnaires. Among the administrative matters the dispatch of the completed questionnaires and other forms which have been designed in the central office must be considered, some of which will be different for each of the three categories of census officers. Therefore the manner and frequency of the dispatch of this census documentation to the regional offices and from there to the central office or to some individual offices must be specified in the instructions. Frequently these instructions are given verbally at the end of the training course and are consequently the cause of many subsequent explanations. A special mention should be made of the dispatch by mail or by any other means of transport which according to the census legislation will afford exemption from certain postal charges, since probably for this to be effective special procedures must be followed with which the staff must be conversant in order to be able to obtain the corresponding benefits. The same is applicable to transport facilities for staff travel. All the aforementioned subjects should be included in the manuals of the three categories of field staff. Those subjects which apply specifically to each one of them will be dealt with hereunder.

9.19.10 Other information. Censuses have been used synonymously with complete enumeration. Lately sampling is also used for census enumeration. Such a method of collection should be explained in the manual. It is useful to include in the manual a brief discussion on geographic coverage and time reference of the information to be collected.

The interviewer and interviewing

9.20 A successful interviewer must possess certain essential qualifications and characteristics and must undergo training. What personal attributes enable a person to become a skilled interviewer, no one knows with certainty. However, it is conceded that ability to interview rests not on any single trait, but on a vast complex of them. Habits, skills, techniques and attitudes all are involved. Competence in interviewing is acquired only after careful and diligent study, training and prolonged practice and a good bit of trial and error. Interviewing is not an exact science; it is an art.

9.21 There is always a place for individual initiative, for imaginative innovations, and for new combinations of old approaches. The skillful interviewer cannot be bound by a set of rules. Likewise, there is no set of rules which can guarantee to the interviewer that his interviewing will be successful. There are, however, some accepted, general guideposts which may help the beginner to avoid mistakes, learn how to conserve his efforts, and establish effective working relationships with the respondents, to accomplish, in a short time, what he sets out to do.

General suggestions for preparing the interview

9.22 (i) The interviewer should plan his daily routine for interviewing. It is important that the interviewer knows clearly what he wishes and feels able to accomplish. It may be desirable, especially for beginners, to write down these objectives, spell out possible problems and possible modification. In other words, he should plan and decide what is to be accomplished.

9.23 (ii) It is desirable to have advance information about the area of interview and the people to be interviewed. If possible, as it usually is, the interviewer should learn as much as possible about the place where the interview will be conducted and persons to be interviewed. What needs to be known will vary with the situation, but the general principle of knowing the respondents holds in all cases. This advantage is available to the local enumerator.

9.24 If the area involved is one of a cultural group, it is often wise to interview the leaders first to enlist their cooperation and if they see any justification for the interview, to have them recommend the interviewer to others in the group.

9.25 The principle of interviewing the leaders first does not only apply to cultural groups. It is also applicable where there exists an organization or an institution. The persons in charge should be approached first and their cooperation secured before interviewing others in the organization or institution.

9.26 (iii) If possible, appointments should be made in advance. For census purposes, such appointments are made through publications, announcements, etc. of the date the census will begin. In some countries, every household is requested to have somebody present in the house during the time the interviewer is expected to be in that vicinity. The interviewer can also make his own appointment. This means that he should have a knowledge of the daily routine of the respondent if a proper time and place are to be chosen. Some experiences in agricultural surveys show that in interviewing the holder it is advantageous to have the wife present. She usually remembers a lot of details involved in the farm operation, specially those pertaining to financial matters.

9.27 (iv) The interviewer should practice taking the respondent's point of view. The objective in this practice is to be able to see the problems as another sees them and to feel toward them as he does (this is known as empathy). A substantial amount of empathic ability is essential for successful interviewing.

9.28 (v) The interviewer should know himself. Few people realize the extent to which everyone is committed in advance to certain opinions, convictions, attitudes and preconceptions. Everyone has some prejudices whether he realizes this or not; everyone carries with him certain stereotypes, preconceived notions about individuals and groups. There is probably no such thing as a truly open mind, one totally unencumbered by preconceptions, totally preceptive to new ideas. This does not mean, however, that such preconceptions cannot be reduced in number and effect or that they should not be faced and either eliminated or discounted.

Some tips on interviewing

9.29 The adequacy of a technique for collecting data is ordinarily judged in terms of criteria of reliability and validity. Reliability requires that repeated measurements yield results which are identical or fall within narrow and predictable limits of variability. The criterion of validity demands that the measurement be meaningfully related to the objectives.

9.30 Both these criteria apply not only to the data collection instrument but also to the technique and procedure specified for using the instrument. The reliability and validity of census data depend not only on the design of the questionnaire but also on the manner of administering the instrument, the technique of interviewing. The following are some tips on conducting interviews to aid the information-getter in achieving the two-fold goals of reliability and validity in his data collection.

9.31 (i) The interviewer should establish a relationship of confidence. The first step is often the most difficult for the interviewer because at the initial contact the respondent needs to be motivated to permit the interview. The ideal atmosphere for such motivation is one of mutual confidence. This confidence must not be just one-sided. It must also rest on genuine and deeply felt respect on the part of each for the other person. It is the interviewer's responsibility to take the lead in establishing the relationship of mutual confidence.

9.32 Ordinarily the interviewer may follow a sequence of procedure as follows:

- a. identify himself by showing an authorization card
- b. explain the purpose and objectives of the census
- c. describe the method by which the respondent was selected, specially if sampling is used
- d. state the anonymous or confidential nature of the interview as provided by the census law.

In many cases this is enough to secure cooperation and confidence. Most people are only too ready to talk about themselves and to air their views. Common politeness, mixed with curiosity, does the rest. Besides, rural folks are simple and known for their hospitality.

9.33 (ii) The interviewer should help the respondent feel at ease and make him ready to talk (motivated). To achieve this end, the interviewer should also be at ease. He can show this to the respondent by using an informal and natural (conversational) manner of talking. He should begin by a conversation on something of mutual interest or easy to talk about, topics such as the ball game or the weather. He should carry on such a conversation to allow the respondent a little time to get accustomed to the situation. However, this warm-up conversation should not be too prolonged for it may suggest to the respondent that the interviewer is reluctant to deal with the real purpose of the interview.

9.34 (iii) Good interviewing means attaining uniformity in the asking of questions and in the recording of answers. The interviewers are expected to ask all the applicable questions; to ask them in the order given and with no more elucidation and probing than is explicitly allowed and to make no unauthorized variations in the wording. The manner of asking the question will differ and affect the way it is answered. The interviewer should be warned about this and instructed to adhere to the prescribed wording and not to give any lead by explanations.

9.35 (iv) It is essential that the respondent feels free to talk unhampered by unnecessary interruptions. Once the interview is proceeding, the respondent should be allowed to talk freely with little prodding from the interviewer. The interviewer should not dominate the interview nor make prejudicing remarks. The interview must be in a warm and cordial atmosphere.

9.36 (v) One of the most important qualities which the interviewer should develop is to listen. Listening is a skill which must be learned and practiced. Only through proper listening the interviewer can discriminate between what should and what should not be recorded.

9.37 (vi) Enough time should be allotted for the interview. The time to be allotted for the interview should be sufficient for the respondent to ponder on the answers. The respondent should not feel that he is being pressed to compete the interview in as short a time as possible. The interviewer should desist cutting the interview short because he is under pressure to complete the census of an area in a definite period. Otherwise the interview will be a hasty one and the respondent may be forced to withhold information.

9.38 (vii) The interviewer should keep the interview under control. Quite often respondents will avoid certain questions by trying to wander to other topics in the course of the interview. The interviewer should learn the technique of rationing and putting up timely questions.

9.39 Some questions are necessary and often unavoidable in some items in the census questionnaires. The respondent may run dry of answers and need restimulation. On other occasions he may be engaging in irrelevant accounts of how he happened to use a particular rice variety. Raising a well-timed question will put the interview in its proper course.

9.40 (viii) Responses should be recorded during the interview. Experience has shown that the only accurate way to reproduce the responses is to record them during the time of the interview. A good deal of relevant information is almost certain to be lost if the recording is left until the interview has been completed.

9.41 (ix) Completion of the interview does not mean the interview is closed. Even after the usual exchanges of departing remarks, the interview is not yet closed. There are still post-censal activities to be done and therefore the respondent should already be warned about these at the completion of the interview.

Some suggestions on resolving common major problems in interviewing

9.42 Available literature does not provide the interviewer with adequate methods for dealing with all the variables at work during the interview. Much of the available literature consists of rules of thumb presented as lists of "do's and don't's" for the interviewer. These do's and don't's are compiled and based on interviewing experience derived from a variety of situations over a considerable period of time. They represent practices which have achieved a degree of success in a variety of situations. As yet, there is no integrated theory on which to base a complete understanding of the communication process and the interaction between interviewer and respondent. A lot must depend on experience and theory in communication.

Manual for the enumerator

9.43 A general description of the work to be carried out will include basically that the enumerator will travel through the areas assigned to him, identifying the farmholdings and asking the farmer for the information requested in the questionnaire or questionnaires which have been designed, and for which he will have to abide strictly by the instructions given to him.

9.44 International recommendations point to the advisability of carrying out a sort of precensus which will make it possible to draw up a list of the farms, and whether a sample or complete enumeration is used, this list will serve to decide which farms will be asked to complete the census questionnaire; however, in many developing countries this operation is not carried out, and the enumerator has to tour the area assigned to him, making at the same time the list of farms and completing the questionnaires.

9.45 Whatever procedure is used, detailed instructions will be given for carrying it out, taking into account both the problems which arise more frequently, and those which are not so frequent but which are more difficult to resolve. All possible problems cannot of course be mentioned, nor would it be prudent to do so; what is intended is that the enumerator should have the necessary guidelines to approach the problems in the light of

these and to resolve them correctly. The problems will be both of a technical and an administrative nature, for example how to ask for information in a settlement in which the plots are owned individually but some of the activities, such as sowing and harvesting, are carried out with machinery on a cooperative basis; if the producers report their production in measurements which have not been considered on designing the questionnaire, if there is a strong resistance on the part of farmers to supply the information requested on account of problems with the municipal authorities, if they do not receive their salary in time owing to administrative delays, if they need to hire a boat to reach some area and this has not been authorized, and many other things which occur frequently.

9.46 Simple but effective instructions should be given on how to approach the farmer in order to get him to supply the information requested; these include the initial greeting, the introduction giving his name, the agency which has sent him (showing at the same time his credentials which accredit him as census enumerator), the brief explanation that an agricultural census is being taken and why this work is being carried out, what advantages it will bring to the country and also to the farmer, until he takes leave of the farmer thanking him for his cooperation.

9.47 It is advisable to draw up an annexure illustrating an interview with a farmer, the way this should be conducted, to familiarize the enumerator a little with the technique of interviewing. Moreover, in this way he will realize that the questions are not always put directly, that sometimes some replies already noted have to be rectified, because the information which is obtained subsequently makes it clear that there were errors in the earlier replies, or on the contrary, the data which he is noting down may not agree with the responses to the other questions.

9.48 The sample interview will provide the enumerator with the resources and devices to which he must resort to obtain the most reliable information, checking the data given to him by the producer without offending him by appearing to doubt his word. Some enumerators will have experience of how to interview a farmer, because they are extension workers or rural teachers or have some other occupation which brings them into contact with the farmers and they are familiar with them, but in other cases the enumerator will not have this experience and he will find the example very useful. It can also be used as a verbal example in the training course before carrying out some interviews directly with farmers who have been invited to the course for this purpose.

9.49 If the questionnaire is drawn up in the form of questions these must be read and only in case the farmer does not understand them they should be formulated in another way (if the census questionnaire is well designed the number of questions requiring explanations will be very few).

9.50 The fact that the respondent must be given time to answer the questions should be emphasized, since for some of them the farmer will have to think back before being able to reply. It should also be mentioned that the response must never be suggested; questions such as "Did you harvest maize this year?" must be completely discarded. Information provided by a person other than the farmer is generally not acceptable. However, in special cases it may be accepted provided that this person is well informed of the farm's activities. Therefore, the enumerator should be informed as to whom he may interview and how to proceed in case he does not find suitable informants when he makes his round. In addition, there should be a fixed number of visits which he should make in his effort to interview the farmer before informing the supervisor so that the latter may assume responsibility for the matter. He should be taught how to fill in each of the forms which will be used, devoting, of course, special attention to the census questionnaire. In general for all the forms but principally for the questionnaire it is advisable to take each question in order, explaining those which are known to be more difficult, mentioning the problems which are expected to occur more frequently, the way to resolve them and the type of replies which are not acceptable. If the questions are not written down in the census questionnaire some ways of formulating them will be suggested, at least for those which it is easy to present badly. It will be explained when to make notes on the questionnaires and where these notes should be written.

9.51 It is very important to teach the enumerator to revise carefully the responses that he has noted before finishing to fill in the questionnaire, so that in case of doubt he can immediately clarify the situation with the producer and complete the information whenever he has left out some response. He must be informed that the questions are so important that they should on no account remain without response. It is advisable to prepare an annex to the manual containing a series of examples and exercises on the way to fill in the questionnaire. Exercises explaining the definitions and basic concepts and giving some information on map-making could also be included. If it is too bulky it can be presented as a separate booklet which will be very useful for the enumerator to study on his own so as to become thoroughly conversant with the subject. It can also be used by area chiefs and supervisors for the same purpose and for the training course for staff under their command.

9.52 The enumerators will be given instructions to prepare the itinerary which they will follow for census taking, although in regions which are difficult to reach it may be rather difficult to know in advance what communications there are between the small villages in the area and, therefore, the travel time required. However, the enumerator must have at least a rough itinerary so that the supervisor can plan his visits and control the work of the enumerator effectively.

9.53 As mentioned in the preceding paragraphs, a subject which deserves special attention is the use of maps. The enumerator should be shown how to find his way in the field by means of a map and how to interpret the symbols. As sometimes it will not be possible to provide cartographic material, instructions will be given as to how to prepare simple sketches which delimit the working area of the enumerator. It is generally desirable that the location of the farms covered by the census should be marked on the cartographic material distributed and this, therefore, should be specified in the manual. The same applies when it is desired that the enumerator up-dates the map.

9.54 In brief, the basic contents of the enumerator's manual may be as follows:

- (i) Why the census is taken and its importance
 - 1. Objectives of the census
 - 2. Uses of census information
- (ii) General information about the census
 - 1. Nature and scope
 - 2. Definitions and procedures
 - 3. Administrative instructions
 - 4. Method of collection
 - 5. Time reference
 - 6. The census field organization
- (iii) The interviewer and interviewing
 - 1. Desirable attributes of the interviewer
 - 2. Preparation for the interview
 - 3. Tips on interviewing
 - 4. Resolving common major problems in interviewing
- (iv) The questionnaire
 - 1. Basic concepts and definitions
 - 2. Item by item explanations and how to make the proper entries
- (v) Other census forms
 - 1. Mapping and listing forms
 - 2. Conversion tables and related tables.

Manual for the supervisor

9.55 In many countries manuals are not prepared or do not contain sufficient details, because it is presumed that the supervisors are of a certain level and many things may be left to their judgement. However, in order to discharge such an important function guidelines must be provided so that procedures will be uniform, otherwise the quality of information obtained may be too low.

9.56 It is essential that the manual should emphasize that the work of the supervisor is mainly to support and assist the enumerator, to improve the quality of his work and to coordinate everyone's efforts, since a very negative but very generalized approach is to consider the supervisor only as a judge or district attorney who will apply sanctions if the enumerator does not perform satisfactorily the work with which he has been entrusted. The supervisors who are in direct contact with the enumerators are in the best position to encourage them to carry out their work properly.

9.57 The general description of the supervisor's work is extensive since his functions are very varied. They include some work prior to the census such as checking the maps he has received and the lists of important farms which must be surveyed in the area allotted to him, and in some cases the preparation of these lists is assigned to him; he also hires and trains the enumerators who are under his command. During the census he will observe the interviews carried out by the enumerators, check at least some of the data obtained, so as to be sure that the interviews have actually been carried out and have not been invented by the enumerator, and in some cases he himself will also have to interview the farmers and complete the questionnaires. He will also have to revise the completed questionnaires, summarize some of the data which will serve to provide the immediate results of the census, and send the census papers to the regional office. Apart from this it is quite probable that he will have to deal with other administrative aspects such as to check the extra expenses of the enumerators, distribute their salaries and hire and dismiss the enumerators. After the census he will have to make his final report and check some expense claims which have remained pending.

9.58 Sometimes he will also be assigned to further duties: the promotion of the census and the formation and setting up of the census committee, the latter when his work area coincides with some politico-administrative division. Generally the distribution of the staff and workload to them is carried out in the central office by dividing the country into census sectors, that is to say, into areas which are assigned to each enumerator, but in other cases, due to the lack of up-dated or to less reliable maps, the supervisors are assigned politico-administrative units which are in principle easily identifiable in the field and are given the responsibility of distributing the enumerators who will be under their command. In this case, they must be given precise rules to facilitate their work, so as to avoid duplication or omission of areas of their work. It is essential that a sketch be prepared in which the area assigned to each enumerator is shown and these sketches should be sent later to the central office which will use them for various purposes. It must be specified whether the preparation of the sketches is the task of the supervisor or of the enumerator. Generally it is done by the latter.

9.59 Having sketches of the areas assigned makes it possible to control the census taking and makes its supervision easier. It is worth pointing out that the distribution of work among the enumerators should be equitable, so that there is no favouritism and some do not have an excessive workload while others have practically nothing to do. This situation creates too much friction among the staff and is detrimental to the quality of the work performed. However, if through lack of information it is feared that the distribution is not fair, the enumerators will be advised and will be asked to report frequently to the supervisor to receive new orders, and the latter must control the progress of the work very carefully to make the necessary adjustments.

9.60 A preliminary list of farms is not always made, but nearly always there is a list of the most important census units, which in the majority of cases is based on the previous census and is sometimes amplified by up-dated information supplied by the farmers' associations or other bodies connected with the agrarian sector of the country. The supervisor must be given instructions to check and amplify the list and use it in checking the work of the enumerator. Sometimes it is the supervisor himself who will have to prepare the list of the most important farms in his area, in which case he must be told the criteria he has to follow in order to judge whether a farm is important and which agencies and persons he must approach to obtain the information needed for the preparation of this list.

9.61 If the census is based on a sample, the supervisor may be responsible for the selection of the sample, and it is essential that the instructions in the manual be very clear and precise. It should be emphasized that this procedure is based on certain statistical principles, for which it is indispensable that the instructions be followed closely, since unauthorized modifications may seriously distort the results obtained from the sample.

Recruitment of enumerators

9.62 Instructions for the selection of enumerators should be as detailed as possible, starting with the basic qualifications and experiences required, although howsoever precise the instructions may be, something will always have to be left to the judgement of the supervisor. However, the final selection and hiring of the staff will be less subjective because it will depend on the evaluation of the quality of the candidates during the course, which will be made principally by means of an examination based on a model prepared in the central office.

9.63 The supervisor must be provided with the lists of agencies which he should approach for recruiting staff, the requirements which the candidates must meet, as well as those undesirable characteristics which make it unavoidable to reject a person as a possible enumerator, for example, if he has some physical impediment, such as lameness, a stutter, etc.

Training of enumerators

9.64 As the supervisor will be responsible for training the enumerators, guidance regarding the subjects which must be dealt with during the training course should be included in the manual, with the approximate time which should be devoted to each subject, as well as their distribution throughout the days of the course. In this way the risk of not covering all the subjects or not giving due importance to some of them will be avoided.

9.65 He should be told the type of premises he need to procure for holding the course and the material which should be available. Stress should be laid on the importance of supplementing the theoretical training of the staff by practical training consisting of interviews and census work in the field. They will be informed that both activities will be the same as those which they carried out during their training. The practical field work will be carried out in a nearby area and cover all stages of the census, from the identification of the boundaries of the enumeration area to the revision of the questionnaires.

9.66 Emphasis should be put on the fact that howsoever good the training course may be and howsoever competent the candidates for the job of enumerator may seem, field practice is always necessary, because it is there that real opportunities will occur to reinforce the theoretical training.

Intensity of supervision

9.67 The supervisor will have to inspect the work of the enumerators, so that they should be told that they must draw up a timetable for this activity, which should be more intensive during the first week of the census so that they can immediately correct the mistakes of the staff. It is in the beginning of inspection that the supervisor will really know the quality

of field work being done by his enumerators. He may plan his future inspections in such a way that he is more frequently available to guide those enumerators who were found relatively poorer in understanding the procedure of census taking.

9.68 Instructions will be given in the manual regarding the number of interviews which he has to observe and how he should do it without embarrassing either the enumerator or the farmer, as well as how to give guidance to the enumerator on the basis of what he observed. In addition, during his field visits he will check a sample of questionnaires completed by the enumerator.

9.69 Since one of the functions of the supervisor is to ensure that the census finishes on the fixed date, he must control the progress of the field work. For this purpose he will be given instructions as to how to keep a suitable record to enable him to evaluate the performance of his enumerators. He will generally have printed forms on which he will only need to make the relevant notes. He will also have printed forms to report to the regional office on the progress of the work, and it will be stated in the manual at what intervals these must be sent.

Power of the supervisor

9.70 The supervisor must have at his disposal a series of measures which he can apply in case any of the enumerators are not performing their work satisfactorily. As a last resort he will have to dismiss them. The replacement of enumerators is one of the problems which the supervisor will have to face, not only for the aforementioned motive but for other reasons, such as illness, family problems, accidents, etc. He should, therefore, receive guidance in the manual as to how to resolve this problem, either by hiring staff who attended and passed the training course but were not hired because the posts available were covered, or by extending the census period and dividing the work among one or more enumerators who have been working well and who will be transferred to the areas where there is no enumerator once they have finished the work which had been initially assigned to them.

How to solve the difficulties of the enumerator

9.71 In spite of the fact that the enumerator has received instructions for solving the problems which are expected to occur more frequently, or other especially difficult ones, he usually reports them to his supervisor, as well as other problems which arise and which, if he cannot solve them, hold up the census. It should, therefore, be stressed in the manual that the supervisor must study carefully the guidelines given to the field staff for dealing with the problems, since he must be in a position to solve them and only in extreme cases he will refer them to the area chief so that the latter may advise him as to how to proceed.

9.72 The enumerators will also inform him of interviews which they could not carry out owing to the refusal of the farmer to give the information, or because they were unable to interview him, in which case the supervisor must try to interview the farmer himself and the manual should, therefore, contain some suggestions as to the procedures to be used, such as approaching someone with influence over the farmer, who is willing to convince him of the usefulness of replying to the questionnaire, or some government authority, or else follow the procedure which is considered appropriate in the region where the information is being obtained; in some cases this may be to approach the religious leader so that he may urge him to cooperate, or the leader of a farmers' trade union, or the president of an association, etc. Sometimes, in spite of these expedients, it will not be possible to obtain the information; the same thing will occur in other cases and instructions should be given to the supervisor on how to apply the sanctions which have been established by the census legislation.

9.73 The revision of the completed questionnaires is one of the tasks which the supervisor has to perform, and as it is a very laborious work he should be given practical rules in order to be able to do it efficiently. These may consist in revising only some sections of the questionnaire which are fundamental, or else some questions which are known to be difficult to answer and where the reply may contain serious errors, or what is worse, the question may not have been answered at all. Initially he will revise all the questionnaires of all the enumerators under his command; it is feasible to do so as they are not too many. This procedure will enable him, on detecting errors made systematically by any enumerator, to give the necessary instructions speedily so as to rectify these errors. As the work progresses and since the enumerator will be filling in more questionnaires and the supervisor will have more work to perform, he will not be able to revise all the questionnaires, therefore the manual should contain some very simple sampling procedure which he can use to continue the revision.

9.74 In some countries the supervisor is asked to sign all the questionnaires he has supervised; this practice is not advisable because it takes up too much time and it often happens that he signs them without having looked into them. In addition to affording an opportunity for correcting the work of the enumerators and improving the quality of the information obtained, the revision of the questionnaires in the same area in which they have been completed makes it possible to correct any erroneous data they contain; instructions should, therefore, be given as to how these data should be amended. Whenever possible, that is to say, when communications and available time permit, the badly filled in questionnaires should be returned to the enumerator to rectify the information with the help of the farmer.

9.75 The supervisor is often asked to make summaries of the census results being obtained. It will be indicated in the manual how often these summary reports should be sent and it should be borne in mind when designing the forms for reports that in the majority of cases the supervisor will make the additions without the help of an adding machine, so that although these summary reports are essential in order to have immediate figures, only a few items should be included and an effort should be made wherever possible to choose those which do not entail very large quantities on account of the difficulty of making the additions. Moreover, the forms on which the information from the questionnaires will be transcribed should be designed in such a way that only a few calculations need to be made so as to reduce the possibility of errors.

9.76 Since the supervisor has to draw up a final report, he must be given instructions, as to how to do so, generally providing him with guidance on the subjects which he must cover and also advising him not to go into too much detail, since often the information supplied is so lengthy that nobody reads it.

9.77 The basic contents of the supervisor's manual may be as follows:

- (i) Why the census is taken and its importance (same as in the enumerator's manual)
- (ii) General information about the census (same as in the enumerator's manual)
- (iii) The supervisor and the census field work.
 1. General responsibilities of the supervisor
 2. Recruitment and selection of interviewer
 3. Preparation of mapping, listing and other census field materials
 4. Field supervision, check, edit and progress report
- (iv) The interviewer and interviewing (same as in the enumerator's manual)
- (v) The questionnaire (same as in the enumerator's manual)

- (vi) Other census forms (same as in the enumerator's manual)
- (vii) Appendices.

Manual for the regional chief

9.78 The regional chief will be responsible for the census in the region assigned to him and the description of his basic functions will generally include: setting up a regional office, negotiations with government authorities, with other persons and with various agencies, promotion of the census, hiring and training of the supervisors, distribution of the field staff, receipt and distribution of the census material, general supervision of the field work, receipt and revision of the completed documentation, payment of the wages, summary of preliminary data, dispatch of all the completed documentation to the central office and preparation of a final report. If he has a technical and/or an administrative assistant, he will also have to coordinate their work, but then some of his activities will be transferred to them.

9.79 Somewhat the same thing occurs with the manual for the regional chief as with that for the supervisor; either it is not considered necessary to prepare it or it is done in a very short form. However, this is not advisable and the manual should be designed very carefully since, although the regional chief may have taken sufficient notes during the training course, there will be some points about which he is a little confused, and will need to clear them up by referring to a reliable source. Many telegraphic and telephonic communications between the central office and the regional chief can be avoided if he possesses a good manual of instructions. As regards office accommodation, he should be informed in the manual which government agencies he should approach in order to obtain office premises and equipment, or whether he will have funds available for this purpose. In many countries the first alternative is the only possible one. In fact, when the regional chief has no assistant and has only a secretary, he does not need much office equipment.

Publicity

9.80 Although the propaganda campaign for the census will have been planned in the central office and the regional chief will be sent the publicity materials prepared for him to distribute, he will need to promote some publicity activity using local media such as broadcasting stations, cinemas, theatres, loudspeakers, etc., for which he will be given instructions and advised of the funds available for this purpose.

Regional census committee

9.81 The regional chief should also be given very clear instructions for the formation of the census committees, that is to say, who should comprise them, approximately how many members they should have, what the functions of the committees are, when they should start to function and when they will conclude their mission, and other details which are considered pertinent so that the committees are of real assistance and not a hindrance to the census work.

9.82 As it is quite possible that he may not have a very big office, he should be advised as to how to handle and control the census documentation which he will receive from the central office and what action he should take when any forms are missing. For example, in some cases he may authorize their reproduction locally.

9.83 In addition to what is included in the supervisor's manual, the following points may be added in the regional chief's manual:

- (i) Selection of applicants for the supervisor posts;
- (ii) Training of supervisors;
- (iii) Receipt and revision of questionnaires and other forms completed in the field;
- (iv) Dispatch of progress reports on the census;
- (v) Summary report on preliminary data;
- (vi) Instructions on administrative aspects in relation to the checking of expenses, payment of wages, rejection of faulty work, application of sanctions to officers, etc.;
- (vii) Dispatch to the central office of all the documentations dealt with;
- (viii) Final Report. Format the same as that for the supervisor but containing more subjects.

10. TRAINING PROGRAMME

10.1 A census of agriculture is a large operation. In fact, it consists of a number of agricultural enquiries and the methodology for obtaining data on individual items may not be identical. Even the reference date is not always the same for all items. The respondent, in this case, namely the farmer, is mostly illiterate, particularly in developing countries, and many times does not have correct concepts of quantities. In large countries, the problem of taking agricultural census is still more complex due to considerable variabilities in socio-economic structure from one region to the other. For this reason, the training of the census staff, from top officials to census enumerators should be organized in a planned and coordinated way in every census.

10.2 The census organization would normally consist of various levels of employees. Again some of the personnel would belong to the census organization itself while others - mainly enumerators and immediate supervisors - may be taken on loan for the period of census enumeration from another organization. Different types of training programmes should be devised so that the training given is appropriate to the level of the trainee as well as the task he is expected to perform in the census operation. Training may have, therefore, to be organized at international or regional centres for senior staff, at national training centres for middle level executives and at various places within the country for enumerators and supervisors. Training for supervisors from the census organization who would mainly become trainers for enumerators might have to be organized in a different manner than training for supervisors taken on loan for the period of enumeration.

10.3 Great care has to be exercised in ensuring that the content and timing of the training programmes are appropriate for the class of personnel expected to be trained. Attention should also be paid to developing proper training material for the training classes. If a census has been conducted in the past, the contents of the training materials may be up-dated by using the experiences of the previous census. Accommodation for training classes, as well as, in some cases, for trainees and supply of blackboards and other requisites for holding a class have to be provided if the training programme is to become a success.

10.4 The requirements of training of an adequate number of professional staff, particularly at advanced levels, and for agricultural census staff and data processing experts should be judged sufficiently in advance. Countries requiring external assistance have to take necessary action to include their requirements in their programmes for technical assistance, well ahead of the commencement of work on plans for their agricultural census.

Training at international or regional centres

10.5 There is a definite need to provide long-term training in the various aspects of the agricultural census to persons who are to be entrusted with the overall responsibility of organizing and conducting the agricultural census. Developing countries should delegate for this training appropriately qualified young men who will be placed in charge of the agricultural census. It is of the utmost importance that individuals who are nominated for these training courses are top officials with the requisite sense of responsibility. This could be ensured by offering adequate fellowships for the duration of the training period, as well as other monetary incentives.

10.6 This training could be conducted at an international or regional level. There are a few international and regional centres offering such courses which extend anywhere from a few weeks to a year. The training should be conducted at least three years before the date of commencement of the census in order that a period of two years is made available to the directors to make proper preparations for the census. The training should include all aspects of the census - financial, organizational and technical. It should include in particular:

- (i) census plan design and preparation;
- (ii) sampling techniques;
- (iii) design of questionnaire and its field testing;

- (iv) pilot census;
- (v) manual and machine processing of the data; and
- (vi) drafting of census report.

10.7 Since such international training is much more needed for the census executives of the developing countries, it will be desirable to prepare the contents of such training programmes based on the experiences of past censuses conducted in developing countries. In fact, practical demonstration of census taking which should be an integrated part of the training, should preferably be conducted in one of the typical developing countries. The possibility, for this purpose, of organizing an international training centre in one of the developing countries with financial support needs exploration.

10.8 The adequate training of the executive census staff will, no doubt, make a significant contribution to promoting the agricultural census. Developing countries may also make use of census advisors available through the aid programmes of other countries and U.N. agencies.

10.9 The regional training centres may be organized with the cooperation of the countries of the region and that of international agencies like UNDP, FAO, Ford Foundation, etc. for imparting training to senior and intermediate level personnel expected to be engaged in agricultural census work. These courses should be directed toward training persons in specialized topics such as data processing, etc.

Training at national centres

10.10 Since the international or regional training is usually limited to a few top officials, it is essential to establish national training centres for other census staff. These centres could be established at least one year before commencement of the census. The top officials who are trained in the international or regional centres should be made responsible for national centres. Here, they can utilize material and course content from their training courses modified to suit their country's needs and conditions. Sampling would form an important subject. Practical training in designing and developing the questionnaire, its field testing, pilot censuses, and manual and machine processing of the data would be essential in this training. In large countries the training at national centres should be organized in batches.

10.11 Persons trained at the national training centre are likely to become the kingpins of the census undertaking, and the success of the census operation will depend upon the quality of their work and enthusiasm they can generate among their co-workers and field enumerators. They should not be trained in only what the enumerator is supposed to do, but they should have broader knowledge of the agricultural census. These trained personnel are supposed to train the enumerator and the supervisor in the census work and then, subsequently, supervise their work. It would be desirable to include in the syllabus information regarding agricultural census carried out in other countries, the experience of the past censuses carried out in the country, and the utility of data collected in the census. They should be taught reading of cartographic maps.

10.12 Although the actual contents of the training of the census staff at national level will vary from country to country, depending upon the status of development of agriculture therein, the broad points on which emphasis should be laid, are as follows:

- (i) Training should be theoretical and practical. Experience shows that practical training in simulated census situations is of utmost importance in leading the trainee to understand the theoretical aspect and in preparing him in advance for various problems and complications which may arise during his work. Seminars and group discussions are also found useful.

(ii) The training should be centralized if possible, since this provides unified training in one subject from one instructor. This could be done for census staff and regional supervisors on a national basis, while for local supervisors and enumerators on a regional basis.

(iii) Training should be conducted according to the work and responsibility of each group. Again, the series of trainers should follow the trainees; i.e., the supervisors are to be trained by those who designed the census, and enumerators by supervisors who were already trained.

(iv) Census personnel should be selected on the basis of a written examination and interview at the end of their training to ensure selection of the most qualified persons.

(v) Seriousness of purpose and positive participation should always be accentuated during the training course.

(vi) Training should be carefully organized and outlined with an appropriate time schedule.

(vii) The training staff should meet daily after training classes to discuss the day's work and evaluate every trainee according to his participation, and to discuss the programme for the next day.

Duration and content of training course for enumerators

10.13 The number of enumerators in the agricultural census is quite large. It is clear that all these people could not be trained at one centre. Such training could be organized on a provincial level where a few centres could be established throughout local areas. However, the training could be unified and given at the same level by employing master trainers who could be trained in a provincial central office. Those engaged in training at these centres could be instructed originally at the master training centre. The master trainers could be selected from the supervisory staff.

10.14 Instructions for and training of enumerators are particularly important because the value of the census depends almost wholly upon the enumerators. As to the instructions for enumerators, they should be contained in well-prepared manuals written in simple local languages. They have to be complete and offer guidance regarding all major and frequently encountered problems. Manuals should take into account the prior training and knowledge acquired by the personnel in previous work. Preparation of these manuals is a priority, and should be undertaken by persons with thorough knowledge and experience of the subject matter, the design of the census, and the psychology of both data collection personnel and landholders. In the case of multi-language countries such manuals should be prepared separately in each of the local languages.

10.15 An important aim of training enumerators is to develop their capacity to motivate respondents in giving accurate and complete answers. The training should also equip the enumerator with the knowledge and skills of doing his job completely, since the census is an inquiry of special technical nature. As stated earlier, the enumerator should have certain qualifications, including cognizance of agriculture. The training should be oriented to prepare the enumerators for:

(i) being conversant with the legal provisions of the census and with his own rights and responsibilities;

(ii) approaching the respondents with a sympathetic and persuasive attitude and not as an official intending to force information out of the respondent. This can be realized through training the enumerator not only in the concepts and technical aspects of the census, but also in the art of approaching the farmers properly and winning their confidence. Furthermore, the enumerator should be trained in particular to avoid the temptation of guessing possible answers to some of the questions which the respondent may have difficulty

in grasping. The training of enumerators should extend over ten days, of which two days may be devoted to field work. This field work should involve the enumerator in collecting data from at least ten landholders. However, due to the large number of enumerators, special questionnaires could be prepared for them to review in classrooms;

(iii) reading maps, preparing usable sketches, and identifying individual plots and determining their areas;

(iv) being able to estimate fractional areas of plots by pacing;

(v) being able to estimate the number of scattered trees accurately, distinguish between trees of bearing and non-bearing ages (and, if possible, newly planted and replanted trees), and identifying all important crops.

10.16 The following subjects may be included in the training programme:

(1) Background information

- (a) Information regarding agricultural conditions prevailing in the country
- (b) What is agricultural census; why is it taken; its importance and use; and the world agricultural census

(2) General information for the enumerator

- (a) His job
- (b) His responsibility
- (c) His place in the census organization
- (d) His relations with the respondents
- (e) The census Act
- (f) Confidentiality of information collected

(3) Objectives and nature of census

- (a) What information is to be collected?
- (b) How the census is organized?
- (c) How the census is to be taken?
- (d) In case sampling is being used, how the sample is selected?

(4) The prescribed questionnaires and listing schedules

- (a) Concepts and definitions that are used
- (b) Making entries on questionnaires
- (c) Example of questionnaires already filled
- (d) Cross checks in the questionnaires

(5) Procedures to be followed

- (a) Making appointments
- (b) From whom to obtain information
- (c) Techniques for conducting a good interview
- (d) How to ask questions
- (e) Overcoming objections of holders to provide information
- (f) Ending an interview
- (g) Checking questionnaires
- (h) Calling back to obtain missing information
- (i) Ensuring completion of coverage
- (j) Use of interpreters

(6) Administrative instructions for enumerators

- (a) Hours of work; need to conduct interviews outside normal office hours
- (b) Absenteeism
- (c) Allowances that would be paid and conditions attached to payment
- (d) What enumerators are required to do on administrative matters
- (e) Required records on time and attendance
- (f) Forms to be filled on completion of work at a place

(7) Practical work

- (a) Visit to an area in the neighbourhood
- (b) Distribution of work among the batch of enumerators
- (c) Explaining their work to enumerators
- (d) Actual filling up of some questionnaires by the enumerators

(8) Revision

- (a) Discussion of the filled in questionnaires
- (b) Explanation of concepts and definitions in the light of experience in the field
- (c) Explanation of job requirement of the enumerator
- (d) Explanation of procedures to be followed in enumeration

(9) Examination

- (a) Quiz on the questionnaires
- (b) Quiz on procedures.

10.17 Experience from several countries indicates that the preparation of an enumerator's manual containing the above-mentioned subjects is extremely important. This manual can serve both as an instructional text and as a reference guide during the enumeration. The enumerator's manual should contain in particular adequate details on the procedures for conducting enumeration, examples of completed questionnaires, tips on interview techniques, how to handle problems, etc.

Duration and content of training course for supervisors

10.18 Special emphasis should be given to the instructions for and training of supervisors. In view of the importance of the role of supervisors, they should go through an intensive training programme. Normally, the field supervisory staff would be trained first by the technical officers of the executive agency responsible for the agricultural census. The supervisors will, in turn, train the enumerators. For this reason, the training of the supervisory staff should also include items concerning the training of enumerators, and they should themselves be trained to become good enumerators. The supervisory staff should be trained, in addition to the subjects for enumerators, in the procedures of selecting the enumerators (if they are entrusted with this task), publicity, preparation of field work reports, etc. They should be given actual practice in the methods of training enumerators and in checking their field work.

10.19 The training of the supervisors will naturally take a longer time than the training of enumerators and includes field practice, which may extend to 15 days. The following subjects are suggested for inclusion in their training programme:

- (1) Why the census is being taken, its importance, census organization, and legislation

- (2) Supervisor's work
 - (a) His responsibility
 - (b) How to check maps of local areas and enumeration districts
 - (c) Preparation of lists of landholders and how they are used and checked, using training guides
- (3) Work dealing with enumerators
 - (a) How to conduct training sessions for enumerators and provide additional instructions
 - (b) Action required to recruit and select enumerators
 - (c) How to observe the enumerator at work
 - (d) How to review questionnaires and other records prepared by the enumerators
 - (e) How to measure the performance of enumerators
 - (f) How to handle cases of refusal in providing required information
 - (g) How to handle special problems encountered by enumerators
 - (h) How to replace enumerators
 - (i) How to make a final review of enumerator's work
- (4) Field work
 - (a) Practical training in data collection and filling out questionnaires
 - (b) Organization of field editing and aggregation of completed questionnaires
- (5) Technical matters
 - (a) Reading maps, identifying plots
 - (b) Estimating fractional areas of plots
 - (c) Identifying all important crops
 - (d) Local units used and their transformation to standard units of measure
- (6) Other matters
 - (a) Publicity
 - (b) Data processing
- (7) Administrative instructions
 - (a) Hours of work
 - (b) Absenteeism
 - (c) His administrative authority and responsibility
 - (d) Required attendance records
 - (e) Action to be taken when work is not completed satisfactorily.

Use of training aids

10.20 It has been found in several countries that the quality of training can be improved considerably by making effective use of training aids. Continuous lecturing tends to become dull and boring and any training programme would fail if the trainees do not pay sufficient attention to what is being taught. Audio-visual aids are of great help in this respect.

10.21 One of the most useful aids for understanding a subject by the trainees is a film. A film showing, for example, methods of interviewing holders, or agricultural and living conditions of the holders in the country would be found to be very effective in preparing the trainees for field work. Unfortunately films are somewhat expensive to produce and to exhibit. Inter-country

cooperation in this regard might perhaps be held in producing a good film at comparatively lesser cost for every country.

10.22 Another and cheaper audio-visual aid is provided by slides. Sildes can be produced easily with the help of cameras. It is possible to exhibit charts etc on slides. Projection equipment for slides is not very expensive and nothing, for example, can be a more convincing procedure in teaching than exhibiting a slide of a map showing the boundaries of a locality and explaining the way these boundaries are to be used in the listing operation. Such examples can be multiplied. Teaching with the assistance of slides shown at intervals would lead to better assimilation of the subject by the trainees.

10.23 Charts and graphs are also usually found to be very useful as training aids. The colours used in drawing a chart should generally be quite bright and the charts should be of a large size so that they can be visible in every part of the room.

10.24 Generally, lectures should be interspersed with film shows or slide presentation. The supervisors might also need to be trained in utilization of these training aids in the classes for enumerators.

Training in writing inspection reports

10.25 To control the implementation of census operations and to tighten the inter-relations of various processes according to the time schedule, certain records have to be designed for each census worker to complete daily after his work. The aims of these reports are:

- (a) To communicate information from the lowest stratum of census workers to the operations room
- (b) To inform the authorities of the work and its relation to the proper time schedule
- (c) To identify any deviations so that proper and timely action may be taken.

These reports should be periodical (daily or weekly) and written by certain persons at specified times. They should be as simple as possible with the minimum data needed to ensure the above aims.

10.26 Enumerators and supervisors should be trained thoroughly in writing up these reports, which should, of course, be realistic. There should be separate forms for the enumerator, the local supervisor, and the provincial supervisor. Each one of them should receive several copies of the report sheets designed for his work. Each enumerator must turn in his daily report to his local supervisor who, in turn, writes his report and hands it to the provincial supervisor. The latter delivers his report to the operations room.

11. PRE-TEST AND PILOT SURVEYS

11.1 Agricultural census is a complex operation consisting of a series of closely related steps which must be planned carefully in advance. The operation is particularly more difficult for countries which take the census for the first time and where agro-economic and social conditions vary from region to region. The census, as the name implies, is conceived in principle as collection of data for all individual agricultural holdings by direct enumeration. Whether the census should be conducted on a complete enumeration basis or on a sampling basis will depend upon the purpose for which census data are to be used, the stage of agricultural development, and availability of the field and statistical staff for undertaking the census operation. However, once the decision has been taken on the census methodology and its scope, it becomes necessary to mobilise the available resources of the country for conducting the census. The first step will be to make systematic studies of all the steps that will be involved in an efficient operation of census taking. If the census has been conducted in the past and a well documented material relating to census operation is available, that will considerably help in planning the future census. The past census whether conducted on a complete enumeration basis or on a sampling basis will provide adequate guidelines for future planning. Even the experiences of census experts help on many matters of census taking. However, since the census is usually conducted after an interval of a long period (5 or 10 years) many technological as well as socio-economic changes take place between the two censuses. Particularly, these days in most of the developing countries of Asia, Africa and Latin-America much faster changes are being introduced in the agricultural system for improving the agricultural productivity. Thus, the past experience alone may not, always, be adequate for planning the current census and it may be necessary to plan a pilot census or survey to study the various steps which are important in a census operation.

Pre-test Survey

11.2 Before planning a pilot census which is almost a miniature of the main census, the conduct of pre-test surveys may be desirable. The objective of the pre-test surveys should be confined mainly to the formulation of census questionnaires, instruction manuals, and concepts and definitions, whose adequacy for the main census will be tested through the pilot census. As mentioned in the chapter on questionnaires, the responsibility of formulation of questionnaires should be entrusted to a group of experts on agricultural census and surveys. The very group should be made responsible for testing their suitability in actual field conditions. Obviously, such tests should be conducted under varying socio-agro-economic conditions. The results of the test should be submitted to the National Agricultural Census Committee if such a Committee has already been established, otherwise to the authority in charge of the main census. The report should give concrete and constructive suggestions on the revision of questionnaires, etc. It should, in particular, emphasize the alternatives of the questionnaires which either need to be abandoned or revised. It should critically examine every question included in the questionnaire from the point of view of (i) the reaction of the respondents and quality of information furnished in the answers; (ii) the reaction of the interviewer and difficulties they faced in extracting the information; and (iii) utility of every question from the point of view of data obtained. The pre-test survey should be conducted at least three months in advance of the pilot census, so that there is adequate time for revising the questionnaires, instruction manuals, and concepts and definitions to be used for the pilot census.

Scale of the Pilot Survey

11.3 The scale of the pilot census should be such as to reflect the conditions that one will face in the normal census operation. Its size and spread should be reasonably large to represent the various agro-economic and social conditions of the country. It is generally believed that one or two pilot censuses or surveys should provide adequate experience for planning the main census. This may not be always correct. For example, in big countries like India, Brazil, etc. not only the agricultural situations differ considerably from region

to region but the socio-economic structures are also very much different. This was the main reason that in the last census of agriculture conducted during 1970-71 in India, each of the States was asked to conduct a number of pilot censuses to represent the various agro-climatic and socio-economic conditions. This is necessary because problems vary from area to area and since the problems are different, the approach and technique of census will also be different. It is difficult to make any guess as to how many pilot surveys should be conducted in order to represent the various situations. The current agricultural data and the experience of the senior agricultural officials will be the best guide in the matter.

Concepts and Definitions

11.4 The first step in planning a census will be to evolve appropriate concepts and definitions which should be communicated to the census enumerator for collection of data. Although the work done in the past by the census organization or similar work done elsewhere can be the basis for the preparation of a preliminary draft of concepts and definitions, its applicability in the actual conditions will need verification. This should be tried in pilot surveys through the census enumerator who would be responsible for collection of data in the main census. For example, in agricultural census, the definitions of operational holding, technical unit, agricultural production, operational holder, total area of the holding, tenure and tenancy, area rented, land utilization, net area sown, current fallows, uncultivated and waste land, etc. are needed, which can be used by the census enumerator. Since tenurial system and agricultural practices vary considerably from region to region, it may not always be possible to adopt uniform definitions for the country. Some explanation, which may vary from one region to the other may be necessary. Any fault in the concept and definition will affect the final results. Therefore, the census organization may evolve appropriate concepts and definitions through pilot studies.

Frame

11.5 As has been mentioned in the chapter 'Frame', an appropriate frame of the census enumeration unit is the key to the success of the census operation. The frame is essential in both the cases, whether it is a sample census or a complete enumeration census.

11.6 Because of cost consideration, there may always be a temptation to use some kinds of frames already available or prepared for some other purposes. For example, there may be an attempt in agricultural census to use the frame of households prepared for human census. This is logical and economical to take advantage of existence of such information. However, the frame in agricultural census should be that of the list of operational holdings, which obviously will not be readily available from the list used for human census. A pilot census or survey conducted on adequate scale covering the different situations should provide an idea as to how far such frames can be used. If the frame is to be prepared afresh the problem becomes much more complicated. Practically in all situations, the list of the operational holdings will have to be prepared enumeration blockwise. The enumeration block may be a village or a segment of compact geographical area. A clear identification of enumeration block is essential for preparing an accurate list of operational holdings. The recognition of the boundaries of enumeration block is not always easy. Enumerators do make mistakes, mostly of under-listing the units. Such under-listing will be more common in the situation where the census is to be conducted on a sampling basis, the primary sampling unit being the segment of area or a village. The demarcation of the boundary is more difficult in areas which have not been cadastrally surveyed. The problem may be similar in hilly areas where households are very much scattered. Many such problems have been discussed in the chapter dealing with frame. All such difficulties should be solved through pilot studies.

Method of Inquiry

11.7 An agricultural census operation involves collection of data on a large number of items. Most of the characteristics on which data are needed are of quantitative nature. In most of the developing countries, the farmer does not keep any records of his farm operations. He does not even know the extent of land operated by him. In the absence of any such records, there is no other way except obtaining the data through careful inquiry from the farmer.

Inquiries have their own limitations. Many times the farmer has got no quantitative concept. Even if he has, many of the agricultural operations are such that the memory fails to recall the accurate information and consequently it introduces considerable errors in the census data. For example, farm labour is an item on which reliable information cannot be obtained by making an inquiry once. Similarly data on production of agricultural commodities cannot be readily obtained by making an inquiry once, particularly if the farmer cultivates several crops spread over the entire period of the year. Similarly, to obtain data on the number of trees or on age-wise and species-wise livestock numbers, etc. is not easy through simple oral inquiries. In fact, different methodologies of procuring the data from the farmer will have to be evolved and that will largely depend upon the understanding of the socio-economic status of the farmer. Pilot studies should provide guidelines on the methodology that should be adopted for collection of data on different items.

11.8 Through pilot studies it should be possible to classify the items of agricultural census for which the data can be obtained through oral inquiries with specific reference date. There may be some other items for which there cannot be a reference date but there should be a reference year. Similarly, there may be items, the accurate information on which can be obtained by adopting only objective method of measurement. It is just possible that some of the items may not be subjected to the technique of complete enumeration and even if they are, the cost consideration may not favour such approach. In such situation, it will be necessary to resort to sample surveys. One of the main objectives of the pilot studies should thus be to evolve an appropriate measurement technique and types of enquiries that can be used in the main census.

11.9 When the agricultural census is based on a sample, the results are necessarily subject to sampling errors. Fortunately, these errors can be minimised, to any desired extent, by employing an adequate sample-size and a suitable sampling design. There are, however, other errors. These are called non-sampling errors which affect all census results whether they are based on a complete enumeration or on a sample. Many studies, by using refined methods of measurement have shown that non-sampling errors can be quite serious, and in extreme cases, they can vitiate the numerical results of the census to such an extent as to distort the picture of the agricultural situation presented by the agricultural census. Therefore, in planning and conducting the agricultural census maximum possible attention needs to be paid to devising procedures for reducing the non-sampling errors to a minimum and the additional cost incurred for this purpose should be balanced against the increase in the reliability of census results and their acceptance by the users.

11.10 In collection of census data two groups of individuals namely the enumerators and the farmers are involved and they both make respective contribution to the errors in the results. It is necessary to know the types of errors that these two groups of individuals make, through pilot studies. Once the weaknesses of the enumerator are identified, it should be possible to remedy them through careful preparation and efficient structure of the questionnaires and instruction manuals and training of the enumerator by providing him with adequate facilities and incentives for his work and exercising a close supervision on it.

11.11 It is relatively more difficult to control the respondent's bias. Except possibly in advanced countries with educated and enlightened farming communities, ability and willingness on the part of the respondent to supply correct data for the census cannot be assumed. In most of the developing countries the farmer is mostly uneducated and frequently illiterate and as mentioned earlier he lacks a quantitative understanding of his agricultural operations and cannot interpret the questions correctly. In the absence of any account keeping, he is not able to give precise information from his memory for operations spread over the whole year. There may be other serious reasons for which the farmer may be unwilling to part with the correct information. He may show apparent cooperation with the census enumerator but have an ingrained suspicion and fear about the reasons for the enquiry and the use to which his information will be put. In developing countries which are engaged in land reform programmes such as fixing ceilings on holdings, fear in the minds of the farmer is more intense. He may also frequently suffer from superstitions and fears that the disclosure of any precise information about his assets may bring ill-luck. Through pilot studies such biases should be carefully studied and appropriate solutions obtained.

Sampling Units

11.12 In agricultural census, the ultimate unit to which data refer, is an operational holding. If the census is based on complete enumeration there is no problem of determining sampling unit as all the operational holdings have to be covered in the census. However, if the census is based on a sample, the problem will arise as to what should be the appropriate sampling unit even if the data is to be collected with reference to an operational holding. Depending upon what kinds of frames are available for selection, the sampling design will be determined.

11.13 As we have discussed earlier in most of the countries, particularly developing ones with poor agricultural statistics system, the census will preferably be conducted on a sampling basis. The segment of areas that we may call enumeration blocks will be the appropriate first stage sampling units if the sampling design to be adopted is two stage. For the same number of operational holdings to be enumerated, there may be different choice for determining the size of the first stage sampling unit. The ideal situation will be that the size of the first stage unit should be as small as possible. Statistically, the best situation will be if the individual holdings are directly selected as sampling unit, which will necessarily reduce to one stage sampling design. However, operational holding as unit of sampling may not be always possible due to widespread or extensive travel involved in such a scheme or for lack of a good list of holdings or other resources. Then, the area sampling is necessary in some form. On the basis of the cost and variance considerations, it will be necessary to determine the appropriate size of the sampling unit.

11.14 The determination of an appropriate size of the sampling unit is a complex problem. The census is basically a multipurpose inquiry. Data are collected on a large number of characteristics of the operational holding. What index should be adopted to study the variability between the ultimate units of sampling? What characteristics of the operational holding should be considered most important for determining the norm of variability. This norm may vary from country to country and even from region to region within the country. It will largely depend on the objective of the census and accuracy of the estimates of different characteristics desired. For example, in the countries where livestock farming is most important, perhaps variabilities between the units can be studied in relation to the numbers of livestock. If horticulture is the most important character for a region, the variability in relation to horticulture crops can be adopted as its index. Study of such variations is a prerequisite for determining the appropriate size of sampling unit. Many times, it should be possible to get some rough estimates about such variabilities from past surveys and censuses. If no past data for such studies are available the pilot census should help in providing information on the variability and the cost of enumeration, and it will in turn provide appropriate guidelines for planning the main inquiry.

Size of the Sample

11.15 If the census is based on a sample, the sampler will be faced with the problem as to what should be the size of the sample. This question will arise even if the census is based on a complete enumeration as, at least, for some of the items, sample survey becomes necessary. Otherwise also, for a post enumeration check of the census data which will necessarily be based on a sample, a problem of determining the sample size will arise.

11.16 The first question that any sampler will ask is "what is the scope of the census?" In other words, how the census results are going to be used and what should be the precision of the estimates. It is difficult for the sampler himself to answer these questions. The answer to these questions must be obtained through mutual discussions between the sampler on the one side and users of census results on the other. Once this answer has been obtained, the sampler will like to have some idea about the variabilities between holdings for the individual characteristics. The best index of the variabilities is measured by the variance " S^2 ". In some situations, it is considered useful to have relative measures instead of absolute measures of the variation. The absolute measures, the standard deviation and the standard error, appear in the units of measurement of the variable and this causes difficulties in some comparisons. Common relative measures are the coefficients of variations

in which the unit of measurement is cancelled by dividing with the mean. The element coefficient of variation is derived from the standard deviation:

$$C_y = S_y / \bar{Y}$$

and is estimated by

$$c_y = s_y / \bar{y}$$

By having knowledge of C_y and the desired precision, it would be possible to determine the sample size. The variance of the sample/estimate, however, depends not only on its size, but also on the sampling design. In complex "sampling designs", it depends on the magnitude of other components of variation. Therefore, in determining the sample size, not only the variance between holdings should be taken into consideration but also the sampling design. To design efficiently a large sampling inquiry for collection of census data, conducting a pilot study prior to conducting the main census becomes necessary to gain information and adequate experience for planning and efficient sampling design. The pilot studies should be of adequately reasonable size in order to produce serviceable estimates of S^2 . If the pilot study is too small, its results are not so useful because they are less dependable than expert guesses which we can obtain without it.

Sampling Design

11.17 There are two main parts of sampling design - (a) selection procedure and (b) estimation procedure. The selection procedure is governed by the basic information that is available with the sampler, resources available for inquiry in terms of personnel and money, and its objective. We have already discussed that in agricultural census, the basic unit on which information is needed is an operational holding. The inquiry has to be designed in such a way that ultimately the sampler is able to select a specific number of operational holdings. What procedure should be followed for selecting the operational holdings will depend upon the way in which the basic frame of holdings is available. The selection of operational holdings directly implies the availability of a list of all the operational holdings. This condition is hardly satisfied. Generally, two-stage sampling can be recommended in which a segment of areas like a village or a cluster of villages can be taken as the first stage unit and a sub-sample of holdings from the selected segments of areas as the second stage units. Then, the question will arise whether the segment of areas should be selected directly from the list of segments of areas, if readily available, or they should be stratified before selecting them. The technique of stratification is a very important statistical device for improving the efficiency of a design. Through proper stratification, it should be possible to reduce the sampling variance of the estimate to a large extent.

11.18 There are many reasons for stratification. The list of segments is many times maintained for individual administrative zones separately. Therefore, it becomes convenient to adopt some such administrative zones as strata. In cases, where reliable estimates are to be obtained for individual administrative units, it becomes essential to sample an adequate number of units from those individual administrative units so that the estimates of desired precision can be obtained. Finally, stratification is also done for improving the efficiency of estimates by grouping the sampling units in a way that variation between the groups becomes large and the variation within the groups is as small as possible. For the last category of stratification, supplementary information on the sample units, which are highly correlated with the characters under study should be available. For example, for a sample census of agriculture, the population of the village may be an appropriate character for stratification or even the geographical area may be suitable. The basic principle underlying stratified sampling is to group the sampling units which are homogeneous with respect to the character under study. This kind of grouping considerably increases the accuracy of the estimates, and thereby the size of the sample can be reduced to a considerable extent.

11.19 If the sampling design is multi-stage, the question will arise as to what method of selection should be adopted for selecting sampling units at each stage. It will be generally found that in spite of stratification the sampling units vary considerably among themselves within the strata. It will not be easy to stratify the population to an extent to make

primary sampling units completely homogeneous. In case of agricultural census, where segment of areas are primary sampling units, it is observed that these segments vary considerably. If the selection of the segments is done by simple random sampling method, it is found that the variance between segments is very high. Such procedure also causes administrative difficulties in the field work. For example, a sample of segment of areas is easier and more efficient to administer if the work-load is roughly equal. If large differences exist, either some segments are too large or too small, to organise the field work efficiently by allotting approximately equal work-load, one way would be to sub-divide the bigger units into smaller units so that all the units become of almost equal size. But this procedure may sometimes cause difficulty of identification of units.

11.20 The other way, which is commonly used in some field surveys, is to select the units with probabilities proportional to their size. This technique has found its principal use in sampling designs, which employ sub-sampling.

11.21 In agricultural census, based on a sample, the stratified two stage design is likely to be more acceptable. The stratification of the large units may be carried out to the point at which strata contain only a small number of units and then select the first stage sampling units with probabilities proportional to their sizes. A sub-sample of holdings from each of the sampled first stage units may be selected for obtaining the census data. The pilot study should be efficiently planned to make careful examination of the various aspects of selection procedure.

11.22 In some situations, supplementary information on the sampling units may not be available in a way it can be used either for stratification or for selecting the units with their unequal probabilities. It may, therefore, be possible to collect supplementary information during the course of a census. In such a situation, better methods of estimation known as ratio method of estimation and regression method of estimation in sampling literature, can be used. What methods of estimation should be used will depend upon the types of relationships that exist between the supplementary character and the character under study. If there is a high correlation between the character under study and the supplementary character, both ratio as well as regression methods would lead to a higher accuracy as compared to simple estimates. Again this will need a careful study of the relationship between the character under study and the supplementary character, which can be done in a well planned pilot study.

Questionnaire

11.23 Once a decision has been taken about the content of the census and methodologies to be used, it becomes necessary to formulate an appropriate questionnaire in order to secure relevant data in an orderly and co-ordinated manner to meet the objective of the census. The formulation of questionnaire is important in either of the cases, whether the census is done on a complete enumeration basis or on a sampling basis. It may be realised that the group of enumerators who are employed in a census or in a large-scale sample survey is composed of individuals who are very heterogeneous in the level of training and experience. The questions must be arranged in a proper sequence and properly worded so that the enumerator can secure precise and unambiguous information from the respondents on various items. In the agricultural census operation, the respondent is a farmer. It is generally observed that the farmer in most of the developing countries is not educated and he does not keep any account of his agricultural operations. Then he is also suspicious of parting with any information to the Government agencies. In such a situation, it may not always be possible to get the relevant information by asking him mechanical set of questions in the order given in the questionnaire. It may rather be better to discuss each item with the respondent in a manner as if two persons are carrying on conversation on a subject. The enumerator may have to ask several questions and may have to give background explanation in the dialect of the respondent in order to communicate to him in his language. The enumerator must win the confidence of the respondent and that cannot be achieved through direct questions. It is a good practice to provide the enumerator with a field note book in which he jots down the data and other information that he secures through his conversation with the respondent so that he can then summarize this material or use it otherwise in order to put down on the main questionnaire

an explicit answer, at the end of the discussion, on each item after verifying this result with the respondent by explaining the details to him. It may be sometimes useful to elaborate the questionnaire itself for recording the data from which the final answer emerges. This may however enlarge the size of the questionnaire. In the interest of extracting accurate data from the farmer this trouble is worth taking. Ascertaining the area of operational agricultural holding would be a good illustration. The farmer is hardly expected to understand the meaning of operational holding. This term is really intended for the enumerator who must understand the connotation of filling the right answer. He can then find out from the farmer all land with which he is connected in one capacity or the other, irrespective of its location in the village or locality in which he resides or any other area and then strike a balance by deducting all land which he may own but does not use himself, having leased out to someone else, adding the land which he may have leased in from someone else and also the land which is strictly non-agricultural, etc. To obtain reliable data on these items to build the size of the operational holding, a series of questions will have to be put to the farmer in order to ascertain confidently from him the correct area of the holding.

11.24 The most important source of error as far as the questionnaire is concerned, is due to the improper wording of the questionnaire or because often the person responsible for designing the questionnaire is himself not sure of the meaning of various definitions and concepts used in the census programme. The designer of questionnaires often assumes that the farmer knows everything about the census. Sometimes, it is not taken into account that the farmer belongs to a different category of people and may not always be able to follow or give proper connotation to the vocabulary used in Statistics for various purposes. In all such cases, to all questions which are not unambiguously understood, the respondent is left to his own understanding. Obviously, it opens a way for errors to enter.

11.25 A considerable amount of discussion and experimentation would be needed before the questionnaire is finalized. Initially, the census expert or sampler himself should interview the selected farmers of divergent views and of different types and discuss with them the aspects on which the information is sought to be collected. This can, however, be easily done during the pre-test survey. In framing the questionnaire, knowledge of the farmer, his beliefs, system of values, traditions and customs would be very useful as it would reveal the various reasons that may induce the farmer to hold back the correct information, and suggest means to overcome these obstacles as far as possible in formulating the questionnaire. The final form of each question should be decided after carefully examining each word and phrase in order to ensure that it must convey exactly what is intended and is not liable to convey some other meaning. The questions should be simple so that they are not beyond the farmer's perception. It may be that the sampler may have to make several visits to the typical farmers in order to finalize the form of the questionnaire. Once this has been done, it should be tried through the enumerator who will ultimately be made responsible for collecting the census data. The difficulties of the enumerator should be discussed further to modify the questionnaires. A full discussion on the technique of formulating the questionnaires has been given in Chapter 7. The role of the pilot census becomes very important for finalizing the census questionnaires.

11.26 The advantage of the pilot census should be taken in analysing the time taken in filling the various questionnaires by the enumerators. The enumerators may be asked to note down time taken in completing each kind of field operation, such as preparation of list of holdings, contact of the holder, extracting the relevant information from the farmer, etc. A critical analysis of time records will help the census executive in distributing the workload among the field enumerators evenly. It will also help in assessing the requirements of total enumerators and supervisors for the main census and thereby the estimate of the cost of the enumeration of the census.

Training of Enumerators and Supervisors

11.27 Training of the field enumerators and the supervisors should be considered as an important step in conducting agricultural census efficiently. The field enumerator is the key person in the agricultural census and its success in making available authentic and reliable data of the country's agricultural structure depends largely on him. He should be fully involved and adequately motivated in the successful completion of the census operation.

To develop the capacity in the enumerator to motivate the farmer in giving the correct replies should be an important aim of his training. Considering the technical nature of the inquiry he should be thoroughly equipped with the knowledge needed for doing his job competently. He should be taught to read maps, prepare useable sketch maps and identify individual plots and judge their area. He should be made fully familiar with crop cultivation practices followed in the region in which he is supposed to work. If the region has got any special agricultural characteristics he should be fully acquainted with them. For example, hilly agriculture is very much different from agriculture in plains. Measurement technique of area of terrace cultivation, which is generally followed in hilly regions is much more difficult. Besides, the class-room lectures for explaining concepts and definitions of the agricultural census, practical training should be imparted in the field for interviewing the farmers and in filling up the questionnaires.

11.28 It is difficult to enumerate the contents of the training here. It will largely depend upon the level of understanding of the enumerator and the conditions of the farmers of the region, from whom he has to obtain the relevant data. The content of the training should be determined through the pilot studies. If the census has been conducted in the past and the problems and difficulties of the past census have been recorded, the contents of the training must take them into consideration. If the census is conducted for the first time or even if the census is being conducted with enlarged scope as compared to the previous one, the contents and the methods of training should be evolved through the pilot census. What should be the content of the training and how it should be organized has been discussed in detail in Chapter 10.

11.29 The training will have normally two phases. In the first phase, the field supervisory staff responsible for the Agricultural census operation and for conducting the training of the field enumerators will be trained. Since the supervisor is entrusted with the supervision of the field work of a large number of enumerators with different background, his training must be very intensive and thorough. The supervisor must be trained to become a good enumerator. He must attain thorough knowledge of agricultural census operations so that he is in a position to remove the doubts and difficulties of the enumerator. What should be the content of the training of the supervisor and what should be the duration of such training should again be evolved on the basis of pilot census.

Tabulation of Data

11.30 The Agricultural Census has got a set of objectives which can be studied with the help of data collected. Data are summarized in the form of tables which can throw light on the description of agriculture. Through the pilot census data, it should be studied whether the prescribed tables in the census can be obtained. In fact, the tabulation of the pilot census data should be a miniature of the main census. A careful tabulation of the pilot census data will clearly bring out the deficiency of the questionnaire with respect to coverage of items.

11.31 If the census is based on a sample, a proper estimation procedure will have to be adopted. As it has been mentioned in an earlier section, there are several improved estimation procedures which can be adopted for obtaining the estimates of various parameters. Estimation procedures, like ratio method and regression method depend upon the supplementary data. At pilot stage it should be possible to examine as to what kind of supplementary information, which will help in improving the method of estimation, should be collected. Once, on the basis of such critical examination, the appropriate supplementary variable has been determined, information on it can be collected as an integral part of the main census operation.

11.32 Some preliminary tabulation for the individual segments can be done by the field enumerator and supervisor themselves. This can be studied in the pilot census as to what kind of tabulation can be entrusted to the field enumerators and supervisors. To some extent, the work of scrutiny and coding of data may be decentralised and entrusted to the field supervisors.

11.33 Depending upon the stage of statistical development, the mode of tabulation, whether it should manual or mechanical, should be considered. Where manual labour is costly and where mechanical equipment is easily available and can be properly serviced, the machine tabulation will obviously be preferred. Time is another factor which should be examined while tabulating the pilot census data. If the census results are to be useful, these must be made available to the users in time. To achieve this objective, a time-table of various phases of processing of census data must be formulated with the help of the pilot census. A rational decision about the mode of the tabulation and the requirement of manpower and equipment can be taken on the basis of tabulation of pilot census data. In India, during 1970 census of agriculture some states adopted manual method of tabulation while others adopted mechanical method of tabulation and these decisions were taken by them after gaining experience in the pilot census conducted by them. It is important in any case to consider at the pilot census stage alternative processing methods in all their implications including speed, efficiency and cost by preparing full length tables by alternative methods. If necessary, for arriving at a firm decision as to whether one or the other method or combination of both would be employed in preparing the final census results alternative procedures should be tried on the pilot census data.

Size and Nature of Pilot Surveys

11.34 From the foregoing sections, it is very clear that pilot surveys should preferably precede the main census. Through pilot surveys we get facts and we gain experience. Without pilot surveys we work on the basis of guesses and more or less qualified judgements. Pilot surveys represent details and means for achieving rational designs through which we can attain objectives of the census. The decision in favour of taking one or more pilot studies will depend upon the agro-climatic and socio-economic conditions of the country. An important principle of the pilot survey is the wide applicability of the design. The design must be prepared in such a way that it is possible to derive large varieties of conclusions. If the census is being conducted for the first time and that also on the basis of a sample, the pilot survey should be organized in such a way that it offers a possibility to estimate variance of a number of alternatively possible designs as well as their costs. Another principle of designing pilot surveys should be that they should be taken under realistic circumstances. In other words, all the possible conditions which are likely to be faced in the main census, should be reflected in the pilot survey. It must cover the divergent situations existing in the country. Well organized pilot census prior to the main census will considerably help in improving the efficiency of its conduct. It may be a scientific strategy to earmark a certain fraction of the total budget of the census for pilot studies, although one of the main objectives of the pilot study should be to determine the budget of the census. It should be large enough not only to finalize the questionnaires, concepts and definitions but also to provide adequate information for determining the requirement of number of field enumerators and supervisors, method and mode of tabulation, time-table, various types of biases and errors likely to occur in field data, etc.

11.35 If the census is to be based on a sample, size of the sample in the pilot survey should be large enough so as to give reasonably good information on the components of variance between units of different stages.

11.36 A well conducted pilot census must provide adequate technical inputs for improved planning of main census. The efforts put into conducting pilot census will be considered wasteful if its results are not made available in time for efficient planning of the census. A critical report on the pilot census must be brought out at least one year in advance of the commencement of the main census. The report should mention the main objectives, the sample design, and the various stages of planning and implementation of the project. The results of the pilot census in the tabulations and derived tables should be given. Suggestions for changes in the material prepared for the pilot census and in procedures and methods followed should form part of the report. It should deal with the adequacy of the questionnaires, the concepts and definitions, the training of field and supervisory staff, field organization, sampling design and estimation procedure and all other aspects which have been emphasized in the preceding paragraphs. The suggestions given in the report will form the basis of the census operation of the country. They should, therefore, be examined and vetted by all authorities concerned with the conduct of the census. The National Agricultural Census Committee should take into account all these suggestions for finalizing the operation of the main census.

12. PREPARATION OF FRAME

12.1 In a census/sample survey, the first step is to define the term 'population'. The population is constituted of units which are determined on the basis of the aims of the survey. In a well defined inquiry, the aim of the investigation should uniquely determine the units which constitute the population. Any ambiguity in laying down clearly the objective and the purpose of the survey will cause confusion in determining the units which are to be surveyed. The sampler himself should be solely responsible for clearly defining the population to be covered and it should not be left to the field enumerator who may not be very well conversant with the objective of the survey.

12.2 A list of all the units or elements with reference to which the relevant data are collected is generally termed as 'frame'. For example, in agricultural census (whether it is based on complete enumeration or on a sample), the aim is to obtain information on various characteristics of 'operational holdings'. Therefore, in the agricultural census, the population will be constituted of all the operational holdings and the frame will be defined as the list of all operational holdings. The planning of an agricultural census thus implies the existence of a frame constituting the list of all the agricultural operators from whom data relating to operational holdings are obtained.

12.3 An appropriate frame of enumeration units is the key-stone around which the enumeration procedure should be determined. Appraisal of the available or obtainable frames must dominate the search for a good enumeration procedure and a choice among several alternative schemes. The nature and details of the frame become the basis for choice of a sampling design if the census is to be conducted on sampling basis. In fact, most of the sampling designs are governed by the description of the frame. There is hardly a situation in practice where the frame is available in the form the census taker desires to use. Even if one succeeds in preparing an accurate and complete frame of identifiable and distinct units according to the object of the inquiry, it becomes out-dated after some time.

Holding and holder

12.4 The listing of the frame is governed by the definition of enumeration unit. In the agricultural census, unit of enumeration is 'operational holding'. The concept and definition of operational holding should be clearly laid down before preparing the list. The operational holding is defined as land which is wholly or partly used for agricultural production and is operated as one technical unit by one person alone or with others without regard to title, legal form, size and location. This implies that the holding might be either fully owned or fully rented or partly rented and partly owned or cultivated under any other management. There may be holding without operating any land, but engaged in dairying or poultry farming or any other agricultural commodity production. The total area of the holding might range from one or two cents to several acres. Again, the land of the holding might be located in a single compact block or in a scattered fragments. The entire area of the holding might be in a single territorial jurisdiction or might spread over more than one such jurisdictions. The common factor is that it is under a single management having its own set of facilities, both technical and financial and no further distinction should be made in terms of exclusive allocation of certain resources to any specified section or sub-division of the holding.

12.5 The holder or the operator for the purposes of agricultural census is the person who assumes responsibility for the management of the holding. He is to ensure the availability of the necessary agricultural inputs and take decisions of all major agricultural operations. It is the extent of responsibility of decision making that determines the categorization as operational holder. He might do the work for one or more operations himself or may direct and supervise the work done by others under his supervision. The operator, may thus be an owner, a member of owner's household, a tenant, a share cropper, etc. The extent of decision making responsibility is to be the main criteria. Further, for the purpose of agricultural census, the technical unit means, the unit which under the same management has the same means of production, such as labour force, machinery and animals. When two or more holders share jointly, as partners, the economic and technical responsibility for the operation of the agricultural holding, each is to be considered as the holder if they belong to different households.

List of operators

12.6 The preparation of the frame of the operational holdings or the operators must conform to the definition of the operational holding/operator as given above. The information relating to the agricultural census has to be obtained from the operator. In many countries, where there is no system of maintenance of land records, the data will have to be collected through inquiry from the operator. Even in the countries which have established a good system of land records like India, Pakistan, etc., only a part of agricultural census data could be obtained through a reference to the land records. In India, during the agricultural census of 1970, information on items like (i) number and size distribution of holdings; (ii) area under crops; (iii) land utilization; (iv) irrigation; and (v) tenure and tenancy was obtained through the retabulation of the survey number-wise data available and maintained at the village level. Data on other items such as farm machineries, livestock, agricultural inputs for which no records are maintained, had however to be collected through personal inquiry from the operator. Thus, it is obvious that a systematic listing of all the operators which can serve as a frame for collection of relevant data becomes essential in a census operation whether it is to be done on complete enumeration basis or on sampling basis. In fact, in the areas which do not maintain land records, the preparation of the list of operators become a prerequisite for taking the agricultural census.

12.7 The preparation of an accurate frame is always a problem, both in censuses and in sample surveys. In case of the areas which maintain regular and up-to-date land records, it may be easier to prepare a frame through the reference to the land records. According to the land record manual, the name of the cultivator is entered against each of the survey numbers operated by him. By looking into the land records, it may be possible to sort out the list of all the cultivators of a given segment of area/village. The checking and internal consistency are in-built in this system. By suitably covering each and every field of the given segment, it should be possible to completely list the operators. The procedure will, however, suffer from two shortcomings. Firstly, the operator staying in that area but operating elsewhere may not be listed. Secondly, those who do not operate land but are engaged in poultry or dairy farming may be omitted. But if the census is based on complete enumeration, by covering the entire operated area in a given region, it should be possible, at least, to list out the land operators. The defect of omission of non-land operators will still remain. This problem becomes more serious if the agricultural census is to be done on sampling basis.

Frame of area segments

12.8 There are two possible procedures which should be adopted for preparing the list of operational holdings. It is generally noted that in several situations, the list of holdings is available in the form of clusters of non-identifiable units. It may, therefore, be preferable in the first instance to prepare the list of such non-overlapping clusters. For example, in developing countries, for the reasons of safety or otherwise, households cluster around a given area which we generally call a village. It is relatively easy to maintain a complete list of such segments of areas and proceed segment-wise for preparing the list of operational holdings, since change in their sizes and composition in a relatively short period is negligible. Theoretically, the accuracy of the list of the frame will vary in the order of their sizes. In other words, a list of revenue sub-divisions will be much more accurate than the list of villages, and similarly the list of villages will be much more accurate than the list of holdings. The danger of inaccuracy of frame will increase as it passes from revenue circles to agricultural holdings. The circles and villages do not change easily. Their geographical boundaries are kept generally fixed for various administrative reasons. Even if there is some change it will affect only a few of them and such a change will be maintained in the government records, which can be easily ascertained through a reference to the concerned government agencies. On the other hand, frequent changes occur in the list of holdings. In this situation, a device to avoid inaccurate frame is to prepare first a list of higher ranking units and gradually go down to the lowest units of enumeration. This procedure will be helpful in both situations whether the agricultural census is to be done on complete enumeration basis or on sampling basis. In other words, if considerable defects are expected in preparation of a list of operational holdings, problems may be solved by sampling villages or clusters of villages. After a sample of villages is selected, the holdings of these villages must be listed again and brought up-to-date by means of physical verification of all the households in the village(s). This however, implies that the boundary of a village is identifiable and this is very necessary, particularly, if the census is based on a sample. Unless an accurate identification of the boundary of the

village or any other segment of area defined for the purpose is made available to the enumerator, he is likely to commit error in listing the holdings. He may either omit some of the holdings from the village or include some holdings belonging to the adjoining villages as part of the sample. Experience has shown that such errors are not uncommon.

12.9 Village or some other well defined administrative unit is of definite advantage for preparing the final list of holdings. In several countries, as in India and Pakistan, the village is a well defined concept with fully demarcated geographical boundaries. These boundaries seldom change. Cadastral maps of the villages also exist and they are kept up-to-date by incorporating the necessary changes that take place within the village boundaries. In some other countries which do not have such cadastral maps, it is possible to demarcate the boundary of the village with the help of the headman or some other knowledgeable person.

12.10 If a population or house census has taken place in the country, it will provide the list of villages or enumeration blocks and also possibly, a measure of the size of the village in terms of population or houses as the case may be. Usually, a village can be treated as an enumeration block but where villages are large as in some countries, each village has to be sub-divided in two or more enumeration blocks with easily distinguishable boundaries. In many urban areas and even in some big cities, agricultural holdings exist. Enumeration blocks for listing of operational holdings will have to be demarcated with the help of streets, by-lanes, roads, etc.

12.11 One of the first tasks for the preparation of taking the census should be to procure all available maps. If the agricultural census is preceded by the population or house census, the maps already procured or prepared for the demarcation of the population census enumeration blocks would be helpful and care has to be taken to conserve these maps by making appropriate arrangements for this purpose while the population census is in progress. In fact, it may be desirable to get such maps duplicated at the time of the population or house census. The population census is concerned only with the habitation of the people and is not very much concerned with the geographical area of the village. If the maps used for the population census ignore the demarcation of the geographical area accurately it may be necessary for the agricultural census to correct such maps by revising the boundaries which determine the geographical demarcation of adjoining villages. Since the population census is mostly concerned with the enumeration of the individuals in the households, it may not be considered essential to prepare the maps indicating geographical boundaries of the villages. In the absence of such maps, it becomes necessary to make systematic and extensive listing of various localities and land-marks to provide guidance for enumeration. For example, two villages might be separated by a rivulet, hillock or some other natural landmark. The natural boundaries should be used to demarcate the adjoining villages as such demarcation will considerably help the enumerator in distinguishing the boundaries of the two villages on the map. Aerial photographs can also serve as a substitute for ordinary maps but are generally very expensive unless an aerial map has already been prepared for other purposes. Aerial maps are likely to be more useful if the segment of area for enumeration purposes is not of a village-size but much bigger than a village. If the size of the enumeration block is increased it is easier to locate some natural boundaries to demarcate the two adjoining blocks, which may be done much more easily with the help of aerial photograph. Similarly, in the urban areas or in bigger villages, it is easier to locate well recognizable boundaries for bigger enumeration blocks than for smaller ones. If the census is to be done on complete enumeration basis, it is immaterial whether the enumeration block is small or large. It will make a difference only in the work load of the enumerator. However, if the census is to be done on sampling basis and if the enumeration block is the first stage of the sampling unit, the size of the enumeration block may affect the accuracy of the various estimates obtainable from the census. It is well known in sampling theory that in a two-stage sampling design, for the same sample size, the smaller the size of the first stage unit is, the more efficient will be the estimate, provided intraclass correlation coefficient between the ultimate units is positive which is generally so in the case of the natural populations.

12.12 The need for cartographic preparation in the context of census taking has already been emphasized in Chapter 6. If the census is to be conducted on complete enumeration basis, the cartographic map will be needed only as interviewer's aid for the preparation of the list of holdings. Such maps should accurately demarcate the boundaries of the adjacent enumeration blocks. However, if the census is based on sampling method, a relatively high degree of accuracy will be needed in preparation of such maps, as these will become the base for the sampling frame. Many agricultural censuses have been conducted through the use of sketch maps. The basic advantage obtained through the use of sketches in census taking is that only geographical features relevant to the enumeration process can be indicated. The resource requirement is usually much smaller than that for the regular cartographic work for preparing an accurate map. Usually prior to the preparation of sketches, the country is divided roughly into a number of enumeration blocks of almost equal interviewing work load. Quite often existing smallest administrative units of the country are used as basic enumeration blocks. Sometimes, the size of such units varies considerably. However, sketches of such units can be uniformized to facilitate field work.

12.13 If administrative divisions are used as enumeration areas, the boundaries of such units are defined in maps usually available in the local administrative offices. The same boundaries can be used and marked correspondingly on the sketches. However, if the enumeration areas are arbitrarily formed, the marking of boundaries will depend on whether such sketches will eventually be used for sampling purposes or will be used simply as interviewer's guide. In general, it is always preferable to use easily recognizable geographic features like roads, rivers, bridges, schools and other structures which are more or less permanent in nature.

Listing of operational holdings

12.14 Once the list of the enumeration blocks (in some cases list of villages) along with well-defined and identifiable boundaries has been prepared, listing of operational holdings may commence. If the census is on complete enumeration basis, all the enumeration blocks have to be covered and listing of the operational holdings has to be done separately for all the enumeration blocks. In a sample census, such a list has to be prepared only for the sample blocks. In order to prepare a frame for census enumeration, systematic listing of households in each enumeration block is necessary and this constitutes an important operation. Its purpose should be to cover all households and mark those that are eligible as farm households to be enumerated in the agricultural census programme. It is here that adequate training should be given to the enumerator in the concept of operational holding, otherwise there is a great likelihood of misclassification of the households. A clear instruction should be given as to when a household should be listed as agricultural household and when it is not to be listed. For example, a household may not cultivate any land but it may be engaged in poultry or dairy farming. According to agricultural census concept, he should be listed as an agricultural operator. Similarly, there must be clear indication of the lowest limit of the size of holding for becoming eligible to be listed as operational holding. What should be the lowest limit of land, or the lowest number of livestock, or the lowest value of agricultural production for becoming eligible to be listed as agricultural operator should be clearly laid down in the instructions to the enumerator. Lowest limit of the land holding size may sometimes vary from region to region depending on the criteria adopted for the purpose. Similarly in case of livestock holdings also, there may not be a fixed number for all categories of animals for determining the lowest limit. This limit may be different for cattle from that for poultry. Unless this is done properly, there is always a danger of preparing an inaccurate list of operational holders.

12.15 It is obvious that his work can be done more efficiently through the cooperation and assistance of local officials. The local knowledge would contribute materially to somewhat intricate decisions for classifying households as farm households and others. If a population census precedes the agricultural census and there is not much gap between the two, households list would be readily available. The screening question for the population census questionnaire as to whether any member of the household cultivates any land or maintains any livestock or poultry would be helpful in sorting out those households which can be further investigated

in order to decide whether they are farm holders or not in terms of definition that might be adopted in the agricultural census. In some countries where rural reconstruction and development programmes have been initiated, a list of households may be readily available and this can be used for screening the farm households. In case the land tax is paid by the cultivator himself, it will be necessary to maintain a list of cultivators which can serve as a useful frame to start with. In India, in some states, list of actual cultivators of land is maintained by the village officials for many development activities. Such list can prove a good starting point for the preparation of the list of operational holdings. Such list, however, does not include those who do not cultivate any land but who are engaged in dairy or poultry production. Whatever method may be adopted for preparation of the list of households and their classification as farm households, a list is basic to the census enumeration and every effort has to be made to make this list complete and the classification of households accurate.

12.16 It may be mentioned here that enumeration block or village does not mean that the entire operated area of the block would be covered by the operational holders of that block. It also does not mean that all the operational holders residing in that block always operate some land in that block. It is very common that a part of the land of a particular enumeration block may be operated by the operators of several adjoining blocks. Similarly, the operators residing in a particular block may be partly or wholly operating in several adjoining blocks. Preparation of list of operators in a given enumeration block means the listing of the operators actually residing in that block. It is not uncommon, particularly in the urban areas where the operator may not be cultivating any land in the enumeration block. His entire holding might be located entirely away from the enumeration block, but for the purpose of listing, he should not be excluded.

12.17 Since the census data has to be obtained from the operator, it is essential that the list of the operators is accurate and complete. Listing errors may occur due to border-line difficulties as well as due to omission of the operator within the enumeration block. It is generally noted that several close relatives live in the same house but they operate land separately. The field enumerator should be carefully instructed to make thorough inquiry at the time of listing so as not to omit any operator.

12.18 To ensure that no eligible operational holding is left out, an objective and systematic approach of listing has to be followed. As mentioned earlier, if the listing of the households for population or house census purpose has been prepared a few suitable questions in the population census questionnaire will give adequate information for sorting out the cultivators' households. In case no such census has been conducted and even if it has been and that the list is out-dated due to lapse of time, it will be necessary to prepare a fresh systematic listing of the households operating some land or keeping some livestock or having both. The enumerator may be given instruction to start from a fixed point of the village/enumeration block and systematically number serially each of the houses of the enumeration block. This will ensure that no house has been left out. In each house there may be more than one householder. Only some of the householders will be agricultural operators. The enumerator should proceed from one house to the other listing householders along with the information whether the householder is an agricultural operator or not. Although in the agricultural census the enumerator is concerned with only the list of the agricultural operators, it will be desirable to prepare the list of even non-agricultural operators for the sake of exhaustiveness and internal check. Later on, when the actual data relating to agricultural census are to be collected the inquiry may be confined only to the householders eligible as agricultural operators. Sometimes, an operator may operate more than one holding. For example, he may operate some land with the help of the members of his own household and some other land jointly with the members of other households. According to the agricultural census concept, there will be two operational holdings in this case, one individual operational holding and the other a joint operational holding. In preparation of the frame, such situations should be covered and there should be provisions for listing such holdings.

Plan of listing holdings

12.19 In cases where the enumeration blocks are small in size, say less than 50 holdings, as is the case in some countries, the work is relatively easy. In such cases the holdings will be visible from one point or will be located along a road. Even if they are spread around, their small number will not permit errors in enumeration except in cases of extreme carelessness.

12.20 In many countries, however, the enumeration blocks may be very large, including as many as 500 holdings or even more and spread over several square kilometers. In such cases, when the enumerator comes to his enumeration block he cannot start visiting the holdings without any pre-established order. Without a definite plan of enumeration there is a definite risk that some holdings may be enumerated twice while some others may be omitted. For this reason, a plan of listing is necessary before the enumerator could start calling on the holdings of his area. If a reasonably good cartographic map is available, he may start the listing from one corner of his area and go round systematically, say clockwise till he completes the visits to all the households. In case of urban areas, all the households are usually divided into blocks and these blocks are numbered in the maps with street names or numbers. The listing can be done blockwise, by starting from a fixed point of the block. However, in rural areas the houses are not usually arranged in blocks, nor do well-defined streets with names or numbers exist. In many countries, people of the same ethnic group or the families closely related stay in the same compound. These compounds can be numbered and listing of the holdings can be completed compound-wise. In such listing, the help of the chief of the families in the compound may be taken. In the list of the households, names of the heads of households and other particulars to identify the holders living in the household may be written. If in a household more than one holder exists, names of all the holders should be written one below the other. It is very important that all households are visited and all the holders listed serially. This will ensure the enumeration of all holdings and thus complete coverage.

Ancillary information

12.21 It is advantageous to collect some ancillary information while preparing the list of frames. If the census is based on complete enumeration, such information may be used for checking the internal consistency of the census results. If the census is based on a sample, some of the ancillary data can be used for improving the sampling design of the census or for developing better methods of estimation. In Chapter 11, "Pre-test and pilot surveys" it has been mentioned that the appropriate estimation procedure for various characters should be evolved in the course of the pilot census so that any ancillary information useful subsequently during the tabulation of census data, can be collected at the time of preparing the frame or otherwise. Ancillary data relating to the enumeration blocks, such as human population, total number of houses, livestock numbers, geographical area, etc., will always be useful and efforts should be made to collect them during the time of listing the holdings if the cost and time taken are not much. In fact, one of the questionnaires to be used by the enumerator should deal with the basic and ancillary data relating to the enumeration block.

12.22 In spite of these precautions, the frame of operational holdings may not be perfect. If the resources permit, it will be useful to have some checking done on the accuracy of the listing of holdings prepared by the census enumerator. It may be possible at this stage to correct some of the inaccuracies while it may not be possible to correct some others without repeating the listing process. The repetition of listing may be time consuming and costly.

12.23 There are several reasons for inaccuracies in the frame. The principal among these may be (a) omission of some holdings; (b) repetition of some holdings; (c) presence of some of the holdings not eligible for agricultural census; and (d) clustering of two or more operational holdings together as one operational holding.

12.24 If on checking, it is found that inaccuracies are not many and not very serious and correction can be made without much expense, efforts should be made to remove these inaccuracies. The other solution to the problem of inaccuracies in the frame may be to ignore the inaccuracies if these are known to be very small as compared to other type of errors and corrections involve considerable cost.

12.25 Some inaccuracies in the frame may be treated statistically. If the census is based on complete enumeration, the inaccuracy of category (c) will automatically be detected at the time of detailed inquiries for the agricultural census data and in that situation, the final correction can be made while tabulating census data. However, if the census is based on a sample even this inaccuracy will affect the final result.

12.26 Errors in the frame may cause serious bias. Any bias in the total number of units in the frame automatically introduces bias in the total for all the characteristics that are to be estimated. Of course, the magnitude of this bias depends upon the distribution of errors in the frame. It may be large if either omissions or duplications are numerous. However, in either of these two cases it will be small if units affected contribute but little to totals for characteristics concerned. For example, even a large omission of small holdings may affect but little the magnitude of totals for most characteristics in the programme of a census of agriculture. However, such omission will give a very misleading picture of the number or percentage of the small or marginal farmers. The general experience is that in the census of agriculture, small and marginal farmers get omitted. Such omission leads to serious difficulties in using the census results for policy matters. Some statistical treatments for such inaccuracies are described in the subsequent paragraphs.

Treatment of inaccuracy

12.27 The most common defect in almost all the frames is its incompleteness. The omissions in the frame will generally go undetected unless proper care is taken in modifying the procedures for detecting the missing units in the frame.

12.28 A supplement in the form of a separate stratum for the missed elements may be formed for their separate selection. The adequacy of a supplement to produce missing units should not be merely assumed but investigated. For example, households missed by the enumerator would often be missed again in a supplementary list prepared by a similar enumerator. Many times the supplementary list may contain units appearing in the principal frame.

12.29 The 'predecessor-successor' method advocated by Hansen, Hurvitz and Jabine (1964) provides information on omissions in the frame and gives equal chance of selection to the units which are evenly missing in the existing frame.

12.30 Consider the situation where the list contains N units in the frame whereas the number of units in the target population is N' (N' > N). There are N' - N omissions in the list in the form of N gaps with the arrangement

$$U_1 \overset{m_1}{\dots} U_2 \overset{m_2}{\dots} U_3 \dots U_r \overset{m_r}{\dots} U_{r+1} \overset{m_{r-1}}{\dots} U_N \overset{m_N}{\dots}$$

where m_r is the number of missing units in the r-th gap i.e. between r-th and (r+1)th unit of the existing frame. Also

$$0 \leq m_r \leq (N' - N), \quad \sum_{r=1}^N m_r = (N' - N).$$

It is assumed here that the geographical ordering of the units in the population exists and there is a rule to uniquely determine the (r+1)-th unit by a defined path of travel when the r-th unit is known.

The following problems in the present situation arise:

- (i) Estimation of total number of missing units in the frame.
- (ii) Estimate of the total of the character under study for the existing units of the frame and
- (iii) Estimate of the total of the character under study for the missing units of the frame.

Since the present concern is with the accuracy of the frame, only the problem under (i) may be discussed. For this it is proposed to select a sample of n units from N existing units by simple random sampling without replacement. Further, note the missing units in between the selected unit and the next unit in the frame and observe the character under study for both the selected units and the missing units. The estimate of the number of missing units in the frame will now be given by

$$\text{Est } (N'-N) = N - \frac{1}{n} \sum_{r=1}^n m_r$$

12.31 The procedure described will be applicable only if the missing units are distributed evenly, which may not be always true. In case of agricultural census, it is more likely to miss the small holdings or jointly operated holdings and it will seldom happen that a large holding is missed. Thus, the method has its limitation so far as agriculture census is concerned.

12.32 If the same holding is listed several times in the frame it will cause upward bias. If however, the census is based on complete enumeration, it should be possible to locate such holdings at the time of collection of detailed data. It has been noted that the repetition of the same holding in the frame may not be uncommon if the frame is prepared through a reference to the land records. It has been observed that the same operational holder cultivates in several villages and therefore, he has got a chance of being listed in each of the villages. To avoid such repetition, some mechanism should be developed. In India, in the last census the entire holding of the farmer irrespective of its location was assumed to be attached with the village where the farmer was residing. This was done through inquiry from the farmer whether he cultivates any land outside the village. If the answer was yes, the census enumerator was instructed to contact the operator to find out the land operated by him outside the village of his residence.

12.33 However, it will be useful to indicate some statistical treatments where it is found in spite of the precautions and instructions, the repetitions of the holdings in the frame has been on a large-scale. Some adjustments can be made in the estimate of the character. If y is the character to be estimated and if the i -th holding has been repeated r_i times, the following adjusted estimate of the mean can be obtained

$$\bar{y} = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{r_i}$$

Here it is assumed that r_i is known for all i . Further the selection of a unit more than once in the sample will be another problem as the probability of selection in that case for the unit appearing second time is proportional to $r_i - 1$, and in the general case, it is proportional to $(r_i - t)$ times for it to be selected $i(t+1)$ th time. The problem can be solved by weighing the characteristic of the unit inversely with the probability of selection and taking the estimate based on distinct units.

12.34 Non-eligible units listed in the frame may not cause much trouble if the census is on complete enumeration basis, since it will be possible to detect them at the time of inquiry for census data. Even if the census is based on a sample, during the field work such units can be detected and necessary adjustments in the estimation procedure can be made. Let the population under consideration consist of N listed units out of which M are non-eligible.

The presence of non-eligible units in the frame introduces variations in the size of the sample. For a sample of size n , the expected number of eligible units in the sample is $n(1-\bar{M})$, where $\bar{M} = M/N$. This variation in the sample size increases the variance of the estimate. However, the sample mean may remain unaffected. If a reliable estimate of M is available it should be used to improve the estimate of the characteristic under study. If the reliable estimate of M is not available, the same can be obtained on the basis of a larger sample by using double sampling technique for estimating the number of eligible holdings. Care should be taken to avoid the method of substitution of non-eligible units by eligible. Such substitution is a common mistake and leads to serious bias.

12.35 Many times, it may happen that close relatives like brothers may be staying in the same house but cultivating separately. There is a danger of listing them as one operational holding although according to agricultural census concept there should be as many operational holdings as there are independent operators. The statistical treatment of this situation may be similar to the one discussed in the case of omission of the operational holdings from the listing.

12.36 An accurate frame is of paramount importance in the census. No other factor affects the accuracy of census results so much as inaccuracies in the frame. All efforts should, therefore, be made to prepare an accurate frame.

13. CENSUS ENUMERATION

13.1 The agricultural census is a complex operation consisting of a series of closely related steps which must be planned carefully in advance. Not only that it requires a well-knit organization to operate it from the stage of planning to the stage of bringing out the final results in time, the statistical problems of measurements of various characteristics of the operational holding, the unit of enumeration, are much more complex than those faced in other types of censuses and surveys. By scope, the agricultural census attempts to survey the entire agricultural economy of a country and, therefore, the operation is difficult particularly for developing countries which have limited experience in organizing censuses and surveys and are not provided with the adequate public services. The census, as the name implies, is conceived in principle as collection of data for all individual agricultural holdings by direct enumeration.

13.2 Since the basic economy of most of the developing countries is based on agriculture, they want to develop their agricultures rapidly through the application of modern agricultural technology mostly evolved in developed countries. For this purpose, detailed data on various characteristics of operational holdings are urgently needed more frequently. The question is raised and discussed whether the agricultural census should be conducted on a complete enumeration basis or sample basis.

13.3 Both the methods of carrying out a census have advantages and disadvantages. A census on the basis of a complete enumeration to give reasonably acceptable results, presupposes the existence of a certain minimum of facilities, such as funds, professional personnel for planning census methodology, sufficient number of qualified enumerators and supervisors, mapping material for the entire area to be covered by the census, machine tabulation equipment, etc. All or some of these facilities are not always available, especially in developing countries, with the result that a census on the basis of a complete enumeration becomes sometimes a difficult operation. Nevertheless a sample census, even though it requires the same type of facilities, may be possible because these facilities are required to a limited extent, the size of the operation being relatively small. In taking a decision as to whether a sample census or a complete enumeration census should be taken, the advantages and disadvantages of both methods should be considered very carefully.

13.4 The principal advantages of carrying out a census on the basis of a complete enumeration may be stated as follows:

(i) The census results can be obtained for administrative and other area units, whatever their size. Such results are sometimes required for irrigation projects or such projects as regionalization of a country on agro-climatic and ecological basis. Sampling method cannot, however, provide accurate information for small administrative sub-divisions such as village or a group of villages, which may be needed for planning development programmes.

(ii) Some of the crops, although cultivated to a limited extent, are of great economic importance. Information on such crops cannot be efficiently obtained through the usual sampling technique. Complete enumeration is the only method that can be recommended. Similar is the situation with regard to rare species of animals.

(iii) Current agricultural statistics in most of the countries have to be collected through annual sample surveys. These sample surveys can be planned much more efficiently if census results are available for small units of area. In the first place census listing can be used as a frame for the selection of the sample. This may prove an important saving because the preparation of the frame itself generally consumes a fair part of the budget allocation for the sample survey. Further census data can be used for improved sampling design and better estimation procedure, which may lead to a much more reliable estimate of the character under study.

(iv) The processing of the data for the sample census for preparing the results and for calculating sampling errors is more intricate compared to data from a complete enumeration, which is straightforward and does not involve calculation of sampling error.

13.5 However, taking a complete enumeration census especially in some developing countries is faced with many problems.

(i) In some countries the people are suspicious of census operations. They suspect that the results of the census will be used by the government for certain economic policies, like taxation, ceiling of holdings, etc. Therefore, the holders refrain from giving the correct information.

(ii) The cost of enumeration in areas with poor communication and transport facilities becomes exorbitantly high.

(iii) When the population is mobile it becomes difficult to control omissions and duplications.

(iv) For a complete enumeration census, the requirement of the number of enumerators and supervisors is relatively large. Quite often candidates in the required number and with the desired qualifications are not available. Then the standard of qualifications has to be lowered with the consequent effect on the quality of data.

13.6 On the contrary, there are several advantages in a sample census. As mentioned earlier, the volume of field work involved is relatively lower compared to complete enumeration. Consequently the quality of data collected can be expected to be much better because of the employment of better trained enumerators and supervisors. Cost of a sample census, in general, can also be expected to be much lower than that for a complete enumeration census. The time required for processing the field returns is also reduced so that the results of the census may be expected to become available with a smaller time lag than would be the case with a complete enumeration. The sample census is, therefore, a very attractive proposition under conditions where there is a severe limitation of funds and personnel and the aim is confined to securing data with reasonable accuracy for the country as a whole and its broad agro-economic regions.

13.7 Against this background, a decision whether to carry out a complete enumeration or to project a sample survey of holdings will depend upon the level at which the results are required, that is, whether the results will be tabulated for the entire country, or for the individual provinces, or for individual districts or even for their smaller administrative sub-divisions. Of course, this decision need not be either a complete enumeration or a sample survey as the only alternative, but could well be a combination of both.

13.8 As has already been discussed in Chapter 12 "Preparation of frame", the basic frame will always be needed whether the census is on a complete enumeration basis or on a sample basis. In the developing countries it will be advantageous to use the opportunity of conducting agricultural census to build up an efficient sampling frame which can be utilized not only for the census but also for the subsequent agricultural surveys for improvement of agricultural statistics. A list of operational holdings with their sizes can be prepared on a complete enumeration basis while other detailed characteristics of holdings can be obtained on a sampling basis. In most of the developing countries, large farms are relatively fewer but economically very important, such as plantations of tea, rubber, etc. These can be enumerated completely while the rest of the holdings can be enumerated on a sampling basis. Similarly, the agricultural holdings of specific size and above can be enumerated on a complete enumeration basis while from the rest a small fraction may be sampled. In India, during the 1970 census, this method was followed in the States of West Bengal, Orissa and Kerala. The second situation where sampling can be used together with complete enumeration, is for increasing the scope of the census by augmenting, with the help of a sample, the information collected through complete enumeration. Here, for basic items in the agricultural census, complete enumeration of all holdings is undertaken, but for various

additional items only a sample of holdings is enumerated. These additional items are usually of a more complicated character and involve careful questioning of the respondents. A better type of enumerator is required and can be entrusted with this work if it is limited to a sample of holdings. Either a single sample can be selected for whatever additional information is sought, or it may be distributed on different samples, a limited amount of information being collected from each sample, so that all samples put together provide the total additional information proposed to be secured by sampling without placing an unduly heavy burden on the respondents. This operation of securing additional information from a sample can be done either simultaneously with complete enumeration or can be staggered so that supervisory staff can be employed for enumerating the sample, after they become free from the supervision of the main census. The so-called post-enumeration check, which has been discussed in Chapter 17, for evaluating the quality of work done in the census, whether it is based on a complete enumeration basis or on sample basis, is also done in the shape of a sample. Thus, it is obvious that in a well-planned agricultural census, the role of sample survey cannot be minimized. In some form or other, sampling technique must be used for improving the conduct of agricultural census.

13.9 While a uniform census programme can be adopted for the entire census domain, whether covered on a sampling basis or complete enumeration basis, certain parts of the census domain, a particular sector of agriculture or a particular aspect of the questionnaire may require study in depth or in greater detail for obtaining specific information reliable enough for purposes of agricultural development and administration.

3.10 Intensive agricultural development programmes may be concentrated in small areas which are known to have high potential of rapid agricultural development and for which reliable benchmark and periodic data are required for evaluation of the progress over years and in comparison to other areas and for revision and reorientation of the development efforts. When a national census is planned on a sample basis to provide estimates for the country as a whole or for major administrative divisions or ecological zones, the sample proves to be inadequate to provide estimates of required precision for specific development areas. The sample size for these areas has either to be considerably increased or a complete census has to be taken.

13.11 Similarly, in a country there can be some holdings of farms which are engaged in intensive or large concentrated production efforts or in specialized production activities, like the large livestock holdings or dairy farms, large fruit orchards, plantations, etc.; which can be adequately covered in a census by treating them as separate strata and taking a much larger sample or by enumerating them completely. When an increased sample or complete enumeration is taken for a particular area of a country or for a particular sector of its agriculture, a few items additional to the regular census programme, which are important and urgent for special development efforts in these sectors, can be included in the census which is possible in view of their being better equipped with human and material resources than other areas.

13.12 Several items of information which are very important and urgent for planning, implementation and evaluation of special development efforts in agriculture, cannot be collected in an agricultural census in as much detail as required because of limitations of time and frame and because of greater depth and more frequent intervals at which the data are required and which cannot be fitted in the agricultural census time-schedule. Some of these items are those for which an agricultural holding is not the proper statistical unit of inquiry. Others relate to agricultural population and its employment characteristics, integration and/or association of agricultural holdings with establishments in other industries and agricultural practices and available facilities. In view of the very pressing demand for in-depth information on these aspects by the national planning and development organizations, the agricultural census statisticians may run the risk of overloading the census questionnaire to the detriment of regular items. The desirability of covering these items in depth by special sample surveys like surveys on use of specific inputs and practices and facilities, periodic labour force and employment surveys and agro-demographic surveys should be stressed; and the agricultural census should attempt to identify the holdings associated with these aspects so as to enable planning of surveys for the required in-depth studies.

Phases and periods of census enumeration

13.13 The census enumeration for or during the census reference year which should preferably be a complete agricultural year (or a calendar year) covering all the time reference dates and periods, has to be divided into a number of phases depending on the agricultural seasons and operations and variability over time in the items of information. Enumeration has to be carried out in each major crop season involving measurement of field areas and crop yields in sample plots. Field area measurements for a season can be carried out soon after the sowings are completed, and the crop yield surveys started as soon as the crop harvests begin. Generally, not more than two crop seasons are visualized in most of the countries. The second phase, i.e., the crop yield survey of the first season will nearly coincide with the field area measurements of the second season and the crop yield survey of the second season will be the third phase. This will mean three phases of census enumeration.

13.14 In some countries, agricultural censuses can be utilized to obtain data by interviewing the holders on volume of livestock products, like milk, yield of which varies from season to season, and production of wool and mohair which are produced almost entirely within fixed shearing seasons; and to minimize errors arising from memory lapses, the information on these items will have to be obtained soon on completion of a season. For milk yield information, a visit to the holdings at the close of each quarter of the year will be desirable. One or two of the quarters can be made to coincide nearly with the sheep and goat shearing seasons. These quarters can be so determined as to coincide with the three phases of land use and crop area and yield surveys. Thus, the census enumeration can be divided into four phases. In each phase the data on employment characteristics can be collected covering seasonal variability.

13.15 The commencement and duration of periods of land use and crop area measurements and crop yield surveys in any phase will be determined by the time of completion of sowings and the harvest periods. Practically the same considerations will govern the duration of inquiry on selected practices and facilities and machinery and equipment. Inquiries about livestock numbers and products and agricultural population and employment can be completed within a week or a fortnight after the quarter or phase concerned.

13.16 The agricultural calendars giving inter alia, the sowing and harvesting seasons and peak periods of disposal of produce of crops and the production periods of the other agricultural products can be very useful in determining the phases of rounds of the agricultural census and, to an extent, periods of inquiry of different items in a phase. Data collected in the course of annual agricultural production surveys and farm management surveys together with other information material can be used to prepare the agricultural calendars. Use of these calendars can be made in controlling census operations (and in planning annual agricultural surveys) and their preparation should therefore receive proper priority.

13.17 The enumeration period for an item should be as close to the reference date or period of its enumeration and should be as short as possible in order that omissions and duplications are avoided. Duplications are likely to arise from changes over time in the information on some items like employment in agriculture, livestock numbers, etc., if the period of enumeration extends longer than a month or so.

Time reference

13.18 The items of investigation which usually refer to the whole year are: type of holding, aggregate area under crops and crop production, production of livestock products, extent to which the work on the holding is carried out by the holder's household members, use of agricultural power on the holding, agricultural machines used on the holding, use of general transport facilities, area of land irrigated and fertilizers and soil dressing, wood and fishery products, etc.

13.19 The week as reference time usually refers to information "unemployment in agriculture". The week is taken as period of seven days preceding the date of enumeration. Sometimes it is taken as period of one week length ending on a particular day, for example week ending Sunday previous to the day of enumeration. A specific date generally refers to information regarding holding, holder, and tenure of holding; land utilization, number of trees or vines; livestock and poultry (excluding limited products); farm population, source of electric power on the holding; agricultural machines owned by the holder; area of land provided with irrigation facilities and drainage; type of industry with which the holding is integrated, etc. Sometimes when the area under crops refers to as "at the census date" and not as "aggregate area" the time reference is also a specific date. Similarly, some countries take for some livestock products, such as milk, cheese, etc., also time reference as a specific date. The specific date is usually considered the day of enumeration or some other days close to this. As mentioned earlier, in some countries there are more than one crop season during the year. Usually one of these seasons is a major one. In such cases the information on total area of holding, area under different forms of tenure, and area classified according to utilization should relate to a specific date in the major crop season. If the seasons are equally important then information on these items may relate to a specific date in the season nearest to the enumeration.

Duration and Period of Enumeration

13.20 Duration of enumeration refers to the time taken in making the census enumeration. In the case of population census de-facto, the entire operation is usually over in one day, at least in urban areas and in just a few days in rural areas. But this is not possible in the case of agricultural census. Generally, the enumeration is spread over a longer period. The duration of enumeration depends upon many factors such as availability of adequate number of qualified personnel to serve as enumerators, length of questionnaires, use of objective measures, means of communication, climatic conditions, etc. Moreover the total census enumeration may be taken in more than one round, spread over the year. There are certain items of information in the census programmes data on which can be more reliable if it is collected in more than one round. For example, data on employment in agriculture usually relate to the week preceding the date of enumeration i.e. the period of one week length which ends at the day of enumeration. This information if collected only once will be of very limited value. On the other hand if the question is asked about employment in the year of census the information will be seriously affected by the memory bias of the respondent. The same can be said about the livestock products such as milk and cheese especially in the case of small producers who maintain no records. Therefore, for such items of information the countries may prefer to collect data by means of successive sample surveys at different times during the agricultural year, and relate to the census. In the past censuses of agriculture the period of enumeration has varied from about a week to almost a year. However it is advisable to complete the enumeration in as short a period as possible. This is especially important to compile better information in respect of items for which the time reference is a specific day or week.

13.21 The period of enumeration refers to the specific period of the year during which census enumeration operations are taken up. This factor greatly affects the accuracy of the census results. It is desirable that the interval between the period of enumeration and the period to which the data relates should be minimum possible in order to avoid memory biases to the maximum. Therefore, if possible the enumeration should be immediately after the harvesting of the principal crops of the agricultural year. At this time the holder has also relatively more free time to attend to the enumerator.

13.22 It is important that the enumerator should select a suitable time for interviewing the holder. During the day the holders are usually at work. Therefore, mornings or evenings are suggested as more suitable for interviewing. Obviously the enumerator cannot work only during fixed hours of the day as is the case with work in offices. Also he cannot necessarily

choose Sunday as holidays. In many countries there are certain "market" days on which most of the farmers go to the market place to make their sales and purchases and nobody can be contacted at home for interview. These days are more advisable for the enumerator to observe as day of rest. However, all these arrangements have to be made keeping the local situation in view in every country or even in different parts within the country. In some countries there are certain regions or pockets which become inaccessible during certain parts of the year due to snow or floods etc. These parts may be given priority over others for purposes of enumeration.

Questionnaires

13.23 Much of the success of a census operation, the ease with which it can be conducted and the accuracy of the data obtained, depend upon the proper design and arrangement of the questionnaire. Not only the different items of information on a topic should appear on the questionnaire in a defined sequence which can be the sequence of their occurrence or inter-relationship, but the different sections of the questionnaire dealing with different topics should also be arranged in a proper connected order. The items in a section which are constant or less variable during a phase of the census should appear first.

13.24 The framing and wording of questionnaires should take into consideration the calibre of the enumerators and respondents, their level of education and comprehension, their training and experience and their ability to interpret properly and convey unambiguously to the respondents the meanings of the items of the questionnaires. The concepts and definitions used should be such as are commonly and uniformly understood by the respondents and as can be easily comprehended and clearly explained by the enumerators to the respondents. The questions should be so framed as to yield a standardized and unambiguous interpretation of the meaning of the census items and should be simple and clear.

13.25 Before designing a questionnaire is actually taken up, the data requirements of the different departments and organizations in a country concerned with agriculture and its development must be ascertained and the extent to which they can be accommodated in the census questionnaire or covered by separate surveys should be determined. The advice and suggestions of a data processing expert can be of immense value in appropriately designing a questionnaire and his assistance and guidance cannot be overlooked. The questionnaire can also be pre-coded to the extent possible as this will assist tabulation. In fact, the tabulation programme should be drawn up along with the designing of the questionnaire as this will assist proper framing and wording of the questions and inclusion of only those questions which will really be tabulated and also avoid situations faced at the tabulation stage when an information collected is found to be not easily extractable for tabulation. A detailed discussion about the formulation of census questionnaire has been given in Chapter 7.

Instructions to enumerators

13.26 What has been said about the designing of the questionnaires is generally applicable to the preparation of the manual of instructions to enumerators, which should serve not only as a text for the training of enumerators but also as a complete reference guide during the census enumeration. Apparently, it should not only be simple and easily comprehensible, but complete and yet precise and concise, and provide full guidance on the problems encountered in the field and on understanding of the tasks to be performed and ensure adoption of standardized and uniform procedure in the field.

13.27 The experience of the field problems and difficulties of the previous agricultural censuses and even annual agricultural surveys and the manner in which they were tackled (or could not be tackled) must be taken into account while preparing the instructions to enumerators for the 1980 agricultural census. Generally there is considerable change in personnel responsible for planning and organization of the census, from one census to another, and while use is made of the currently and readily available documents, guidelines and suggestions in preparing the instructions for field work, the past experience is often

forgotten and the same mistakes are repeated. The reports of the past agricultural censuses need to be minutely looked into and the lessons learnt in the field operations of those censuses fully taken into consideration in preparing the manual of field work for the 1980 agricultural census.

13.28 The questionnaires and the instructions to enumerators must be drafted at least 8 to 12 months ahead of the census and pretested so that they are finalized and printed well in advance of the census operations and the training of enumerators and supervisors. The necessary details on the formulation of instruction manuals have been given in Chapter 9, Instruction Manuals.

Control of census operations and time schedule

13.29 In a large country-wide operation like the agricultural census involving staff spread all over the country and with a tight time schedule, it is of prime importance to devise ways and means of day-to-day control of the operations so that they are planned, organized and carried out methodically, correctly and according to a pre-determined time schedule. The need for provision of an adequate number of supervisors and drawing up of detailed guidelines for them and their training is well recognized and discussed in Chapter 9, but the importance of designing (a) control chart of operations for each phase or round of the census and (b) a time disposition schedule for enumerators (and also supervisors) is too obvious to be emphasized.

13.30 For each phase of the census, a control chart giving the estimated date of commencement of an operation on any census item and the estimated period of its completion can be drawn up. The experience and knowledge gained in the past censuses and even in exploratory and pilot censuses can be used to design and formulate such a control chart. Against this control chart, the performance of each enumerator can be assessed, action for his lapses taken and bottlenecks removed.

13.31 But in order that the control chart is really effective, each enumerator should be required at the end of each day's work to record on a prescribed time-disposition schedule the time spent by him on the different items of work. The content of this schedule can differ from phase to phase and month to month in the same phase depending on the items of work to be covered in a phase or a month.

13.32 The information contained in supervisors' and enumerators' time disposition schedules can also be used for cost variance function for planning and organizing future agricultural sample censuses on a better footing. This is an aspect of the census and survey operations, which has often been overlooked but with the experience of the past censuses accumulating, a beginning needs to be made in the 1980 agricultural census.

Methods of enumeration

13.33 The mail method of census is generally followed in the countries where the farmer is educated and maintains an accurate account of his farm operations. However, data suffer from errors arising from non-response and biases inherent in a mail questionnaire method. Mail questionnaires can be used in the census of large modern farms, settlement and irrigation schemes, farms under the control, supervision, guidance or management of government or public organizations and institutions for which some sort of records are maintained or can be maintained. For the individual agricultural holdings which are mostly small and subsistence in character with no means of measurements and record keeping, the census will have to be conducted by interview or inquiry method with the help of trained ad hoc enumerators.

13.34 While actual measurements are desired and possible in respect of items like land use and crop yields, information on items like livestock numbers (and even livestock products if included under the census programme), machinery and equipment, farm population and employment, etc. will have to be collected by interrogating the holders. But it is necessary to make provision for physical verification of a part of the information obtained on interrogation.

This can be done at all the three stages, namely by the enumerators themselves in the process of enumeration, by supervisors and in any programme of post-enumeration verification. Systems of adequate cross-checks of information on related items at the inquiry stage can be developed. This will not only improve the quality of the data, but will also give the enumerators an insight into the types of mistakes the respondents are likely to make and the precautions to be taken to avoid them.

13.35 Objective methods of area and yield measurements and physical verification can be applied where the census is conducted by trained ad hoc enumerators. In the case of census by mail questionnaire, to the extent the farm areas and yields are not measured, the respondent will frame his own judgement estimates in which he can make use of the measurements already taken, if any, sales, ratios of quantity of seed planted to area planted, estimated average yield per unit, fertilizer and pesticide application rates, etc. He can also make use of the quicker but cruder method of measuring field dimensions by pacing. Measurements by local weights and measures can also be taken resort to in estimation of production of commodities like milk, wool and mohair.

13.36 Estimation of areas under different vegetables in small gardens like communal gardens, school gardens, prison farms, etc., where a single plot can grow several vegetables, all sown mixed in separate rows, present a case where the subjective method of eye estimation of proportions of areas occupied by the different crops offers a solution. Unless actual crop yield survey for vegetables is planned which seems difficult in a census operation, estimation of production of crops in such gardens will have to be based on subjective judgements. This subjective estimate can be verified against the quantity actually harvested from a known area and sold. Such subjective estimation and verification of an estimate thus framed, can be applied to fruit orchards also for which use of objective method of yield survey is difficult as part of the census operation.

Special problems of census enumeration

13.37 Mixed cropping. A number of more or less objective methods of allocation of areas to component crops of a crop mixture, based on plant densities and seed rates corrected for mixed sowing, can be thought of. But all the methods involve some calculations which cannot be applied at the field level unless the seeds of different crops are not sown promiscuously but in separate rows. A simple way will be to treat a crop mixture as a separate crop. There can be a very large number of combinations of crops sown as mixtures, but some of the components in a crop mixture will be occupying a negligible fraction of the area and can be ignored, its share being treated as if under the major component. The crop mixtures in a country or in a region of it can thus be reduced to a very small number, not exceeding 5 to 6 which can be classed as major crop mixtures and each of them can be treated as a separate crop for the purpose of enumeration of area at the field level. These major mixtures will be two or three - crop mixtures. Even for the crop yield survey, a crop mixture can be treated as a separate crop and the yield of each major component can be treated as originating from the mixed area and its total production can be calculated as a product of its yield-rate from that mixture and the total gross area of the mixture.

13.38 For the purpose of land use statistics the gross area of a crop mixture can be allocated to its constituent crops at the district or regional or country level on the basis of an estimate of normal ratio of areas occupied by them in the mixture, which can be formulated if for the mixed fields selected for the crop-cutting survey, the seed-rates actually applied and the seed-rates that should have been applied, had the field been sown pure with each of the component crops ascertained. Suppose a field is sown mixed with maize, beans and cowpeas, and their seed-rates actually sown are m , b and c , but their pure-sowing seed-rates would have been M , B and C , then the ratio of their net areas will be

$$\frac{m}{M} : \frac{b}{B} : \frac{c}{C}$$

The ratios of the individual sample fields can then be pooled to get the average ratio at the district, regional or country level.

13.39 In the case of associated crops, the area should be recorded both under the fruit-tree (orchard) crop and the crop under ground cultivation and it should be specified whether the fruit trees are of bearing age or non-bearing age.

13.40 Continuous harvesting. Root crops like carrots, beetroots, radishes, turnips, sweet potatoes, etc., are harvested continuously from the same field throughout the season. Green corn cobs are also harvested continuously. In the case of green beans and green peas and leafy vegetables like spinach, continuous harvesting takes place throughout the season from the same plants. To these can also be added, for illustration, cotton crop which is obtained in several pickings from the same plants. These are annual field crops which are ploughed up and destroyed at the end of the season. The perennial fruit trees and long-duration crops (like sugarcane standing in the field for more than one agricultural year) are also harvested continuously during the season.

13.41 The area in respect of these crops has to be enumerated only once during an agricultural year irrespective of the number of harvestings from the same fields or plants. As regards estimation of their yield rates, all the harvestings during the year have to be included. If crop-cutting surveys are designed to estimate their yield-rates (which would be difficult as part of census operations), all the harvestings in sample plots will have to be attended to. Perhaps regression equations could be worked out between the yield obtained from the first few harvestings and the total yield.

13.42 In some cases, the continuous harvestings might extend into the succeeding agricultural year. If such extended harvestings cover only a small part of the succeeding year, it will be more practical to include them during the current year. But if the extended harvestings cover a considerable or major part of the succeeding year, they should be included in that year.

13.43 Scattered fruit trees. The number of fruit trees which are planted along field borders or planted scattered in fields and in other parts of a holding should be counted separately for each species, classified into those of bearing age and those not of bearing age. Total production from such trees can be calculated if the estimate of yield per tree is known from yield estimation survey or by a subjective method of estimation. As yields from a scattered tree is likely to be different from that from a tree in a compact orchard (other things being equal), it will be preferable to have a separate estimate of yield from scattered trees.

13.44 The number of scattered trees of a fruit species can be converted into its area equivalent by applying its normal planting rate.

13.45 Enumeration of outside holdings. All the holdings of a selected household, whether they lie within the selected primary sampling unit or outside it, have to be enumerated under that household, provided they are not operated under a separate technical unit and under the management of a separate household which may be the subsidiary of the selected household. Generally, such outside holdings will not be very far from the selected household. But if they are, they can be enumerated by the nearest enumerator and the relevant forms passed on to the enumerator in charge of the selected household. In fact, this practice was followed in India during the 1970 Census of Agriculture.

13.46 Enumeration of nomadic livestock presents some problems in some countries. Due to the scarcity of water or pasture lands or other climatic conditions, the owners of livestock are forced by natural circumstance to move together with their livestock from place to place in search of suitable conditions. These people may generally be divided into three classes:

- (1) The whole tribe is on the move with their livestock and they don't practise cultivation in any place. These tribes may be called purely nomadic.

- (ii) The whole tribe is on the move with their livestock for the greater part of the year but they practise cultivation also for certain periods. These tribes may be called semi-nomadic.
- (iii) The third class comprises of tribes where some members of the group are sedentary and engaged in cultivation or other economic activities, whereas a part of the group moves with the livestock as herdsmen.

The livestock of the second and third class of nomadic tribes mentioned above can be and should be enumerated where they cultivate and should not present any serious problem. But the enumeration of the livestock of the first category of tribes is generally faced with serious problems because of the difficulty arising from their movements. Happily these tribes generally follow well-defined periods of time and routes for their movements with the result that their movements and location at a particular period of time are usually known to administrative authorities. For example, in Iran the nomadic tribes move to the plains of the south during winter and towards the mountains in the north during summer. They camp in tents outside villages. Each group has a fixed and well established route and period of time for their movement. This information obtainable from the administrative authorities can be used to prepare a list of the tribes, their subgroups and the approximate size of each which can serve as a frame. This method would give information on livestock according to nomadic holdings which is essential in an agricultural census.

13.47 An alternative frame for consideration can be a list of water points. This can be of some use if a complete list of all water points, such as water holes, wells, etc., with information of degree of permanency of each well and adequate maps indicating location of these points are available. However, in this frame there will always be the problem of incomplete coverage, as it will exclude on the one hand the younger animals which are kept and watered near the camping place, and on the other hand those herds which are watered on rivers and other sources which are not in the list of water points.

13.48 Apart from the problem of contacting the owners of the nomadic livestock, there is another problem of their reluctance to provide information to census authorities. This problem may be solved to a considerable extent by including in the survey teams of veterinarians and associating the people who are known to the tribesmen such as sons and other relatives of their clans.

Shifting cultivation

13.49 In an agricultural census the basic unit of tabulation is the agricultural holding. For census purposes a holding is all the land which is used wholly or partly for agricultural production and which is operated as one technical unit by one person alone, or with others, without regard to title, legal form, size or location. However, there exists a system of cultivation according to which people clear certain parts in the reservoir of natural vegetation (forest or grass-woodland) and abandon them as soon as the soil is exhausted. This system of cultivation is called "shifting cultivation".

13.50 In such cases the usual definition of holding as given above cannot be strictly applied. The total area of the holding should in such cases be considered as the sum of:

- (i) the area under crops during the reference period of the census, and
- (ii) the area prepared for cultivation but not sown or planted at the time of the enumeration.

13.51 Some cases can also arise where a holding is composed partly of settled agricultural land and partly of shifting cultivation. In such a case each part of the holding should follow its own rules when recording total area.

Rationalized supervision of field work

13.52 A rationalized supervision of the field work, involving an element of surprise, in a sub-sample of holdings meets the twin objective of keeping the enumerators on the alert and of assessing the nature and extent of errors being committed and of providing correction factors to the census results where found necessary. For the second objective to be achieved the supervisor has to record independently on prescribed forms the figures on the questionnaires as actually found by him.

13.53 The success of rationalized supervision depends, among other things, on the sub-sample of holdings being kept completely secret from the enumerators, and the visit to a holding selected for supervision being made after the enumerator has completed work on it. Preparation of a detailed control chart for each phase of the census enumeration by districts and even by ecological or physiographic zones and a very close watch of the progress of field operations are essential in order that the supervisor pays surprise visits to the holdings at the right time without the prior knowledge of the enumerators.

13.54 Rationalized supervision puts a serious constraint on the movement of supervisors. They have to visit enumeration areas and holdings not according to their own will, convenience and comfort, but as included in a random sample. Some sample enumeration areas will be far flung. Time taken in such supervision will be much more than in a supervision of convenience. The supervisors have also to look after administrative and operational aspects of the census. Some routine supervision is also necessary for on-the-spot training of enumerators and for solving their day-to-day problems. These put a limit to the size of the sub-sample for rationalized supervision. The available supervisors' strength and their calibre is another constraint. Transport may be still another one. Depending on these and other factors, a supervisor can be expected to complete rationalized supervision of not more than 5 enumeration areas or 15 households in a month. This should determine the size of the sub-sample for rationalized supervision.

13.55 A part of the rationalized supervision can be done by the senior statistical staff at the national headquarters and their sample should include a part of the supervisors' sub-sample.

Procedure for collecting and forwarding of filled questionnaires

13.56 The supervisors should be directly and very closely involved in collecting the questionnaires from the enumerators and forwarding them to the census headquarters. They can refer back to the enumerators incomplete and incorrect work before it is too late for rectifying the mistakes with reference to the position on the spot. The supervisors should be provided with the guidelines for not only supervising the field work but also for the scrutiny of completed questionnaires. Editing work at the headquarters can be considerably facilitated if the supervisors are required to satisfy themselves fully in regard to completeness, accuracy and consistency of the questionnaires before forwarding them to the headquarters.

14. ORGANIZATION OF FIELD WORK

Department responsible

14.1 A census is a government-sponsored operation in principle for collecting statistical information from all units in a country at a given point of time. In case of agricultural census this unit is an operational holding and statistical information relates to the characteristics of the holding. It is conducted to obtain for agricultural development and administration comprehensive data on the characteristics of the organization and structure of agriculture and utilization of agricultural resources and provides a basis for the development and implementation of an integrated system of food and agricultural statistics and also for planning and execution of other agricultural and agro-demographic surveys. Considering the volume of data collected and the scale and duration of the enumeration work involved, an agricultural census is definitely a greater and more complex operation than a population census or any other census. The primary and chief responsibility in regard to planning, organization, conduct and supervision of the agricultural census operations and tabulation and analysis of the results and preparation and publication of the report definitely rests with a single government department, but its success depends on the support and assistance of other government departments and public agencies at various stages of the work, e.g. field work and its supervision, delineation of enumeration areas and their mapping, seeking co-operation and support of the people through their chiefs, training of enumerators and supervisors, securing accommodation and other facilities for them and their transportation to the areas of their operation, etc.

14.2 The main department at the national headquarters responsible for the organization of field work of the agricultural census can be either the Statistics Division or Department in the Ministry of Agriculture or the Bureau of Statistics or Central Statistical Office located in the Ministry of Finance and/or Economic Planning. The position will differ from country to country depending on whether the Ministry of Agriculture, as the main user of agricultural statistics, has a full-fledged division or department of statistics or there exists a central statistical organization in the country which is not only a coordinating body but is also charged with the responsibility of organizing and conducting censuses and surveys.

14.3 The department responsible for organization of the agricultural census, in any case, will have to seek the support and assistance of other departments either in organization of the field work and in enlisting the cooperation of the people or in laying down plans and procedures, concepts and definitions and classifications. This support and assistance can be secured by setting up an agricultural census committee at the national level with representatives of all departments concerned with the field organizations and use of agricultural data. One of the major functions of this committee should be to coordinate the activities of the staff of the different departments in the field and to solve the practical difficulties encountered during the census operations. For tackling the field problems more promptly and effectively, it is also necessary to set up census committees at regional and district levels. The need for setting up census committees at various levels of census operations has been discussed in detail in Chapter 2.

14.4 The census provides an opportunity to mobilize the resources of manpower to undertake a huge operation of data collection. If there is a gap of proper personnel, an attempt is made to fill it up through training or through borrowing from other organizations including the international ones. The organizational and technical momentum generated for the agricultural census should, therefore, be exploited fully and not be allowed to wear off completely by the end of the census year. Instead of disbanding the entire census staff and closing the census office, a nucleus permanent staff which has been trained during the census years should be retained for developing suitable sample surveys and for collecting other data and thus developing gradually a permanent agricultural census organization.

Regional offices and their work

14.5 A large-scale country-wide agricultural census operation is difficult to control and guide effectively and promptly from a single central office at the national headquarters. The problems and difficulties of the field staff cannot be expeditiously communicated to the central office and solutions obtained in time. It will also be difficult for a central office to make adequate arrangements of transport for field staff in distant places. The training of all the field staff and supervision of their work from a central office cannot be adequate and effective. Supply of equipment and forms and provision of necessary facilities and amenities and payment of salaries, etc., to the field staff from a central office will be slow. These problems will be much more difficult to tackle particularly if the country is large and transport and communication facilities are limited. It is, therefore, necessary to establish census offices at the regional and district levels. If the department responsible for the census organization has already its regional and district offices for its normal statistical work and for survey and census purposes, these offices should be strengthened to cope with the increase in work arising from the agricultural census. The regional offices for the census purposes should, as far as possible, be located where the other government regional offices are.

14.6 The regional and district offices can serve as the secretariat and coordinating body for the census committees. These offices can place the problems and difficulties faced in the field before the different departments represented on the committees and obtain solutions and their support and assistance. To enlist the support and cooperation of the village leaders and the people to the census operations, these offices can organize local meetings in which the district administrators and officials of the Local Administration Department and Rural and Community Development Department can assist in explaining to the people the objective and scope of the census, its need and importance, its role in planning country's agricultural development and people's welfare and the importance of people's support and co-operation in achieving the desired success in the census operations. Any misapprehensions which the people might have about the census operations can be allayed more effectively by the regional or district authorities than by the authorities at the national headquarters. In some areas, more than one meeting of the chiefs and the people may have to be held and discussions continued before their agreement for support and cooperation is reached. The regional and district offices have a particular role to play in such situations.

14.7 The regional and district offices can pool together the field and supervisory staff of the different departments made available for census operations in the region or district and coordinate their activities; and instances of lack of cooperation on the part of any member of the field staff can be brought to the notice of the concerned department for prompt solution at the local level. These offices will also be ideal for assessing day-to-day transport requirements and pooling together the transport facilities that can be made available for the census operations in the region or district.

14.8 The regional offices can organize more intensive training courses of small groups of census enumerators and their supervisors in the region and with reference to specific local conditions and problems. The enumerators and supervisors in a region can be called more conveniently at a regional office to discuss any problems that appear common to most of them. Some trained enumerators can be kept in reserve at regional level to fill sudden vacancies arising from resignations, sickness, etc.

14.9 The supervision of field work, prompt rectification of the mistakes in keeping with the position on the spot and gathering of the completed questionnaires from the enumerators and their scrutiny in consultation with them can be better organized from a regional office than from the head office. Transfer of an enumerator from an area where the work has been completed to another area where the work is lagging behind or is not up to the mark, can also be assessed and effected promptly from a regional office.

Census field staff

14.10 The agricultural census being taken at periodic intervals, can be conducted either entirely with the help of new ad hoc enumerators or by supplementing the field staff already employed for annual censuses or surveys by some ad hoc enumerators. The ad hoc enumerators are generally fresh from schools and have little background knowledge of agriculture and agricultural census and local conditions. They require quite an intensive training, supplemented with considerable practical work, field demonstration, tests and exercises. Considerable governmental energy, time and resources have also to be spent in securing accommodation for them in rural areas, in providing them with camp equipment and facilities and in introducing them to the village leaders and the people and in securing their cooperation for them. For better prospects or for higher education, some of them leave the job in the middle of the census operations and replacements have to be found. These inconveniences can be avoided if the normal field staff of the department responsible for the conduct of the agricultural census is supplemented by the field staff of other departments concerned with agricultural statistics or agricultural extension.

14.11 One such agency can be that of the extension assistants or field officers of the Ministry of Agriculture who are familiar not only with the boundaries of the enumeration areas of their jurisdiction, the terrain and the land-use and crop cultivation practices, but also with the people whose cooperation they can easily obtain. The census field operations and extension work can be so dovetailed as to complement each other. In most developing countries, however, the number of the extension agents may be limited and in some areas their jurisdictions may be large. Moreover, the extension activities cannot be postponed for a long period. Therefore, only a part of the strength of the extension agents whose jurisdiction and extension work are not heavy, can be drawn to assist in the census work.

14.12 Many of the advantages which an extension agent has over an ad hoc enumerator in census operations can, however, be lost if he is moved to an area even slightly outside his jurisdiction. Moreover, the cost of the census operations will increase as the extension agent will have to be paid for his overnight stays outside his normal jurisdiction. An extension agent should not, therefore, be allotted an enumeration area which does not fall within his normal jurisdiction.

14.13 For the census of agriculture in specific pockets like communal gardens, mission farms, school gardens, prison farms, irrigation and settlement schemes, farms at the farmers' training centres and at research and experimental stations and farms of persons primarily engaged in distributive trade or other professions, it may be desirable to employ such field level staff available there as are responsible for farm operations and maintenance of farm records. For each field level worker at these farms or gardens, the area to be covered and the enumeration work to be done will be small. In the case of mission farms, school gardens, prison farms and farms of traders, etc., the census will be tantamount to self-enumeration. Even if a census enumerator is assigned one or more of such farms or gardens lying within his allotted jurisdiction, he will be substantially assisted by the field level worker there.

14.14 The association of the extension agents and the field level workers of the farms and gardens mentioned above, with the census enumeration, however, involves the danger of their performance being exaggerated or under-rated as suited to them. Efforts to reduce the risks of such biases will have to be made by proper training of the concerned staff and by adequate supervision and sample verification.

General organization of field staff

14.15 It is advisable that the field staff, particularly the supervisors and enumerators, should live in the places where they are going to work. To send staff who are unfamiliar with the region has many disadvantages; they cannot move around easily, they awaken the mistrust of the farmers, they do not communicate easily with them since they do not know the local dialect, they are not familiar with the local measurements and weights.

14.16 If such staff with local knowledge is recruited for the census, the enumerator can move alone in his jurisdiction as he will get all the cooperation from the farmers. However, if it is not possible to recruit qualified and experienced enumerators from the localities where they have to work, it may be sometimes advantageous to allow the enumerators to work in a team of two or more. This may be desirable in difficult areas with poor transport and communication facilities. Sometimes, for safety reasons also it may be desirable to have such a team of enumerators.

14.17 The advantages are, however, likely to be lost as a team becomes larger. There can be some economy also in regard to transportation and provision of accommodation and camp equipment and facilities if the enumerators are organized in teams. The enumerators in a team can discuss their problems and difficulties and experiences which can be of mutual advantage. Organization of enumerators in teams can be specially advantageous if there are a large number of new and inexperienced enumerators. This can serve as an in-service training for the new enumerators till they are trained to work independently or as team leaders.

14.18 A team of, say, two enumerators can work simultaneously in the same group of enumeration areas or in two different groups of enumeration areas. In the former case, the items of work can be divided between the two; for example while one is engaged in physical measurements like field area measurements or crop yield survey in an EA, the other can collect data on farm population, livestock numbers, machinery and equipment. etc., by interviewing the respondents. Also, the information collected by one member of the team can be checked and verified by the other. This will lead to instant knowledge of types of errors being made in the enumeration and their avoidance in future by the whole team.

14.19 Formation of teams of enumerators can also be advantageous when the field staff of other departments are drawn to supplement on a part-time basis the normal strength of trained and experienced enumerators of the department responsible for the organization and conduct of the census. Such a part-time enumerator can be joined in a team with the nearest regular enumerator and they can be of mutual assistance as their varying knowledge and experience and available facilities can be supplementary.

14.20 In a team, however, the enumerators are likely to duplicate certain amount of work or spend some time in idleness if there is no proper organization and distribution of work between the members of the team and adequate supervision over their work. A slow enumerator may be a drag on his faster colleague. Whether the enumerators should be organized in teams or should work individually in their separate allotted areas will eventually depend on the conditions and the type of census organization in a country. But even if the enumerators work independently in their separate areas, they can be treated as members of a team in a supervisor's zone or in a district to ensure balanced progress of field work all over the zone or the district. Workload in some enumeration areas of a supervisor's zone may be heavier than in others. The supervisor should then be able to transfer the enumerators from the areas where work has been completed or suspended to the areas where an increased strength of enumerators is needed for a specific period.

14.21 The crop harvest in the same season may be at somewhat different times in the different parts of a supervisory zone or district or in different zones or districts of the country, but the harvesting period itself in an area may be very limited and the enumerators allotted to that area may not be able to complete the crop-cutting survey on time. In such situations, enumerators from other areas where the crop harvests have not started or have been completed, can be transferred to assist them.

Supervisory work and staff

14.22 Adequate supervision of enumerator's field work at proper time and at frequent intervals, both by routine procedure and by surprise visits, is very essential for the success of a census operation and its completion on time and for ensuring the quality of data collected. Enumerators' problems and difficulties and the guidance and assistance they need at any stage

of census enumeration can be known and the required help given in time if their work is inspected at regular intervals. Generally an enumerator's work should be supervised at least once every week: it can be more frequent in the initial stages of his work, but less frequent when the supervisor is convinced that he not only understands his work but also does it systematically and correctly. The purpose of supervision should be not only to prevent carelessness and negligence on the part of enumerators but also to impart instructions to them with reference to actual situations in the field and to solve their day to day technical and operational problems.

14.23 For a supervision to be really effective and useful particularly in the initial period of an enumerator's work including identification of enumeration areas with the help of maps and boundary descriptions and listing of the households, it should be carried out while the enumerator is actually on the job. The supervisor should be present at several of initial interviews and actual measurements done by the enumerator, observe his work closely and take immediate remedial measures for the defects and shortcomings noticed. Later supervisory visits should include observation of one or two interviews and the checking of a sample of questionnaires to ensure their completeness, accuracy and consistency. On completion of each phase of enumeration work in an area, the supervisor should review the work and ensure that all households have been covered and the questionnaires have been fully completed for all holdings; and in case any deficiencies are observed, he should ask the enumerator to rectify them before starting the next phase or moving to another area.

14.24 Each supervisor may be required to carry out a part of his supervision in a random sub-sample of enumeration areas and households of which the enumerators should have no prior knowledge. The supervisor's findings along with the data entered by the enumerators on the questionnaires, can be recorded on a prescribed supervision form. This will provide an assessment of the nature and extent of errors committed by the enumerators and also correction factors if necessary. Such a programme of rationalised supervision will take a considerable time of the supervisors. They have also to arrange for obtaining transport facilities, forms and census and camp equipment for the enumerators from the headquarters or regional offices, introduce them to the people and brief them about the census operations and the need for their cooperation and finally secure accommodation and other facilities for them in the rural areas. Considering the extent and nature of work and the responsibilities he has to discharge and the difficult terrain in most cases, a supervisor can effectively supervise and control 5 to 10 enumerators. In difficult areas with poor transport facilities and with suspicious farming communities about the census, not more than 5 enumerators should be put in charge of a supervisor. This number may go up to 10 in the areas with good transport and communication facilities and where farmers are familiar with such censuses and surveys.

14.25 For a successful, timely and effective supervision, adequate transports of appropriate types are essential for both the supervisors and enumerators. Whereas a supervisor can be provided with a landrover or a motor cycle, an enumerator can have a bicycle. In some areas, particularly the interior ones, these will not work; and the supervisors and enumerators will have to be provided with the authority to hire local transport means like horses, mules, camels, etc. depending on what is available in the area.

Enumeration work and staff

14.26 The number of enumerators for the census operations in a country will depend not only on the volume of enumeration work but also on the intensity of agricultural exploitation, the number of crop seasons in the year and the terrain to be covered. In many developing countries, while most parts have only one major crop season or at most two, the terrain is difficult, transport and communication limited and movement from one enumeration area to another time consuming. Even the households in an enumeration area may be far apart. It is difficult to fix up the norm of workload that should be assigned to an enumerator. This workload will depend upon the content of the census, whether the enumeration area is compact or widely spread and transport and communication arrangements. However, experience shows that not more than 100 farm households should be allotted to an enumerator to obtain data of quality.

14.27 If the enumerator comes from the area where he has to work, he is known to the people and can get the maximum cooperation from them and in case he needs some assistance for some of his census operations he may be allowed to choose his own helper. However, if he is new to the area, he has to be introduced to the village leader and the people by his supervisor or a senior local administration or rural development officer. The chief or the village leader has to arrange for his accommodation and, if necessary, a meeting of the people in which he can explain the objective and the need and importance of the census and secure their cooperation. The chief or the village leader has also to assign to the enumerator a helper who is familiar with the people and is well informed about the agricultural practices in the area. He may be selected from those who usually work or have worked in the past on similar missions.

14.28 The helper can guide the enumerator around the area, take him from one household to another and to different fields of a household and to cattle sheds if required. He can help him in measuring and taking bearings of the sides of the fields. He can hold the poles at the corners of the fields, run the measuring wheel or chain and strings or frames for demarcating crop-cutting plots. He can also assist the enumerators in harvesting crop-cutting plots and in drying and threshing or threshing and drying the experimental produce. He can be sent to make appointments with the holders in advance and to carry messages to them.

14.29 The helpers can be paid either on a daily wage basis or a monthly wage fixed on the basis of quantum of work to be done. The remuneration should be in keeping with the wages paid in the past or paid for similar work.

15. USE OF SAMPLING TECHNIQUES

15.1 Sampling techniques are now being increasingly used by various countries in carrying out of their agricultural censuses. The main reason for their adoption is the limited resources available in terms of money and trained personnel. The latter are usually not sufficient to execute agricultural censuses on the basis of complete enumeration. Sampling has also been resorted to for a rapid publication of results of the census and for carrying out of quality control checks on the data collected during the census. Even if a country can afford to or has to conduct an agricultural census on a complete enumeration basis for compliance with a legal obligation or for providing information at the level of the smallest administrative division and for minor crops, or for establishing an inventory for agriculture for future use, it will be still necessary to employ sampling techniques for other purposes for a better control of the operations of the census. For example, pre-testing of schedules, carrying out a rationalized supervision and for checking the quality of data and determining the extent of incompleteness of the census count, have necessarily to be carried out on the basis of a probability sample. Also, where the facilities of a large size computer are not available, tables needed urgently by the government could be processed on the basis of a sample of the questionnaires as has been done by some countries. On the whole, sampling techniques have been successfully applied in recent agricultural censuses at least for carrying out the main census operations, especially when the selection of units was done at the headquarters of the agency technically responsible for carrying out the agricultural census. Tabulation of the results of the census on the basis of a sample has been equally effective.

Advantages of sampling methods

15.2 Practical problems of executing satisfactorily the various operations of the agricultural census in a developing country are manifold, whether it is carried out on a complete enumeration basis or on the basis of a probability sample. Merits and demerits of use of a sample in agricultural census have been discussed in Chapter 13. Illiteracy of the farmers, their lack of sufficient quantitative knowledge of their various farming operations and farm characteristics, difficulty of conveying "concepts and definitions" of census to the farmers, their distrust of the government's intentions in seeking information about their farming activities, lack of proper communication with rural areas, lack of sufficient facilities for carrying out the census, especially lack of trained personnel at the various levels and insufficient funds and sometimes their timely non-availability are among the several factors which stand in the way of successful conduct of census, particularly in a developing country. The latter is indeed a great hindrance in the proper carrying out of the various census operations according to a prescribed time schedule. If facilities are not available at the time these are needed in the required quantities, schedule of census operations is disturbed and sometimes unnecessarily prolonged. Even when the facilities, as mentioned earlier, are available workers in the field and at headquarters are unable sometimes to work according to a prescribed time schedule. All this tends to put census operations out of gear besides making the census unnecessarily more costly. Sometimes it results in the curtailment of the scope of the census operations. The latter affects the originally adopted sample design of the census, making it difficult to provide valid estimates of the various characters under study.

15.3 Selection of suitable enumerators and supervisors, their continuity and their training have presented problems which have not been satisfactorily solved by the agency responsible for executing the census. Inadequacy of trained personnel to carry out the census and equipment for processing data has resulted in serious delays in the publication of the census results in many developing countries which have no tradition of conducting a census or large-scale agricultural surveys. Beside the above general problems there are special problems peculiar to the local conditions like the continuity of the staff working for the census, including the executives.

15.4 It has, however, been emphasized in Chapter 13 that even those countries which lack resources in terms of funds and trained personnel, should undertake at least a minimum programme of the census on a complete enumeration basis to provide a good base for preparing an efficient sampling design for collection of detailed data on important items of the census and for planning future agricultural surveys for collection of current agricultural statistics.

15.5 Problems mentioned above are indeed more serious when the agricultural census is planned on a complete enumeration of holdings than when it is based on a probability sample. This is so, as for the latter the work load at the various levels is reduced as also the requirements of resources required for the census taking. Also control of errors due to faulty responses can be better organized for a sample census. As a matter of fact, control of non-sampling errors including that of non-response is only possible on the basis of a sample. Thus even though a census may have been planned on the basis of a complete count for certain reasons, sampling techniques will have to be used for controlling the census operations and of the response errors and those of data processing. However, in order to carry out these tasks effectively there is a need of highly qualified persons for designing the sampling plans and their execution. It will also be necessary to give adequate training to persons responsible for supervising the various operations in the use of sampling techniques. Also the expertise will be needed for handling the situations when the proposed sampling plan could not be carried out as such but resulted in significant deviations from the original plan. The resulting executed sampling plan perhaps became one which ceased to have any probability basis. This particularly happens when units other than selected sampling units are canvassed by mistake or by design or if a large number of the originally selected units do not respond.

Uses of sampling in census

15.6 Thus, the use of sampling techniques in some form or the other is necessary for successfully completing the work of an agricultural census. These will be required, for example as seen earlier, for:

- 1) Carrying out census on the basis of a sample;
- 2) Checking the completeness of the frame of holdings or households especially when the frame available is rather old;
- 3) Pre-testing questionnaires for use in the agricultural census;
- 4) Arranging supervision of field work on a rational basis with a view to provide an idea of the quality of data collected as also to provide for a correction factor wherever possible;
- 5) Arranging the field work in a set of interpenetrating samples such that each is capable of providing valid estimates of characters under study and the consistency or otherwise of these estimates to provide an idea on the reliability of the census data;
- 6) Arranging collection of data in two parts: the simple one by a less-qualified set of enumerators, the complex information by enumerators of higher qualifications;
- 7) Planning of post-enumeration checks on the completeness of data collected, evaluation of its quality and controlling non-response errors;
- 8) Rapid preparation of some preliminary results of the census;

- 9) Control of errors in the processing data - codification, perforation, etc;
- 10) Final tabulation of the data on the basis of a sample in case resources are not sufficient for carrying out the analysis of all the data collected.

Choice of sampling designs

15.7 It is difficult to discuss an optimum sampling design for the various above-mentioned uses. An ideal sample design has to be one which is optimum for the study of multiple characters and control of census operations. An optimum design perhaps does not exist unless one puts certain restrictions on the requirements of accuracy. But a reasonably good design will depend upon the resources available especially funds and trained personnel, the desired accuracy of estimates of principal characters, taking of course into account the seriousness of the problems mentioned above. It is also necessary that the sample design is simple enough to operate in the field with the help of the available personnel. Perhaps the design could be self-weighted where the computer facilities are not available for processing the data. The experience indicates that it is difficult to make adjustments for any significant deviations occurring from the sample design in case the sample design is not simple. Also the size of the sample has to be fixed at an adequate level and capable of being executed within the time limit prescribed for the census operations. It is, of course, necessary to estimate the cost of executing the various individual sample designs for various census operations beginning with the one for testing the incompleteness of the frame and ending with that for processing the data. The total cost and requirements of personnel (the number and the period) and the other facilities required for their operation should be clearly assessed and a definite approval of the Government obtained for incurring the expenditure. In case funds and other resources required are much beyond the capacity of the country, the sample designs have to be adjusted keeping in view the resources actually available indicating to the authorities the type of results to be achieved by this change in the sample design. It may also be said that resources once promised originally are seldom given in full and at the time required as mentioned earlier, this could lead to the failure of the sampling design unless this factor is kept in mind while planning the sample design. It is perhaps advisable to keep back a certain portion of the resources promised and plan on the basis of resources which are somewhat less than the promised ones. Alternatively, one has to develop a sequential sampling plan which is to be adjusted according to the actual resources available at the time for carrying out a phase of the census. The latter really requires a great deal of ingenuity on the part of the statistician, periodic review of the resources and an intimate knowledge of how the census operations are proceeding. The original design, of course, once chosen with care, should not be abandoned or modified except for serious reasons. It is difficult to say whether sampling statisticians of such a high order will be available as most of them are used to pre-fabricated sampling designs.

15.8 In the choice of the sample design, the nature and extent of experience already possessed by the country in the carrying out of agricultural census and surveys have also to be taken into account. Much simpler designs have to be recommended for countries which have no or only a little experience in handling sample surveys on a scientific basis. Perhaps it will be useful to encourage the use of sampling techniques in such countries over the next few years under guidance and supervision of a sampling expert, in order that sampling techniques can successfully be employed at the time of the 1980 agricultural census.

15.9 Very frequently it is believed that the nature of "concept and definition" adopted in the census has nothing to do with the sampling design to be adopted in the collection of data. But this is not so, sampling designs differ in their effectiveness to control response errors. Problems of communicating census questions to the farmers in the desired sense are indeed great in view of illiteracy, etc. Farmers are not acquainted with the concepts of size of holding, parcel and employment on the farm, etc. They do not even fully know quantitatively the extent of their farms and production. It is thus difficult to expect a satisfactory response to the census questions unless they are prepared over a

period of time in order to understand the language of the statistician. Perhaps it may be worthwhile to provide means of educating them in these concepts over the next five years. Incidentally, the enumerators themselves also need considerable experience in handling these concepts. Even after their training, it may be considered necessary to split the census questionnaire into two parts: one part to be handled by enumerators and the other part to be handled by the supervisor cum enumerators or supervisors. For this purpose, a two-phase sampling design shall have to be developed.

Stratification

15.10 The common sampling design that can be recommended for a sample agricultural census would be a two-stage stratified sampling. The strata would generally consist of administrative divisions at the desired level depending on their size, or other agriculturally homogeneous regions on the basis of type of farming, the type of farming community, population densities, physical features and climate, geographic compactness, etc. Strata of equal size with respect to agricultural land or agricultural population will further improve the efficiency.

Selection method

15.11 Within each stratum a village or an enumeration block constituted for the agricultural census will form the primary unit of sampling, while a household or a farm household, depending on the information available from pre-listing of households will form the secondary unit, which is to be enumerated. Since villages vary quite considerably in size, they could be either stratified within the main strata, according to their sizes or made approximately equal by grouping together small villages and sub-dividing large villages before sub-sampling them for selection of households. Another method available for dealing with variable size of villages could be to select them with probability proportional to their sizes. A fixed number of farm households, usually not more than 10 to 15, can then be selected from each primary sampling unit either systematically or randomly.

Sub-stratification

15.12 If at the time of pre-listing of households some ancillary information, like total land cultivated by the holder, has been collected, this can be used to stratify the holdings according to their sizes and a fixed number of holdings can be selected from each stratum so formed.

15.13 In some countries, large holdings are few and they are known to the local administration. They can be completely enumerated while the sample may be selected from the rest of the holdings.

15.14 Occasionally, the sub-sampling of the villages or enumeration blocks is not feasible, making it necessary to enumerate all households in the primary unit because the farmers become suspicious about the object of the inquiry when only certain holdings are selected for the purpose. To allay their fears and to ensure their cooperation, enumeration of all holdings in the village has to be resorted to even though this is a statistically inefficient procedure.

15.15 Sometimes, a single stage sampling of holdings within each stratum is possible when strata are small in size and the cost of listing the holdings is not much. This design is statistically the most efficient for a given sample size.

Use of multi-phase sampling

15.16 Occasionally, two-phase or multi-phase sampling can be recommended. Here, for some basic items in agricultural census, like farm population, crop areas, land use, livestock numbers, etc., a large sample of holdings (or even all the holdings) can be selected from the sampled enumeration blocks within each stratum and only a small sub-sample from the samples of holdings selected for basic items can be selected for securing data on additional items, such as use of fertilizers, seeds, agricultural implements, breeds of animals, etc. These additional items are usually of a more complicated character and involve careful questioning of respondents. A better type of enumerator may be required and be entrusted with this work. Either a single sub-sample can be selected for whatever additional information is sought or it may be distributed on different sub-samples, a limited amount of information being collected from each sub-sample, so that all samples put together provide the total additional information proposed to be collected by sampling without placing an undue burden on the respondents. This operation of securing additional information from a sub-sample can be done either simultaneously with the larger sample for basic items or can be staggered so that supervisory staff can be employed for enumerating the sub-sample, after they are free from the supervision work.

15.17 The procedure can be further extended in that a much smaller sub-sample can be selected from the sub-sample for additional items for securing data on such items which require physical measurements. One such situation is the need for calibration into standard units of the area and yield reported by the farmers. This need arises partly on account of all kinds of arbitrary local units of measurements that are in use in different parts of the same country, and partly because of the general tendency among farmers to under-report their areas and production. In this case, actual measurement of area of holdings of a much smaller sub-sample of farmers or fields and the crop yield of standard sized plots marked in a sample of fields giving the particular crop should be made. Here, area and yield data are obtained from a much larger sample of farmers by inquiry method, the one adopted generally in the census, while physical method of measurements of area and yield through crop-cutting technique are done on a sub-sample of farmers.

Use of successive sampling

15.18 Many times, the census data are needed more frequently for improving the agricultural plans than what is actually done. For example, the census may be conducted once in ten years, while data on characteristics of holdings may be needed at intervals of five years or even more frequently. Some developed countries, like U.S.A., Japan, etc., in order to meet such needs, plan their agricultural census quinquennially. Because of the enormous cost in organizing the agricultural census, the developing countries cannot afford to do so although the need of basic agricultural data is felt by them much more for planning and evaluating their agricultural development programmes. In such situations the use of the technique of successive sampling may be recommended. The successive sampling consists in selecting a sub-sample from the sample selected for the previous census and supplementing it by selecting a fresh sub-sample from the units not selected and canvassed in the previous census. The two sub-samples taken together make the complete sample. With the help of repeated sub-samples the census data are up-dated by using the ratio or regression procedure of estimation. From the other sub-sample, an independent estimate is obtained. The two estimates are then pooled to give an improved estimate. If only a change from the previous census is to be studied, it will suffice to confine to the sub-sample selected from the sample for the previous census. In fact, in most situations a study of change will provide adequate information for all important policy matters.

Sample size

15.19 What should be the sample size in a given situation, is difficult to answer unless the purpose of the census information is known. If the census data are needed for planning at administrative sub-divisions level, a much larger sample will be needed. Depending on the density of agricultural population, a sampling fraction of 2 to 10 per cent may be adequate for providing reliable estimates for all the principal characteristics of holdings. However, if such information is needed at the broad regional level, a sampling fraction of 1 to 2 per cent of holdings may do. A critical examination of the sample size should be made at the time of the pilot census. It has been mentioned in Chapter 11, that one of the objectives of the pilot census should be to study the variabilities of different variable characters and the time and cost taken in obtaining information on them. If such information is made available, for different sampling design sample size can be easily determined.

Size of sampling units

15.20 The question is also sometimes raised as to what should be the size of sampling units at various stages if multi-stage sampling design is used. It has been generally observed that there exists a high positive intra-class correlation coefficient between the values of the sampling units which are geographically contiguous. It would be, therefore, desirable to have a large size of sampling units at higher level of stages. For example, if the sampling design is two-stage, for the same sampling fraction the larger the size of the first stage unit is, the more efficient will be the result. This principle can be extended to any stage of sampling design.

Crop-cutting

15.21 It has been the general experience that crop-cutting technique is the only method that can be recommended for obtaining reliable estimates of crop yields in the developing countries. In the census, information on crop production is, no doubt, obtained through oral inquiry from the farmers. As has been mentioned earlier, the farmers generally understate their crop production; therefore, to remove under-reporting bias crop-cutting experiments should be conducted in a sub-sample of fields of the sampled farmers. The technique of crop-cutting for estimation of crop yield is being adopted by many developing countries as a routine measure. Generally stratified three stage sampling design is recommended. Administrative sub-divisions are adopted as strata, and enumeration blocks or villages, holdings and crop-fields being the respective stages of sampling units. From the sampled fields, a standardized cut is taken for measuring the yield. In case of food grain crops, a cut of 50 square metres is considered to be adequate. However, the size of the cut may vary for other crops. For the homogeneous crops, even smaller than 50 square metres cut may be adequate, but for heterogeneous crops even larger than this may sometimes become necessary. It has been the experience that for obtaining reliable estimates of yield at district or administrative sub-division level, 100 to 200 crop-cuttings should be made.

16. DATA PROCESSING

16.1 Data processing relates to those activities usually undertaken after the field enumeration is completed. Data obtained from an agricultural census are immense, and their processing is a lengthy and complicated operation. Of course, it is not possible to utilize such a huge amount of data without their classification, summarization and tabulation. Tabulation of these data into a large number of tables not only requires a great deal of effort, but sufficient finances as well. This tabulation depends on the method of processing, manual or mechanical, or both, type and number of equipments to be used, and time and personnel needed for each operation, to guarantee issue of the tables as quickly and accurately as possible with minimum cost.

16.2 Preparation of the tabulation programme requires knowledge of the volume of data, type, number and speed of equipments, facilities available (quantity and quality), and the time limit for completing each operation and its cost. It is during the planning stage that details of the tables must be prepared. A detailed list of the tables, their type and format, and the approximate date of their issuance should be determined after consultation with the principal users. This should be done when finalizing the census questionnaire, so that the final census results should be issued as soon as possible after field work is completed. The size of the questionnaire, order of the inquiries, recording the codes, and relating the entries to the final tables, all have a great effect on the efficiency and accuracy of the data processing, saving time and money, and reducing errors resulting from coding and punching processes.

16.3 With proper planning for analysis of census data and organization of the data processing operations, it is usually possible to make the final results available to the users within two years after completion of the field work. Important preliminary results, such as number of operational holdings according to size, land utilization and cropping patterns, distribution of livestock numbers according to operational holding size, etc., can be made ready within six months. Unless there exists a proper appreciation of the facilities essential for the timely issuance of the census results, preparation and publication frequently get delayed, making at least some of the results obsolete. In preparing the organization of the census, this aspect needs to be given special attention so that the necessary facilities are assembled timely in order to prepare and issue the census results according to the time schedule prescribed for the purpose.

16.4 Usually, there is a timetable for issuance of the census results. The priority tables of general interest are issued first and then the tables of second priority and so on. The processing programme must take this into account and organize the processing of the census data in such a way that the data relating to priority tables are put on punch cards first, if the mechanical tabulation method is adopted. Even in the case of manual tabulation it is possible to prepare the data sheet in such a way that the priority tables are generated first. In India, in the 1970 census of agriculture, both the systems of processing, manual and mechanical, were adopted. Some of the States of the Indian union adopted mechanical method of processing while others adopted the manual method. Surprisingly, it was observed that the States adopting the manual method of processing produced the basic tables much earlier than those adopting the mechanical method. This may not be taken as a proof that the manual method is superior to the mechanical one. The basic advantage of the mechanical method of processing is that once the original data are on the punch cards, any cross-tabulation is possible while this is difficult in the case of the manual method.

Methods and equipment for data processing

16.5 Mechanical processing of data depends on preparation of punched cards where the original data are recorded by means of perforation after suitable coding. The punched cards are then verified and sorted according to classification, and the results are then finalized with the help of a tabulator. However, electronic computers which utilize

punched cards and are much faster, offer new ways of preparing tables with complex cross-classification. Of course, there are many factors to consider before selecting manual or mechanical/computer methods of processing census data, or a combination. Where clerical labour is costly and if mechanical equipment is easily available and can be properly serviced, machine processing is obviously to be preferred; where clerical labour is cheap and efficient and the ratio of machine operating costs to clerical salaries is high, the only advantage of machines would be greater accuracy and saving of time. The greater cost of machine processing is worthwhile by the time-saving standard, but this may not suit every census's need. In some cases, a combination of manual and computer processing may be appropriate. Also, a number of preliminary data processing operations may be undertaken manually in statistical offices of each administrative district.

16.6 An alternative that is often suggested when machines are not locally available and cannot be easily imported or serviced is to send out the original returns to private companies which are prepared to undertake their mechanical processing on payment. However, this is not normally advisable since official control at various processing stages would not be available. A private company, perhaps, would not possess the sense of responsibility in providing accurate results or the deep interest in the census that are bound to exist with original census personnel. For these reasons, countries where mechanical facilities are not locally available may prefer manual processing.

16.7 In any case, it is important to consider at the pilot census stage all processing methods and their implications, including speed, efficiency, and cost in order to reach a decision as to whether one, or a combination of both methods, would be better utilized in the preparation of final census results. Either way, punch card and verification machines are needed, in addition to sorters and tabulators, or a computer and its peripherals.

Design of computer operations and preparation of computer programmes

16.8 Once the decision to use the electronic computer for processing the census data is taken, its implication should be fully realized. The pre-coding of items on the questionnaire, the type and number of corrections made during the review of the questionnaire, the errors detected during key punching or key-to-tape operations, and the various specifications for making tabulations are factors which are all handled differently when using a computer. The use of a computer requires experienced agricultural statisticians working together with experienced computer system analysts and programmers. For a successful data processing programme, it is essential to:

1. consider realistic rates for coding, punching and verifying in order to have a justifiable time schedule;
2. prepare and finalize an outline of all the statistical tabulations simultaneously with the questionnaire;
3. ensure that the system analysts have worked completely through the overall data processing operations;
4. prepare and thoroughly test the computer programmes by the time the data collection begins;
5. require the system analysts and programmers to fully document all programmes to enable other programmers to make corrections. The computer programme should be self-documented by use of comments within the programme, and user's manuals should be prepared; and
6. limit changes in computer programmes to those that are absolutely necessary after the programme has been prepared.

16.9 Considerable time is required to write up computer programmes for tabulation, error identification and certain desirable types of automatic error correction. Therefore, it is advisable to start this work at least one year before collecting the data. This could be done by employing pre-testing surveys. Since the questionnaires used for pre-testing may differ from those used for the main agricultural census, certain modifications are necessary in order to transfer information from the pre-testing questionnaires to the others, to enter items not included in the pre-test, and to use particular techniques to test the full range of error specifications for the computer programme. An important step is to test all computer programmes after their preparation. Computer print-outs should be produced, errors identified, and the corrections made and reviewed to determine if, in fact, all errors or inconsistencies are there.

16.10 It is important to have a programme which checks internal data inconsistencies, i.e., detects the unacceptable entries, such as impossible, missing, or large errors. This technique would also allow for detection of overall inconsistencies which would spoil balancing within and between the tables. This requires proper understanding of the nature of the data and the design of the statistical tables, as well as ability to grasp advanced programming techniques.

16.11 Serious consideration has to be given to the errors discovered, since they have to be corrected. Of course, all measures have to be taken from the beginning of the enumeration process to discover errors on-the-spot and correct them. Procedures for correcting mistakes will depend on the amount of detected errors. In the extreme case, if there are many errors, it may be necessary to repeat the enumeration in certain areas where the errors are discovered after taking steps to overcome those difficulties which were encountered the first time. In some cases, certain large errors may be corrected by substituting them with other, more acceptable entries. This procedure is known as "correction of errors" and is done manually or by computer ("automatic correction of errors"). Filling in missing entries or replacing unacceptable ones by more satisfactory entries is done manually by using certain missing data techniques or even simple formulae, e.g., using an average value or a value taken from data for similar cases. In some cases these missing entries, when their incidence is significant, would be tabulated separately under the title "holdings not reporting". However, using automatic error correction requires complex computer programmes and this must be considered carefully, especially in developing countries.

16.12 It is essential to note that automatic correction of errors is a very risky, complicated and delicate operation. If implemented, all possible precautions should be taken and the operation limited to the more obvious and easily corrected errors. The related computer programmes should be tested very carefully.

16.13 Common types of computer operations for automatic error detection that may be used with little effort are:

1. checking for missing entries;
2. checking for inadmissible entries (e.g., age of landholder below the minimum specified, non-existing crop codes, etc.);
3. checking totals (e.g. totals of areas reported under different land use categories should be equal to the total area of holdings).

A balance between and within the tables depends on whether the arithmetical relations between data on the holding level are correct.

16.14 In the process of automatic error detection it might be very useful to provide preliminary totals for each item. These totals represent a basis for a professional review of the data prior to the production of further tabulations.

16.15 The verification of computer programmes is commonly performed by checking results of the error detection and the tabulations from a group of 200 to 300 questionnaires. The original data and the corrected data should be printed out for each questionnaire, and a manual tabulation made from the print-outs to check each item or its classification in the tabulation. The manual tabulation is time-consuming and requires qualified staff which is sometimes not available. In such a case, the number of questionnaires for testing the computer programmes could be reduced. It may be preferred to prepare the data in the test questionnaires artificially to cover all items in as few questionnaires as possible; if the data in the test questionnaires are well prepared not more than 50 questionnaires may be needed for manual tabulation.

Organization for data processing

16.16 The details of computer data processing will depend on the available facilities for the purpose. However, there are certain operations to be conducted before starting computer work, the most important of which are:

(i) Checking for completeness of the enumeration and of questionnaires. Adequate organization of field work includes control of enumerator's work and the questionnaire received in each locality. If there exists sufficient organization in the field, the work of the central office is reduced considerably. For example, questionnaires for each enumerator need to be checked against the household and holding lists for the enumerator's area and action must be taken for missing questionnaires and a satisfactory explanation must be sought for missing questionnaires. Again, all efforts should be made to detect errors in the questionnaire. Missing entries should be referred to the technical staff for immediate action. A visual check could be made to see that each questionnaire has some entries in essential parts of the questionnaire (e.g., land use, livestock, etc.). Special attention is also given to large or special land holdings. All this must be undertaken before starting the data processing operations. This could be done by passing on the complete returns of the enumerators to the supervisor and to the editing staff regularly as they become available, and not all together at the end of field work. Apart from reducing the burden of checking, this will help in rectifying the omissions and other errors by referring them back to the enumerators while they are still in the field.

(ii) Coding, punching and verification. After the above checks are performed, there should be a well-defined and complete organizational plan for the data processing operations, including order of operations, rate of performance for each operation, number of data processing staff and their distribution on various operations and their training. As to the rate of performance for each operation, it is possible to fix these rates by using the previous experience gained in similar operations. As soon as the number of workers is determined, which is usually more than those available for regular work at the executive agency, arrangements should be made to select the required number through an aptitude test. A training programme should be initiated for recruited staff which should include:

- definitions of the questionnaire inquiries and how they are filled out;
- office practical training for filling out the questionnaire;
- how to check the data on the questionnaires;
- office checking of questionnaires and practical training; and
- how to deal with missing or unacceptable entries.

16.17 Each trainee should receive a prepared list for coding and the necessary instructions. Coding of the field data forms an important item in the preparation of the field returns

for mechanical processing, and hence special attention should be given to code checking. A suitable system of coding is to use the self-coding questionnaires where most of the items on the questionnaire are coded automatically in the field. A suggestion in this regard has been made in Chapter 7. This procedure saves time and reduces errors. It is advisable to use a 100 per cent checking for the code and employ the best coders for this checking. However, it is possible to use another trained group for this operation and leave the best coders to other work of improving code quality and reducing errors. It is also possible to use quality control techniques for this checking by selecting a sample of questionnaires and checking their entries. If the errors are not within certain limits, then a 100 per cent checking is desired. Computers can be used for coding, and in this case operations will be performed uniformly and without error. An example of coding by computer is assignment of size class codes on the basis of the total area of holdings. Computer coding is normally performed only after all data have been checked and corrected. Complete or sample verification of key punching or other routine operations is important. The use of sample verification schemes requires that punching machine operators or clerical personnel have acquired enough experience to perform their work at a relatively stable quality level and that this level of error is acceptable. This is on the consideration of the cost of 100 per cent verification, the fact that verification will not detect all types of errors, and that some of these may be detected through the use of computer editing. Once a punching machine operator or clerk has produced work of satisfactory quality, verification of only a fraction of the work is necessary to ensure that the quality of work is maintained. Control of errors and detection of work units with too many errors can be done through the verification of relatively small samples of each work unit, the accumulation of the results of the verification for a number of work units, and the comparison of the cumulative error results for a specified number of units with acceptance standards. In case the work does not meet acceptance standards, complete verification of the work units needs to be performed and all errors corrected until the quality of the work becomes acceptable. The setting up of appropriate quality control procedures for office editing and punching is an essential component of the data processing operations. Workers who do not meet quality control standards within a reasonable time need to undergo additional training or be removed from the operation. The speed of keypunching and the number of punching errors depends considerably on the legibility of entries in the questionnaires. It is, therefore, important that enumerators be able to write figures clearly.

Plan and timetable for data processing

16.18 Census data processing is a lengthy operation taking many months and often more than one year before all the census tables are completed. Steps should be taken, therefore, to meet those urgent needs for data before all tabulations are completed. It is recommended to plan the whole tabulation in two or more phases. The first phase will include the more important and urgently needed tabulations, while the second and subsequent phases will include the other more detailed tabulations in accordance with the priorities in each country. The preparation of advance tabulations on the basis of a sample of enumerated units may be used as part of the earlier phases. Computer programmes should, however, be prepared in such a way that the same programmes can be used for advance and for final tabulations. These computer tabulations are in addition to whatever aggregates are compiled manually for the main census items. Enumerators might prepare such aggregates for holdings on summary sheets which may be further aggregated by provincial administrative staff. Corresponding national and other tables could be prepared and issued in the central office.

Maintenance and control of questionnaires

16.19 Since the agricultural census is a huge operation involving the whole country, it will not be possible to ensure that all questionnaires are received without establishing control measures. The complete returns from all enumerators in all localities should be passed on to the supervisors regularly as they become available. To simplify control measures, questionnaires should be grouped; otherwise, any control will be time-consuming. Alphabetical or geographical indexing and proper filing are essential. Control should also extend to the removal of questionnaires from folders and records of such removals. As records pass through various processing stages, they should be periodically checked to detect any delays, misplacement of questionnaires, etc.

Manual processing

16.20 In spite of the advancement in computer technology, there is a large number of countries, which may not resort to mechanical method of processing of the census data due to the lack of trained personnel and/or resources to install a costly computer, and they may prefer the manual method of processing. It will, in such a situation, be desirable to decentralize the processing arrangement and confine to the preparation of essential tables. The supervisory field staff with a little training in tabulation can easily prepare the basic tabulation sheets for further analysis. The tabulation done by this personnel can be thoroughly checked by statistical personnel. The final statements can be prepared by the statistical staff at the regional office or at the census headquarters depending on the distribution of the technical personnel at various levels.

16.21 If the census is based on a sample, the estimation procedure for various characters consistent with the sampling design, should be developed much in advance. In fact, the most appropriate time for developing estimation procedure would be the time of evolving the sampling design. If the census is to be based on a sample, one of the objectives of the pilot census (which is described in Chapter 11) should be development of an appropriate estimation procedure. The census is a multi-purpose inquiry. An appropriate estimation procedure for a specific characteristic may not be equally appropriate for another characteristic. What is a good weighting factor for one character may not be an equally good one for another character. Therefore, the decisions on the estimation procedures and that of appropriate weights should be taken in time so that tabulation programme is not hampered. In the absence of such preparation, the tabulation programme will be unduly delayed, and the census results will be relatively de-evaluated. If the decisions on the appropriate estimation procedures and weights are taken prior to the actual field work, the staff employed for field work can easily be used for collecting ancillary data which will subsequently be used as weights or otherwise for improving the estimations and for evaluating reliability of the census results. This preliminary step is much more important particularly if the processing of data is to be done manually. The format of data sheets can be structured in such a way that each step of arithmetic depends on what has been done in the previous steps.

17. QUALITY CHECKS AND POST-ENUMERATION SURVEYS

17.1 The collection of data in a census can be thought of as consisting of two parts: (i) identification of units constituting the population, and (ii) obtaining data itself from the units under (i). However, before the identification of units starts, knowledge of their distinct features and definition is needed. In a census of agriculture, units constituting the population are all the households operating some land or producing some agricultural product, irrespective of the area or the value of the produce. Unless adequate and necessary precaution is taken in identifying the accurate list of units in obtaining the relevant data from them, there is a danger of serious bias in the final results.

17.2 The agricultural census is a big operation. A large number of field enumerators and supervisors is employed for the collection of data. The size of the questionnaire becomes large as information is needed on a large number of characteristics of the operational holdings. Many of the items are not easily observable. The respondents in the case of agricultural census are farmers who are many times not educated and are neither quality nor quantity conscious. Cultivation practices vary considerably from region to region, particularly if the country is large. All these factors affect the quality of data in different ways. Biases of varying order exist in the data, depending on the conditions under which the census is conducted. Bias in data collection exists irrespective of whether the census is based on a sample or on a complete enumeration. It is, therefore, necessary to exercise some kind of quality checks on the data collection.

Errors in census data

17.3 Errors in census data may creep in from many sources. In the case of a sample, the census results are accompanied by what is known as sampling errors. Fortunately, these sampling errors can be controlled to any desired degree by using the proper technique and by enlarging the sample size. But sampling errors are not the only ones in these results. There are other errors which are called non-sampling errors and their treatment is difficult and it is difficult to eliminate them completely from the survey and the census results. Thus, whatever the method of taking a census of agriculture, the results are accompanied by some kind of unknown errors.

17.4 There are many reasons for the appearance of these errors. These errors begin to creep in right from the preparatory stage, such as determination of the concepts and definitions to be used, and go on adding up at every subsequent stage of the execution of the census till the final publication of the results. The errors in the census results may broadly be classified in three groups:

- (i) Errors resulting from inadequate preparation;
- (ii) Errors committed in the stage of data collection;
- (iii) Processing and tabulation errors.

Usually, all these errors do not follow any probability law. Had they been so there would have been a possibility of knowing their limits. Unfortunately, they tend to be systematic.

17.5 At the preparatory stage, some definitions may be inadequate, or some concepts may be defined in a misleading way, with the result that the enumerators do not apply them correctly at the enumeration stage. The wording of some of the questions in the questionnaire may be misleading, etc. The manual of instructions for the enumerators may not be well drafted and, therefore, may not be clear to them. If it is too detailed the enumerator may not take the trouble to read it carefully with the same result as in the case of too brief instructions. The selection and training of enumerators and supervisors may itself be deficient.

17.6 There may be errors in the listing of the units. The omission of some of the units in the listing may lead to under-estimation of the totals for most of the characters, while duplication of some of them will lead to over-estimation. Omissions are more common and, therefore, it is generally noted that census estimates for most of the characters are biased towards the lower side.

17.7 Listing errors are most common whether the census is based on a sample or on complete enumeration. The sources of listing errors are manifold. They might appear because of difficulties connected with various characteristics of enumeration areas. If these are large in terms of area or the number of potential units (units from which data are to be collected), some units can easily be either omitted or listed several times. On the other hand, if they are too small there is a difficulty of defining their border lines unambiguously. In the latter case, it may happen that the enumerator does not know whether a particular potential unit belongs to the enumerator's segment or not. Such misjudgement naturally leads to errors.

17.8 Accuracy of listing also depends on the distribution of units over the area of the enumerator's segment. Congestion of units is often a cause of trouble. In a situation of housing shortage, a number of holders might be found living in the same house sharing many of the common amenities, but at the same time operating land separately. Very commonly it happens that brothers living in the same house and sharing common facilities operate land separately and, therefore, they make as many operational holdings as the number of brothers. The enumerator may, however, list them as operating one operational holding. In such a situation, omissions are very likely.

17.9 Another source of listing errors is the way the enumeration segments are prepared for identification and the quality of related mapping materials. If the border lines are not well described and if there are no distinct signs on the ground separating the two consecutive enumeration segments, the enumerator may find it difficult to decide whether a particular household should be taken in his enumeration segment or not.

17.10 In the countries where cadastral surveys have been conducted and maps have been prepared indicating the boundaries of the various segments of areas like villages, it is not very difficult to demarcate the boundary of the two consecutive villages provided the enumerator is trained in reading the cadastral maps. However, where the land has not been cadastrally surveyed and cadastral maps are not maintained, unless well-defined boundaries which can be physically identified on the ground are prepared, there is a great danger of making errors of omission or misinclusion of the border units.

17.11 The enumerators themselves represent another source of listing errors. Some of them are careless and attempt to complete the work in undue haste. Some are not properly trained and do not know how to use the existing facilities with a view to preparing accurate lists. It also happens sometimes that some of them are not sufficiently interested in the work they are doing and do not want to take the trouble to clarify some more complicated situations. Besides this, poor understanding of the concepts and definitions by the enumerator may also lead to errors in listing. For example, for those agricultural holdings the size of which, either in terms of area or value of the produce, is around the qualifying limit, the information obtained either from the holder or by the enumerator's evaluation might be slightly inaccurate.

17.12 The other error of serious nature may be of under-reporting. This may be very common in countries where the farmer does not keep any record of his agricultural operation and does not have a very clear concept of the area measurement. Sometimes under-reporting is done due to fear of land taxation or imposition of land ceilings. The nature of the inquiry may also be the cause for under-reporting. If the farmer does not keep a record, it is difficult to get information on the number of trees in his orchards which is needed in the census. Under-reporting is also very common in the case of livestock numbers.

17.13 In many developing countries, the quality of census data also suffers because of the prevalence of a large number of units of measurements and weights and sometimes even the non-existence of any meaningful unit. The enumerator cannot easily convert them into standard units.

17.14 Finally, many errors enter at the stage of processing and tabulation of the census data.

17.15 All kinds of biases and errors that are likely to enter into the census data should be known on the basis of past surveys and censuses. The pilot studies undertaken prior to the implementation of the main census would also give some idea of the types of errors. If the census is being repeated and if in the previous census post-enumeration survey for studying the quality of data has been conducted, the results of post-enumeration survey can be a guide. Some guidelines can also be obtained from current surveys planned for the collection of agricultural statistics. A good analysis of the types of error and their causes should be made. Every component of an error should be separately analyzed in order to get information on the contribution that is likely to be made to the total error. This will help in determining how significant a particular component of the error is. This type of analysis will help and improve the planning of post-enumeration checks. At the same time, it should also be known how the error will affect the decision of the users of the census results. Sometimes, even a large error will be of little consequence while in other cases even a small error will affect the decisions adversely. Such analysis will mainly determine the content of the post-enumeration surveys.

17.16 Once the components of errors and biases that are likely to creep into the agricultural census data have been determined on the basis of past censuses and surveys, including the pilot studies prior to the implementation of the main census, it should be easy to determine the methodology and size of the post-enumeration surveys.

Checking with other data

17.17 The common and often practised technique for checking the quality of data is the comparison of census data with information available on the same item from independent sources. For example, data on crop acreages as collected in current surveys can often be successfully compared with the corresponding information available from the census. In India, crop and land utilization statistics are collected annually on a complete enumeration basis by employing the land record and revenue staff. These statistics can be compared with the corresponding statistics obtained through the census. This is possible only if the data have been collected in both cases by using the same definitions and concepts. If this is not so, comparisons become inconclusive. However, it is important that the data against which the census data are compared should be accurate beyond any doubt.

17.18 In many cases, there may not be comparable figures for totals although there might be some possibility for evaluating sub-totals. In some countries a list of farms of a certain size is maintained for the purpose of land taxation. If census data are tabulated in such a way that the farms of such categories are separated it might be possible to compare the data with the results obtained in the census for the groups concerned. Such comparisons primarily refer to the studies of the effects of listing errors and then to other characteristics available in the records. However, such checks have limited value from the point of view of the population as a whole and an accurate sub-total is not a guarantee of the accuracy of the grand total, unless each of the sub-totals is checked separately for its accuracy.

Consistency check

17.19 Another technique that may be found useful in many cases is the consistency study. In this case, the evaluation procedure aims at examination of consistency of data evaluated with respect to some available knowledge which is generally accepted either because it has

been demonstrated so many times or because the opposite would contradict logic and our basic experiences. For example, total operated area as obtained in agricultural census should always be less than the total geographical area. Similarly, the number of agricultural labourers as obtained in the agricultural census should necessarily be less than the total rural labour force as obtained through the population census. Such comparisons can only be broad-based. But they provide reasons for judging the quality of data. However, if on the basis of such comparison, it is found that the data from two sources differ significantly, there is no way to correct the census figure. Therefore, it is necessary to develop a built-in system of checks in the census itself.

Post-enumeration check surveys

17.20 The post-enumeration check through sample surveys is a very common practice of studying the accuracy of the census results. In many countries, irrespective of whether the census is based on a sample or on a complete enumeration, the post-enumeration survey is planned. Obviously, the post-enumeration survey should be qualitatively better than the census, and by implication of cost its size would be relatively small. The question will arise as to what should be the content of the post-enumeration survey, what should be its sample size, who should do the field work, and when should the field work be organized.

Purpose of post-enumeration survey

17.21 The objective of the post-enumeration checks and surveys should be clearly laid down. Generally, the results of any check survey will be to determine the quality of census data which the users of the census data should know. Whether the post-enumeration survey data could be utilized for adjustment of the census results will depend on their extent and the nature of the post-enumeration. In the usual post-enumeration survey, the data collected are too scanty for such adjustment and as the number of items in the census is large, their adjustment would present an intricate problem. Moreover, census results are presented for small administrative and geographical regions. Any adjustment based on post-enumeration survey data for small areas will introduce serious limitations on the use of the census results as the correction factors based on post-enumeration check data will be subject to large sampling errors for small administrative divisions. Many times, such adjustment will also introduce internal inconsistency in the census results. For example, if it has been found that there is a serious error in the irrigated areas obtained from the census, any adjustment made in the irrigated area on the basis of post-enumeration survey may introduce serious inconsistency in the total cropped area. However, there may be some situations where common characters can be determined on this basis of post-enumeration survey to correct the census results. For example, in the case where the area figures have been reported in a particular local unit, physical measurement of area in the post-enumeration survey can provide a correction factor for adjusting the census results.

17.22 The utility of the post-enumeration survey for checking the quality of census data is more in countries that are at the initial stages of their statistical activities. In such countries, there may not be any data even to check the consistency of census results.

17.23 There may be another advantage of planning post-enumeration surveys. It is just possible that, because of lack of an adequate number of census enumerators, the content of the main census may be simplified and the information may be ascertained on only those items on which it is easier and relatively cheaper to obtain information. The post-enumeration survey can aim at not only checking the quality of the data collected in the main census, but also at collecting some additional data which cannot be collected in the main census.

17.24 An additional advantage of the use of such post-enumeration survey for the purpose of quality check would be that it may create a kind of pressure on both the respondents and enumerators to supply more accurate data. The enumerators and the respondents both will be alert and conscious that the inaccuracies of the data would be detected later on.

Design of post-enumeration survey

17.25 The size of the sample and its distribution will depend on the available resources for this purpose and the knowledge one has about the types of errors that are likely to creep into the census data. A frame of enumeration blocks, which has been prepared for the main census will be the most convenient one. Thus a design which is likely to prove most useful for post-enumeration check survey has to be based on area sampling. Agricultural situations and levels of farming considerably vary from region to region, depending on the agro-climatic and socio-economic conditions. Errors in data collection, to a large extent, are governed by the socio-economic situation of the farmer. It will, therefore, be advisable to adopt agro-climatically and socio-economically homogeneous regions as strata, with segment of area or the village as the first stage unit and an operational holding as the second stage unit. The technique of "two phase sampling" can also be adopted if it is desired to collect data on some items from a larger sample of holdings while for some others a smaller sample may do. For example, the listing of operational holdings can be checked for the entire sample selected for the post-enumeration check survey while the information on cropped area, agricultural inputs, livestock numbers, etc. can be obtained from a sub-sample of holdings. In its simplest form the post-enumeration check surveys would involve

- (i) selecting a sample of some area units, such as villages or enumeration blocks;
- (ii) preparing a new list of operational holdings in the selected enumeration unit;
- (iii) collecting relevant data holding-wise on items incorporated in the census programme;
- and (iv) estimating separately the listing bias and then adjusting, if needed, the census totals to allow for inaccurate listing and inaccurate reporting of data.

Method of ascertaining data

17.26 It is obvious from the discussions given in the preceding paragraphs that most of the biases in the census results are due to errors in listing and errors in measurement. The post-enumeration survey should normally take the shape of a small sample survey to be carried out soon after the census enumeration is over, utilizing better qualified and trained and experienced investigators possibly recruited from an independent organization. The questionnaires to be used by the post-enumeration survey investigators should deal only with certain key items in the census, which are considered important. The preparation of a fresh list of the units in the sample areas should be an integral part of the post-enumeration check. As mentioned earlier, it is a common experience in many countries that a substantial part of the listing errors are due to difficulties in identifying borders of enumeration areas. This results either in omissions or duplications because an enumerator might think that a border unit may or may not make a part of his assignment when it is otherwise. Such errors should be checked by the post-enumeration survey investigator by preparing accurate maps with boundaries set down along with some clearly distinguishable natural marks, thus facilitating the identification of areas included. It will be desirable that the investigators employed for such work have local knowledge and agricultural background. As far as possible, the methods followed by the investigator for ascertaining the data should be more objective and reliable than those used by the census enumerators. By merely repeating the same type of questions and by following the same method of collecting data, there is hardly any possibility of revealing the errors in the census data. If the census data have been obtained by the interview method, it would be necessary to check their quality to adopt some method of physical measurement. This means that for a proper quality check on the census data, it is necessary not only to have a superior enumerator but also to adopt a different superior technique. In most cases, use of physical methods of measurement of area, and actual count of livestock and of trees where horticulture is important should be attempted.

17.27 The field operations of the post-enumeration should start soon after the census enumeration is over. The re-enumeration survey during the census enumeration is possible and will also be more economical but it is not recommendable because it will lose the possibility of selecting the best qualified and experienced staff for this work. Starting the post-enumeration survey soon after the census enumeration will have one big drawback that the respondents will remember the replies they gave during the census and may repeat the same. But this can be remedied considerably because, as mentioned earlier, the technique for data collection during post-enumeration survey can be varied entirely, including the questionnaires. The big advantage of having the post-enumeration soon after the census enumeration is to avail of the atmosphere created for the census which is very important for getting people's willing cooperation. If the post-enumeration survey is conducted very late, there is a danger of the respondent's forgetting many things. The longer the time allowed to lapse before the sample check is instituted the more problems will have to be resolved.

Method of comparison

17.28 The post-enumeration survey can be extended to any part of the population involved. Check data collected for the sample of units can be compared with those obtained in the main census, for the same set of units. The difference between the data collected in the post-enumeration check survey and those obtained for the same units in the census would provide an index of the quality of census results.

17.29 If systematic records are kept on various characteristics of the units where errors have been detected, it is possible to have a broad knowledge of where the errors appear, under what circumstances, their characteristics, etc. This knowledge is extremely valuable for planning and improvement of techniques of future surveys and censuses.

17.30 It may be emphasized at this stage that listing errors in surveys and censuses affect the results more than any other factor. Bias due to either omission or duplication of units introduces errors in estimates of all characteristics. Of course, the magnitude of this bias will depend on the distribution of listing errors. It may be large irrespective of whether omissions or duplications exist. However, in either of these two cases, it will be small if units affected contribute but little to totals for the characteristics concerned. For example, a considerable omission of small holdings may affect too little the magnitude of totals for most characteristics in the programme of agricultural census. However, it is generally found that small holders concentrate more on livestock and poultry for improving their income. In such situations, if there is a large-scale omission of small holdings, there is a great possibility of under-reporting the livestock and poultry numbers. There is no doubt that the totals are particularly sensitive to listing errors and that is the reason that so much importance is attached to listing errors in census work.

17.31 Errors in totals or, for that matter, in any other characteristic of the holding will occur not only due to errors in listing, but also due to response of the farmers, measurement technique, units of measurement, etc. It has been observed that there is considerable under-reporting of areas in agricultural census. This is particularly so in case of large holdings. The large farmer generally forgets the reporting of all the parcels of land operated by him. He generally operates land in several segments of areas or villages and while reporting forgets to give information on the parcels operated by him in villages other than the village in which he resides. Similarly, under-reporting is noted in the case of livestock numbers and number of orchards and trees. The post-enumeration check survey may, therefore, be planned in such a way that it should be able to assess the total errors in the field work, caused either by errors in listing or by wrongly reporting the characteristics of the holdings.

Presentation of results

17.32 The space does not permit to give the description as to how to estimate the bias and its significance in relation to the totals. However, the results should be presented in such a form as the users may know the quality of the census data they would be using for policy matters. Listing errors must be presented in such a way that erroneously excluded holdings and erroneously included holdings are noted clearly. The erroneously excluded holdings make up what is called under-listing or under-enumeration, while erroneously included holdings make up over-listing or over-enumeration. Similarly, comparative figures of characteristics of the holdings should be presented side by side so that the users may see at a glance the totals or sub-totals which are subject to over-estimation or under-estimation.

17.33 In agricultural census, results are presented according to the size of the holdings. Each size class has got its own economic significance in the context of the land policy of the country. The users would generally be interested in the accuracy of the sub-totals of individual classes. The results of the post-enumeration survey should be presented according to principal size classes. The results relating to listing errors and those relating to totals and sub-totals of quantity characters, such as total operated area, area cultivated under individual crops, livestock numbers, etc., should be presented in different tables.

17.34 It may not be possible to check up the quality of data for all the items included in the census but it is always possible to pick out the principal and key items which are considered important in a particular region of the country. As the listing errors affect the accuracy of totals and sub-totals of all the characteristics, it would be desirable to present elaborately the causes of listing errors. A table of the type given below for the developing countries where the average size of the holding is small and the bulk of the cultivators operate tiny holdings, will be useful. (i) Tables A and B below can be used to give numerical account of the effect of listing errors on the numbers of holdings in various size classifications of agricultural holdings, and (ii) the totals of various census characteristics by size classes. The first row of table A contains the number of holdings in different size classes as found in the main census, while the second row gives the corresponding figures obtained in the post-enumeration surveys. The third row contains the number of agreement in each size class. Agreements are also expressed as percentage of post-enumeration survey totals. The meanings of the rows 'erroneously excluded' or 'erroneously included' are obvious. The row absolute difference contains the sum of the absolute values in the row erroneously excluded or erroneously included. Obviously, the absolute differences are expressed as percentages of the post-enumeration survey data in the second row. Row No.6 contains the algebraic sum of the data in rows 4 and 5. Algebraic differences are also expressed as percentages of post-enumeration survey results in the second row.

17.35 Table B is constructed in an analogous way, the difference being in the fact that it relates to the total operated area. Accordingly, the first row contains data on the total operated area of agricultural holdings by various size classes for all the holdings operated according to the main census in the sample of enumeration blocks selected for the post-enumeration survey. It should be pointed out here that the difference between rows 1 and 2 is not only due to listing errors but also includes measurement errors. The row, "erroneously excluded" refers to the total area of holdings which are enumerated in the post-enumeration check survey because the main census failed to cover them. Similarly, the row "erroneously included" shows the total area of those holdings which are enumerated in the main census but do not belong to the population of operational holdings according to the post-enumeration check survey. Table B can be prepared for as many characters as are desired to be checked.

17.36 A critical study of the two tables together will give an excellent idea about the quality of data collected in the census. Data for various size classes also point out as to what categories of holdings are more affected by disagreements and whether attention should be directed in future surveys and censuses to ensure higher quality of data. In fact, each statistician responsible for planning the agricultural census would like to know to what extent he should worry about the listing and measurement errors in connection with the various characteristics, and whether these errors can be neglected without running the risk of biases, etc. All such questions are answered by studying the data in table B for the characteristics involved.

Supervision and Post-Enumeration Check

17.37 The question may be raised whether the content of the post-enumeration check can be included as part of the supervision of the census work and whether the supervisory staff of the census can be utilized for providing the necessary data prescribed in the post-enumeration checks. It may be mentioned here that the existence of the sample checks by the supervisor represents a kind of pressure on the census enumerator to do his work as correctly as he can. The procedure corresponds to application of statistical methods for controlling the quality of industrial production. The mere introduction of the control brings about noticeable improvement in the quality. The purpose of the supervision should be to cover by surprise visits as many census enumerators as possible. However, the supervision should be intensified in those areas where work is found to be unsatisfactory. The census enumerators are of different background and with different levels of training and experience. Some may be honest and intelligent while others may be indifferent, careless and dishonest. The supervision of the work of the latter categories of enumerators should be more intensive. Similarly, there may be some items in the census in which recording biases may be much more. Such items should be supervised more intensively. Thus, these supervisors may not be able to play the same roles as is expected from the post-enumeration survey investigators. Therefore, the objective of supervision and that of the post-enumeration check should not be confused. The role of supervision is to improve the quality of the field work. Increasing emphasis on the supervision is a distinct feature of modern methods of collection of statistics. In recognition of this tendency the hierarchy of supervisory staff is built up.

17.38 For the complex field work of the agricultural census, there should be one supervisor-in-charge for every 5 to 6 field enumerators. The duties and functions of the supervisor are not only to inspect on the spot the field work of the enumerators, but also give guidance to them in their work. On the other hand, the objective of the post-enumeration check should be purely to study the quality of census data. It should clearly bring out how far the census data would be useful.

17.39 In some situations, on the basis of post-enumeration check surveys, it may be possible to develop what is called "correction factor". However, the post-enumeration check survey should not be planned mainly for developing the correction factor. The main lesson of the post-enumeration survey should be to develop appropriate guidelines for improving the future surveys and censuses. A systematic study of errors located through the post-enumeration survey may not yield immediately the results which can be practically exploited. If the results of post-enumeration check surveys are properly analyzed and recorded, these would be of considerable help in planning the next census. A competent statistician always tries to take advantage of the past experience while planning the future programme of his work.

17.40 In developing countries, knowledge is accumulating slowly. Many opportunities are needed to clarify some aspects of the problems of census through a number of field investigations, and test how efficient some methods are that might come into account for practical action. The developed countries have evolved census methodology through surveys and past censuses. The developing countries have to go a long way to develop a census methodology suiting their own local socio-economic conditions. Post-enumeration check survey is one of the steps in that direction.

18. PUBLICATION PROGRAMME

18.1 The census is one of the largest statistical undertakings that a country implements. Through its publicity and propaganda programmes and other operations, it is known to all the people. Even if the census is conducted on the basis of a sample where only a small fraction of farmers is contacted for extracting the census information, other farmers not part of the sample come to know about it through publicity media to which reference has been made in Chapter 4, "Census Publicity and Propaganda". In fact, the main purpose of the census publicity and propaganda programme is simply to make known to the people the objective and purpose of the census so that full cooperation may come forth from them for the successful completion of the field work of the census. Once curiosity has been created in the public mind, they are expected to look for the census results. It may be that in the developing countries the general public may not fully comprehend the implication of census results for planning the programmes of agricultural development, but the same thing cannot be said about those who are the principal users, such as agricultural planners, research workers, agro-industrialists, etc. The latter class of people keenly wait for the publication of the census results. Moreover, the taking of a census involves the use of public resources and the authority in the government of the country is responsible for accountability of the funds spent on it. It is but natural for the department responsible for the census taking to expedite the bringing out of the census results.

18.2 There is another reason that the census results should be made available to the users as early as possible. The utility of the statistical information decreases in proportion to time taken for its availability to the users. Therefore, the cost per unit of information brought about by the censuses and surveys will go on increasing as time passes. In extreme case, if the census results are not made available to the users and if they remain unused, the entire resources spent on such censuses should be considered as waste.

18.3 It is, therefore, essential to bring out, as early as possible, information on how the work was done, how successful the utilization of the resources was and what was achieved. In order to secure this, the results and findings need to be properly arranged and published in a report or a series of reports. Without a good report the users of census information do not know how far they can go in the use of information published and what the real meaning of the data is. Similarly, without systematically prepared reports the experiences gained and lessons learned in a census are forgotten and another census in the same field just means a new and independent effort that starts from scratch. A good report and its timely publication is, therefore, a matter of rational utilization of resources.

Advanced results

18.4 It has been very well brought out that each operation of the census taking should have its time schedule and every effort should be made to stick to it. If the time schedule is not strictly adhered to in any of the operations, all the subsequent steps of census taking are disturbed. A time schedule should also be prepared for processing and tabulating the census data and finally bringing out the report. To maximize the benefits of the census data, the results can be published sequentially. There are certain items of information, such as number of operational holdings according to their sizes, land use, area and production of major crops, number of livestock and poultry, etc., which are of immense use to the agricultural planners and administrators, which should be published as early as possible. The importance of the items will vary from country to country and, therefore, they should be chosen for advance tabulation in consultation with the National Census Committee. In fact, these should be determined while preparing the processing and tabulation programmes. Because of the time factor it may not always be possible to prepare advance estimates of principal characteristics of the holdings based on all the holdings enumerated in the census, and in that case only a sample of holdings may be chosen for the purpose and results can be released for the country as a whole or at most for broad administrative regions. The users of such results may, however, be cautioned about their limitations as these will be subject to varying orders of sampling errors. If the tabulation has been organized with the help of mechanical equipment and electronic computer, an accurate method of calculating the sampling variance

may be adopted and the results can be presented along with their sampling error. Even in the case of manual tabulation method, an experienced sampling statistician should be able to give an idea of the accuracy of such estimates..

18.5 If the census is based on a sample, quick estimates for principal characteristics of holdings may be calculated by suitably selecting a sub-sample from the sample chosen for the census. Here also, limitations of such estimates should be mentioned as a foot note so that the user is cautious while making use of them. Some idea about the accuracy of estimates can be obtained from the pilot census if it has been carefully conducted and the necessary analysis of data collected has been made. One of the purposes of the pilot census is to study the variabilities of the census variables and if it has been done, with the help of the sample size it should be possible to approximately indicate the order of sampling errors of various estimates thus calculated. If the census was conducted earlier, and if the records have been properly maintained, an idea about the sampling error can be made.

18.6 One way of speeding up the issuance of census results is direct reproduction of computer print-outs. However, this technique requires a very thorough testing of the computer programmes for tabulation in view of the need for a neat presentation of tables. Moreover, extensive manual corrections and changes may be difficult to make. Direct reproduction of computer print-outs can, therefore, be adopted in only those countries which have got a sufficient number of programmers to start timely preparations of data processing.

18.7 No uniform period for releasing the advance estimates after the completion of field work can be suggested for all the countries. It will depend on the strength of technical personnel and data processing equipment that are available with them. However, the period should not be more than six months after the completion of field work. If it takes longer than this period, urgent needs for census information are left unsatisfied and the practical usefulness of the census is seriously diminished.

Preliminary report

18.8 Advance estimates of some basic characteristics of holdings may be useful mostly to those who are actively engaged in the process of planning agricultural development programmes and are intimately connected with the formulation of the census operations. There is another class of people, like research workers, agro-industrialists, agricultural input manufacturers, etc., who are also equally interested in the results of the census. Since such users are not fully conversant with the technical contents of the census taking, it is necessary that the results should be reported with sufficient detailed background of the census operations. A preliminary report consisting of the most important tables and some explanatory notes should be brought out for the use of the specific class of people mentioned above. Some of these tables may not be in final form as further studies may necessitate corrections.

18.9 If adequate facilities for rapid tabulation of census data do not exist in the country, preparation of such tables can be resorted to on the basis of a sample of holdings enumerated in the census. However, if the census is based on a sample, the tabulation for preliminary report may be confined to a sub-sample of the full sample. When all the holdings enumerated in the census either based on complete count or on a sample are not used in the tabulation, tables should be reported in summary form at the level of the country and broad administrative regions.

18.10 The contents of the preliminary report may be broadly as follows:

- (a) Geographical coverage
- (b) Item coverage
- (c) Concepts and definitions
- (d) Census period
- (e) Reference periods and dates
- (f) Census methodology
- (g) Field organization
- (h) Summary of results
- (i) Explanations for the use of results
- (j) Tables.

18.11 The preliminary report is expected to meet the requirements of all those who cannot wait for the publication of the final report. The majority of the users usually forget that the results reported in the preliminary report are provisional and subject to revisions on the basis of careful technical scrutiny and use of additional data collected in the course of census operation. Sometimes, they even forget that the estimates are not always based on full data from all holdings enumerated in the census. Therefore, the section dealing with the instructions for the use of results must fully describe the limitation of the results. If the estimates are based on a sample, the concepts of sampling variance should be used and if it is possible, the order of the sampling errors might be indicated at least for important items of the census which are likely to be quoted frequently. One such example is that of the estimate of the number of operational holdings. Once such figures are published, the various agencies, including the research workers and the press men, start quoting them. Their subsequent revision on the basis of use of the entire data collected in the census causes problems. It will, therefore, be advisable to give a clear foot-note on the use of such estimates.

18.12 A reference has been made in Chapter 17, "Quality checks and post-enumeration survey" that the census methodology obtaining information through oral inquiry on some of the items might not be appropriate one and the results might be subject to large biases and non-sampling errors. The explanatory note on the results should emphasize on the census methodology and, thereby, on the limitation of the results. This is considered very important, particularly in the developing countries as they have no tradition of conducting censuses of a complex nature. The farming communities, in spite of their best efforts, might not have been able to supply correct data to the interviewers. It is hard to suggest an appropriate method of presenting the results when it is known that they are subject to large non-sampling errors. This will depend on the nature of the results and experience of the country. Sometimes, it will be advisable to present the results in percentages rather than in absolute figures. For example, if it is known that there has been under-enumeration of total holdings due to some reason, it will be better to present the number of holdings in different size classes as percentage of the total number of holdings rather than presenting them in absolute figures. This technique of presenting the results will be useful in many situations when the reliability of the census results has not been fully evaluated.

18.13 The preliminary report should be brought out as quickly as possible. Any undue delay will diminish the enthusiasm of the users of the census data. What period should be taken in bringing out such a report will depend on the facilities available in terms of statistical personnel and processing and tabulation equipment in the country. It should, however, not take more than a year after the completion of the field work of the census.

Final report

18.14 A general and final report on the census should be prepared by the professional staff and, if possible, vetted by experts familiar with the agricultural situation of the country. It may be issued in a number of volumes, depending on the size of the country and contents of the report. In addition to statistical tables, the report should include all information that might be useful for better understanding and evaluation of data, along with details of the organizational and administrative aspects of the census, which may be useful for the preparation and implementation of future censuses. The report should also include materials on the purpose and objective; historical background of the census; description of agricultural situation of the country; scope and geographic coverage; census legislation; census organization (with strength at each level, their responsibilities and duties, and organizational charts); preparatory work (an account of events after the decision of taking the census and before the pilot census such as committees and meetings, administrative and technical discussions, preparations of schedules and instructions, steps taken for the recruitment of the staff); pilot census with emphasis on the objectives, methodology, and results and their uses in taking decisions on census programmes; time table; concepts and definitions; reference periods and dates; census methodology; training of technical and field personnel including that given abroad; field operations with the description of the entire phase highlighting the difficulties encountered in reaching the holdings, and in the collection of data and time taken in various items of field work including travelling;

supervision with the details of agency responsible, volume of supervision and the findings; processing and tabulation including editing and coding, method of tabulation, scrutiny and evaluation of tabulated results; summary of results highlighting the salient features of the findings; census budget and cost analysis with necessary details such as proposed and actual expenditures on field work, processing and tabulation, and on headquarters staff; and finally suggestions for future censuses. In addition, the report should have annextures such as questionnaires, instructions, estimation procedures if it is based on sampling, maps, etc.

18.15 Undoubtedly, the preparation of a good report on agricultural censuses is a product of thorough knowledge of technical and operational procedures and problems of census taking. Therefore, in countries which have achieved a sufficient level of statistical development and of conducting censuses, it will not be difficult to tackle satisfactorily the problem of preparation of a detailed report. The developing countries, which have just started setting up a proper statistical system and which have limited experience in organizing large-scale census operations, must begin to think of preparation of a detailed report on the census work proposed to be done. However, no matter what a country's level of statistical development is, it should be pointed out that it is no good reporting unless documents on the various phases of census preparations are collected as the work goes on. This approach simplifies the preparation of the final reports and ensures that the salient points and experiences are recorded while they are fresh in the minds of technical and field staff. It is important to have a continuous recording of important points in the course of the various phases of the census, including the problems and decisions made from time to time to enable the census staff to prepare the final report.

18.16 It may not be forgotten that the preparation of a good report needs time and expenditure. Sometimes, experts are employed as consultants for a short period to give an appropriate interpretation of the census data. In order to make this work possible there is an absolute need to provide sufficient funds in the census budget for the preparation of a good report. It may also be added that the tradition of exchanging reports concerning censuses, particularly among neighbouring countries, can serve a very useful purpose in the improvements of the reports. This will give countries with less experience in preparing reports the benefit of the technique followed by more experienced countries. A wider circulation of reports will also foster exchange of experiences and enhance the improvement of statistical practices in the field of agriculture.

18.17 It is worth emphasizing that the publication programme is as important as the other components of census operations. The availability of computers and feasibility of storing the primary data permit utilization of results in a variety of ways in addition to those included in the main census publications. In particular, information requested by users on special topics not included in the general tabulation and publication programme may be tabulated from the census data stored on tapes or other media. Similarly, such census data stored on tapes or disks may prove useful for several studies to be taken by research scholars in future.

18.18 If the census has been conducted on a complete enumeration basis, obviously with the objective of presenting the census results at the smallest administrative level, bringing out a census report with all such details will be faced with tremendous problems. The report will become unwieldy in size. Moreover, the individual users will be interested in detailed data for specific areas. In such situations, the report may be split into different volumes, each volume serving the interest of a different class of people. This becomes important in large countries. In India, the results of the 1970 census of agriculture were brought out in several volumes. All India report gave the summary results for the country as a whole as well as for individual states of the Union, while separate reports were brought out for individual states. The state report presented the detailed data for the individual districts constituting it. Otherwise the format of the all India report and that of individual states was the same.

No uniform method can be suggested for all countries whether the census results can be brought out in one volume or in several parts. It will depend on the scope and coverage, the size of the country, and the methodology followed. The report should be prepared keeping in view the interest of the users. The size should be such that the readers do not find any difficulty in handling it.

Special post-census studies

18.19 The agricultural census results provide a basis for studying the change in agricultural development. Many users get interested in the studies which link the census results with the data of previous censuses and inter-censal periods. There is a great demand for ready-made information on various averages, coefficients, changes in important characteristics and inter-relationship in the various sectors of the economy. Such requirements may be met through special studies and special tabulation programmes.

18.20 As mentioned in Chapter 7, "Census questionnaire", while finalizing the census questionnaires, the interest of all the users of census results is taken into account. However, while processing and tabulating the census data, because of expediency only principal items are covered and much of the information remains either in the questionnaires or in punch cards, depending on whether the manual method or mechanical method of tabulation has been adopted. Special studies should be taken to make use of such data. If it is necessary to fill up the gap of data not covered by the census, field studies may also be organized. Results of such studies should be published in the shape of articles or research papers. Main emphasis in such studies should be on methodology and results. These should be in continuity of the census reports and properly indexed for future use.

18.21 Such special studies may better be taken up by the research scholars on contract basis. Funds may be granted to research institutes or individual research scholars to complete them in the time specified by the census organization. The advantage of such an arrangement will be that not only will it be economical, but the real experts in the field will be involved in giving scientific interpretation to the census data used for the purpose. However, it will finally depend on whether there exist such institutions or scholars to take up such in-depth studies.

Technical report

18.22 The main purpose of the general census report is to bring out the results in such a form that agricultural planners and administrators can make use of them. The report should not be burdened with technical details. No doubt, a brief description of all phases of census taking should be part of the report. However, a critical examination of the technical procedures should be brought out separately for the use of census and sampling experts. Such technical reports will be of immense use to those responsible for future censuses and surveys. In fact, the future researches in census and survey methodology can be based on what has been reported in the technical report.

18.23 The methodology of agricultural census and the quality check of the census data are considered to be the two important technical aspects of census operations and a separate technical report may be prepared on each. This is particularly important for the developing countries which have to accumulate a lot of technical information for improving the quality of the conduct of future surveys and censuses. They should not only prepare such reports but exchange them with the countries placed in similar socio-economic conditions.

Census methodology

18.24 The following guidelines may be useful for preparing the technical report on the census methodology.

- (i) Introduction. It should give the genesis of the census, lessons learnt, if any, from the previous surveys and censuses, and gaps of data that it was supposed to fill up.

- (ii) Approach to census methodology. It should describe the principal factors affecting the methodology of the census, types and details of data required by the users, response from the farmers, availability of personnel, means of transport and communications, funds, administrative structure, agricultural practices in the country, current agricultural statistics and its relationship with the census, etc.
- (iii) Pre-field work preparation. It should describe the basic principles adopted in formulations of census questionnaires, and instruction manuals; conduct of pre-testing and pilot census and discussions of salient results which affected the technical programme of the main census; segmentation of the country into enumeration blocks and preparation of their maps; preparation of frame; and training of personnel.
- (iv) Field work. It may explain the methodology followed in the collection of data such as mail inquiry, self-enumeration, interview, measurements, etc.; advantage and short-comings of each method, and place of enumeration; schedule of field work such as number, timing and duration of field visits to collect different information, distribution of enumerators and their work load and various phases of field work; supervision giving method of inspecting field work; and arrangement of collecting of complete questionnaires, monitoring of information.
- (v) Use of sampling methods. It should discuss the sampling design giving details on units of sampling, use of stratification and gains achieved, choice of units at different stages in multi-stage designs, methods of selection of sampling units, and sampling fractions; estimation procedure; combination of complete and sample enumeration; broadening the scope of the census through the collection of more detailed data from a sample of holdings in complete enumeration censuses (from a sub-sample of holdings in the case of sample censuses), use of objective methods of measurement from a sample or sub-sample of holdings, use of supplementary surveys, study of seasonal variations through the programmes of sample surveys, etc.; sample tabulations describing the method of calculation of advanced estimates, estimations of sampling errors of estimates of different census characteristics, use of inter-penetrating sub-sampling schemes for calculation of sampling errors, etc.
- (vi) Suggestions for further research. On the basis of the lessons learnt in the census, the new problems for research should be listed. This section is considered to be very important as the future progress and improvement will be based on what is done between the two consecutive censuses.

Report on quality checks and post-enumeration surveys

18.25 The need for quality checks and post-enumeration surveys has been emphasized in Chapter 17. As the quality checking is a complex operation all the information related to it might be usefully presented in a separate report. This report might also be useful from a practical point of view. Quality checks will mainly be as post-enumeration surveys. In other words, the work involved will be carried out and finalized quite some time after the census was taken. It may, therefore, be difficult to finalize the analysis of the check data in time, which will permit the incorporation of its findings in the census reports or even in the technical report on census methodology. There is another factor that calls for a separate report on quality checks. This is rather a complex and slow processing of data collected in the check. Needless to say, if the organization of the check and the processing of the data collected permit, the whole material regarding the check survey could be included in the technical report on the census methodology.

18.26 The contents of the report on quality checks have been discussed in detail by S.S. Zarkovich (Quality of Statistical Data, FAO, Rome, 1966). Briefly, it should contain: design of the check; supporting evidence (regarding the quality of data collected in the check); description of tables presented; interpretation of data and their use; and conclusion.

18.27 The question whether such technical reports should be brought out in one volume or should be broken up into several parts, will depend on the conditions prevalent in the country. In large countries with different socio-economic and agro-climatic regions, it is assumed that the census methodology will not be identical in all the regions. In that situation, a technical report on the census methodology may be prepared for each region separately.

Similarly, the users of the technical report may be different class of people. A group may be interested in studying bias and non-sampling errors in the census. A separate technical report on biases in the census results can be prepared for the benefit of such a group. Similarly, a separate technical report can be prepared on the use of sampling method in censuses.

18.28 The technical report on quality checks can also be split into two parts. The first part may deal with the contents described in paragraph 18.26. The second part may be of a more technical nature and may contain sections on: aims of check; sample, its selection, efficiency studies; method of collection of data; organization of the check; supporting evidence on quality of check data; analysis of errors and biases; suggestions for improvement; problems needing further study; efficiency considerations; and suggestions for the improvement of future quality checks. The appendix of the report might contain the questionnaire, field instructions, instructions for measurement, etc.

18.29 Along with the preparation of the time-table for the various operations of the census, a time-table should also be given for the issuance of the various types of reports discussed in the preceding paragraphs. The final and general report of the census should not take more than two years after the completion of field work. Any delay beyond this period will diminish the utility of the report.

The technical reports are mostly used by the statisticians in charge of agricultural surveys and censuses, and they are mainly utilized while planning similar work in future. No doubt, the earlier they are brought out the better it will be. However, their utility is not lost even if their publication is somewhat delayed, but brought out much in advance of planning the next census. In many developing countries, the results and experiences of the agricultural census become the base for planning the current agricultural surveys. In that case, the publication of the technical reports should be expedited.