

INTRODUCTION

1. The need for current population estimates

Information about the size of a country's population has been sought since ancient times. In some of the old empires, efforts were made to ascertain approximate numbers of inhabitants so as to estimate the military forces which could be recruited, the numbers of slaves who could be impressed, and the numbers of persons from whom taxes could be collected. Similarly, the headmen of tribal societies have wanted to know the numbers of families in tribal divisions in order to estimate the areas which were required for seasonal pastures, or the number of representatives who would appear at a gathering of the tribal council.

In modern times, the functions of government have become increasingly complex. In addition to the preservation of law and order, government has become more and more entrusted with the planning of economic and social programmes; this requires a fairly accurate knowledge of the size of the country's population, its rate of growth, its distribution among the various towns and provinces, its composition by sex, age, ethnic and educational groups, and the extent to which it is engaged in, or depends on, various branches of economic activity. The further a country has progressed in its technical development, the greater is the need for accurate and detailed information.

Information regarding the size of the population and its growth can be secured by periodic census enumerations, records of births, deaths and migration, and, at least in a few countries, by a continuous population register. Such information can be supplemented in some areas by records of school attendance, rationing registration, occasional sample enumerations, taxation lists, records of military conscription, social insurance records, voting registers, etc. However, facts of this kind are not available in all countries, nor are they always up-to-date even in those countries where they have been gathered.

In most countries in which technical development has advanced relatively little, censuses have been taken sporadically, if at all, and have yielded only a limited amount of information. The cost of periodic detailed censuses is large in relation to the financial resources of the governments in such countries. Where the level of education is low, moreover, it is difficult to assemble a sufficient staff of trained enumerators for a simultaneous counting of the entire population, and difficult to get accurate answers to census questions from the people. Obstacles to the accurate recording of births,

deaths and migratory movements appear even greater; they are considerable even in countries which are much richer and which have a more educated population.

In some of the most advanced countries, the social and economic tasks of government have reached such high complexity that detailed and accurate statistics regarding their population and its characteristics are needed. Even in these countries, however, there are limits to the frequency with which censuses can be taken, to the number of questions which can be asked, and to the numbers of answers which can be tabulated on the occasion of any one census. Moreover, the final results of an enumeration are not entirely up-to-date by the time they become available. Estimates are therefore required if changes since the census, or items not included in the census, are to be taken into account.

2. Recent progress in population estimates

Much progress was made in the last century in collecting statistics concerning the size, structure and rates of change of the population in various countries of the world. The periodic enumeration of the population and of its main characteristics became an established practice in most Western countries during the nineteenth century. Towards the end of the century, censuses were taken in India and the Russian Empire, while the size of the Japanese population was determined by periodic reviews of the population registers. Statistics of births and deaths, though not always complete, were being collected in many parts of the world. A close study of population movements and up-to-date knowledge of the population required the development of various estimating techniques, which led to the establishment, in the census offices of many countries, of special sections concerned with population estimates.

Progress during the present century has been even more rapid as the recognized need for demographic knowledge has increased both in extent and in scope. Scientific censuses have been taken for the first time in many more countries, and the characteristics of the population investigated in much greater detail and with increased precision. The registration of births and deaths has been begun in new areas, while in older areas it has been made more complete and detailed. Still more recently, significant investigations have been made regarding the quality of the statistics collected. The improvement of scientific sampling techniques in recent years has provided useful tools for the collection of additional data and the evaluation of the accuracy of censuses and vital statistics.

In the countries where census-taking and the collection of vital statistics has become a long-established practice, elaborate techniques are used for estimating a wide range of population aspects. In other countries, where basic statistics are relatively new and more limited in scope, recent estimates are less refined and detailed than in the former countries, but are markedly superior to those estimates which previously were produced. There is still a considerable number of countries and territories in which there has been no census and where statistics relating to population trends are either absent or very scanty. Even in those countries, however, increasing efforts are being made at estimating the population by various other means, some of them requiring considerable ingenuity. Although these estimates, at best, can be only rough approximations, they can serve a variety of purposes if their limitations are kept in mind.

The advances made in preparing current estimates of total population are reflected in international statistical compendia. The International Statistical Institute, prior to the Second World War, did not find it feasible to publish reasonable population estimates for several countries and territories of the world. Between the two world wars, the League of Nations published current estimates for *every country* of the world in its *Statistical Yearbook*, though many of these estimates were known to be unreliable, and the reliability of many others was unknown since the method of obtaining them could not be ascertained. The United Nations, in its *Demographic Yearbook*, is now in a position not merely to publish current estimates for every country, but also to specify the manner in which most of these estimates have been derived and thereby to indicate — at least roughly — how reliable these estimates are.

As a result of rapid progress in obtaining basic data in some countries and less rapid progress in others, the best way of making population estimates varies more widely than was formerly the case. In many countries, the estimates that are published currently are probably the best which can be made in view of existing statistical information. However, there are still many countries and territories in which the basic information, whether good or poor, is not utilized to best advantage.

3. Scope and purpose of this Manual

This Manual is confined to the problem of estimating the total population of a country at a current date. There are many other related problems, such as estimating the past and future population, its geographic distribution, its composition by sex and age, and its structure according to various other characteristics. It is planned that some of these problems will be dealt with in future manuals.

Although this Manual is intended for use in all countries of the world, it is concerned especially with the preparation of population estimates in those coun-

tries where the available statistical information is rather limited. The Manual shows that current estimates of population can be produced even in countries having very few basic statistics, that existing information often permits the improvement of the estimates which are now being made, and that additional data, which would permit the making of superior estimates, can often be obtained at small cost. The Manual also shows that in countries with highly developed statistics, there are still various problems regarding the comparability and consistency of estimates.

The Manual is concerned not only with the methods of constructing population estimates, but also with the problem of evaluating their quality.¹ In some countries, official population estimates are published with comments relating to their nature and accuracy, but these countries are still in a minority at the present time. The appraisal of the quality and reliability of estimates is a subject which should concern all countries of the world — those with highly developed statistical systems as well as those where statistics are more rudimentary. Mediocre statistics, whose nature and reliability are not indicated, have often proved to be more dangerous and have led to more incorrect conclusions, than much poorer statistics which are clearly shown to be such.

The information necessary for an accurate evaluation of the reliability of population estimates can often be obtained rather cheaply, and it can enhance greatly the usefulness of results obtained from base data which are secured at great expense. Sampling offers a cheap and effective means both of checking the accuracy of existing information and of obtaining new data. Some of the ways in which sampling and other techniques can be used for these purposes are discussed in this Manual.

Population estimates are used to serve various purposes in various countries. For this reason the estimates now being made often differ from country to country as regards definition, coverage and time reference. Some countries, for instance, define their population in terms of habitual residence, while others define it in terms of actual presence within the territory. Categories such as temporary migrants and travellers, nomadic tribes, merchant seamen, foreign troops stationed inside the country or national troops stationed abroad, certain cultural or racial groups, migrant workers and their dependants, or displaced persons, are sometimes included and sometimes excluded. Similarly the estimates may refer to the middle of the year or to some other date.

While these differences may be well justified because of specific national needs, they lessen the comparability of estimates from country to country which is highly desirable from an international point of view. The Population Commission and the Statistical Commission of the United Nations have therefore established certain

¹One requirement for a full evaluation of the quality of population estimates is the appraisal of the quality of the basic statistics; this subject, which is somewhat specialized, is scheduled for separate treatment in a future manual.

standards for demographic statistics. In preparing estimates which are useful from a national point of view, it is highly desirable that every country consider carefully the modifications which would facilitate comparisons with those of other countries. To achieve better international comparability, some of the estimates now being made in various countries need to be adjusted in certain ways, which are discussed in this Manual. Where conformity to international standards is not possible, it is desirable that the deviations from the standards be clearly indicated, or that appropriate sub-totals be given in order that the desired figure may be derived. Information relevant to international comparability is still lacking in the statistical publications of many countries.

4. Types of methods of estimating total population for current dates

Because there is great variety in the amount and type of information relative to population size and population growth available in the various countries of the world, the methods used in making population estimates must vary accordingly.

At one extreme are the few countries which have a current bookkeeping system, known as a "continuous population register". In such a register a new entry is made for each birth and for each arrival of an immigrant, while a deletion is made for each death and for each departure of an emigrant, the actual events being recorded within a very brief interval of time. By balancing the books at convenient intervals, such as once or twice a year, a highly accurate estimate of the population can be obtained.

In other countries which are well advanced statistically, no such system is in operation, but information on each of the component items of population change is available from separate sources. The population total is known for the date of the last census, the number of births and deaths can be obtained from registers of vital statistics and the number of immigrants and emigrants from the records of migration across the frontiers. Adding to the last census the total excess of births over deaths and the net immigration (or subtracting the net emigration) gives an estimate of the current population. This procedure takes into account every component of population change. If the census and the statistics of births, deaths and migration are complete, such an estimate is highly accurate. Even if there are minor defects in the vital statistics and inadequate migration records, quite accurate estimates of total population can often be obtained.

There are many countries where censuses have been taken, but where birth and death registration either does not exist or is known to be very inaccurate. In such

countries, population estimates for current dates can be produced by means of mathematical extrapolation. This method is less reliable than the foregoing, since it is unlikely that population change will conform precisely to a mathematical formula. It may, however, be the best method if vital statistics are markedly defective. No mathematical methods can be used in countries where the results of only one census are available, or where censuses have been of doubtful and variable accuracy.

In some countries, and many territories, there has so far been only one census, while in others there have been only certain types of enumeration (e.g., registration for food rationing or a count of the number of households) which are not comparable to a census. Population figures of this type can be brought up to date only by the use of certain assumptions — some of them quite arbitrary — concerning rates of population growth. Some non-censal counts, however, are repeated annually, which facilitates obtaining current population estimates.

There are, finally, a considerable number of countries and territories in which the population has never been counted in any way. In such areas population estimates can be based only on conjectures, or "reasoned guesses". Conjectures can be based on comparisons of certain conditions in these areas with those in other areas where population size or density is known. There is scope for the use of much ingenuity in making the best possible conjecture.

Even where a high degree of reliability cannot be attained in view of the limited information at hand, it is still important to obtain at least some kind of a population estimate. A high degree of precision is not needed for every purpose. If an accurate estimate cannot be made under given conditions, this should not stop efforts to produce as good an estimate as circumstances permit. It is important, however, for the reasons stated above, to indicate the methods used and the degree of reliability of the result.

In this Manual, the problems which arise in the making of population estimates and the possible ways of improving them are discussed separately with reference to each of the types of estimating procedures mentioned above. The discussion begins with the estimates having the least adequate foundation: the conjectural estimates. Succeeding chapters relate to estimates based on defective censuses and non-censal counts, estimates made by mathematical extrapolation and similar procedures from the results of one or more censuses, and finally, estimates based on the results of censuses and current vital and migration statistics, and on continuous population registers. The discussion of the various methods is preceded by a chapter dealing generally with the problem of assessing the quality of population estimates.