INTERNATIONAL AGRICULTURAL STATISTICS SOME ASPECTS OF ITS GROWTH, PROBLEMS, AND PROSPECTS*

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A system of international agricultural statistics was proposed by the International Statistical Institute at its first session in Brussels in 1853 when it decided on five groups of materials necessary for the purpose, namely : (*i*) geographic and climatic conditions of a country; (*ii*) tenancy; (*iii*) general economic conditions influencing agriculture; (*iv*) specific conditions of agriculture itself; and (*v*) reports of producers. The Institute recommended that decennial agricultural censuses be taken in all countries as a part of their general censuses of population and further recommended a minimum programme for them which included reports of area under each crop, amount and value of product, quantity of fertilizers used, conditions of farm labour and livestock numbers.

At its subsequent sessions the Institute examined some of the conceptual and methodological problems related to statistics on land, property and crop production and questions whether agriculutral information should be collected through paid enumerators or be supplied voluntarily by farm operators. It was 16 years after its establishment that the Institute was ready for its first project of compilation and publication of agricultural statistics. It charged the French Statistiques Generales with the collection and publication of international agricultural statistics. The questionnaire prepared by them included four topics : (*i*) area cultivated and uncultivated; (*ii*) production of each crop; (*iii*) livestock numbers; and (*iv*) size of holdings and implements used. The results of this project were, however, only a few incomplete series of international statistics

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limited to about 9 European countries which were incorporated by the French Statistical Office into its biennial reports. Some methodological problems of agricultural statistics, however, continued to be discussed by the Institute. The session in 1897 emphasized the importance of cadaster as the basis for agricultural statistics and recommended to governments a procedure of making crop production estimates which may well be worthwhile taking note of. It proposed that "typical farms be selected in each county and the utilization of their arable lands be exactly ascertained in June before the harvest. The proportion of areas under each crop in these farms should be then applied to all arable lands in the county. The average yield per acre should be established from the reports of the typical farms for each crop and each section of the county separately". Not that such procedures of estimation were unknown before or not practised in specific countries. The point is that a recommendation was made by an international forum on the methodology of estimated crop areas and yields for possible adoption by all countries.

The real impetus for the establishment of systematic international work on agricultural statistics, however, came from quarters quite independent of the International Statistical Institute. In the early years of this century a merchant and wheat and fruit farmer in USA by the name of David Lubin became interested through his own farming activities in securing international crop reports on the agriculture of all parts of the world. He felt that the farmer and the statesman remained in the dark with respect to the forces which determined the price and trade of farm products unless national statistics were supplemented by world statistics. He conceived the idea of an international institute collecting, publishing and disseminating agricultural statistics. His proposal did not find any response in his own country and he, therefore, decided to sell his project to Europe. Without any official connections or backing but possessing a strong will, enthusiastic faith and a magnetic personality, Lubin tried unsuccessfully in London and Paris, then secured against many difficulties an audience with the King of Italy. His persistence and vision were successful in appealing to the imagination of the King who offered a building to the future institute and an annual subvention from Italy, and sent invitations to other countries for a conference at which the foundation of the institute had to be decided upon. The International Institute of Agriculture was founded in 1905 and its statutes were ratified in the same year by about 40 governments. (This was 38 years before Hot Springs which established the Food and Agriculture Organization of the United Nations).

The International Institute of Agriculture started publishing area and production data for the principal grains in the February issue of 1910, *Bulletin de Statistique Agricole*, which included data for the years 1908 and 1909 and for the average period 1899-1908. From the year 1913 the Bulletin showed also data relating to the monthly import and export, stocks and prices of some cereals. The first yearbook of agricultural statistics, 1910, was released in 1912 and included area, yield and production of selected crops and livestock numbers. The coverage of the yearbook was subsequently expanded to include trade and price data for major crops, livestock numbers and fertilizers. The Institute published also several monographs and methodological notes. A series of volumes on farm accountancy statistics were published almost annually from 1927-28 to 1936-37. The results of the first agricultural census (1930) were published in five volumes covering about 38 countries and territories. Results from a few countries relating to the attempted Second World Census of Agriculture (1940) were published in the Bulletin de Statistique Agricole.

As is well known, the Second World War interrupted the work of the Institute. Many of its functions were subsequently taken over by the FAO. To mark its transition in the statistical field, the last of the Institute's statistical yearbooks was a joint publication with the FAO issued in three volumes published in 1947 and covering the period 1941-42 to 1945-46.

The Institute, of course, dealt with a wide range of activities relating to agriculture besides statistics but it is not my intention to describe them. I would only like to quote from the introduction to the second edition of David Lubin's biography by Olivia R. Agresti: "The greatest contribution of the Institute has been its work in laying a foundation of facts in the form of statistics on which to build national and international economic plans for agriculture and commerce. In its annuals of agricultural statistics, the report of the First World Census of Agriculture, and in the monthly Crop Report Bulletin, it has provided an important part of the basis for studies of economic development since 1910."

It should, however, be stated that the motivations which led to the establishment of the FAO had a somewhat different emphasis from those for founding the International Institute of Agriculture. The FAO was established as the agency through which governments could work together in the task of enabling people of all countries to

have enough of the rightkinds of food and to enjoy adequate standards of living. There was a general awareness that a large proportion of the world's population was inadequately nourished but the facts and figures needed to measure the size of the problem had never been systematically assembled. No broad statistical picture existed which could serve as a guide in the campaign against hunger and malnutrition which the members states of the FAO had pledged themselves to undertake. The World Food Survey published by the FAO in 1946 provided such a picture for the first time. The point of reference in this Survey was the immediate pre-War period. This was because in 1946 the War had just ended and even many of the pre-War figures for food supplies and sometimes population could only be rough estimates. The analysis referred to covered 70 countries whose people made up about 90 per cent of the world's population. The Survey attempted to disclose the main gaps between actual consumption and nutritional targets and called attention to the possibilities existing for closing these gaps. It stressed that many of the figures for food supplies and even population were only rough estimates. As regards the adequacy of calorie levels it considered per caput intake of 2550-2650 cals per day as the minimum level to which intake should be raised in the low-calorie countries.

A second appraisal of the world's hunger was made in the Second World Food Survey published by the FAO in 1952. It was essentially concerned with the same basic questions as the first, viewed in the light of changes that had occurred in the post War period and the greater knowledge available. It was based on data for food supplies in the post War period and revised data for the pre War period. The most important improvement in this Survey, as compared with the first, was the incorporation of tentative estimates of national calorie requirements taking into account age, sex, body weight and environmental temperature. This made possible the analysis of food intake in relation to requirement to be carried out country-wise instead of the use of a uniform standard of about 2,600 calories per caput per day used in the First World Food Survey.

The Third World Food Survey was published in 1963. Like the Second, it compared the present with the past and took account of the trends and changes that had taken place since pre War. It covered three time periods—pre War, post War and the most recent period for which estimates of food supplies could be made available, and also presented an outlook of the needs and possibilities for the future. Obviously since the preparation of the Second World Food

Survey more and better data had become available despite the considerable variation between different parts of the world in respect of coverage, concepts and reliability. While the First and Second World Food Surveys essentially analysed the total food supplies as between countries, the novel feature of the Third World Food Survey was to attempt to analyse the available information on the patterns of distribution of food supplies between households within countries with a view to estimating the total numbers undernourished or malnourished. Another significant countribution to the analytical work was the introduction of the concept of variation in requirements among individuals based on the FAO Requirement Scale for estimating the incidence of undernutrition from data on food consumption collected in household surveys.

The Fourth World Food Survey released by FAO early this year makes an attempt to update the Third Survey : it reviews recent trends in food production and supply against the background of increasing population, and documents most recent evidence regarding the level of nutrition and incidence of undernutrition. Besides presenting a broad estimate of the number of undernourished for the world as a whole, the Fourth World Food Survey gives such estimates for many individual countries. Not that data on the distribution of food intake by households from food consumption surveys were available for all these countries. Rather, assuming a certain consumption-income function, extensive use was made of the most recent information available on household incomes or expenditure from countries to estimate the variability of the distribution of food supplies in terms of calories among peoples within countries. The calorie-income elasticities needed for this purpose were those derived by FAO in connection with the work on projections of demand for agricultural commodities. Thus, the concept of undernutrition was implicitly linked with the lack of purchasing power. In other words, those who do not have adequate purchasing power to procure a minimum standard of food supply in terms of calories became classified as undernourished.

From a purely nutritional standpoint the above concept of undernutrition may appear to lack rigour and perfection since the consumption function relating the expected intake to different income levels masks within income class variations that in practice exist. As a result there may be some households with inadequate purchasing power and hence classified as under-nourished, yet actually having calorie intake levels higher than the minimum standard or critical level ; and, at the same time, some households with intakes

lower than the minimum standard may be excluded because of the higher consumption expected by virtue of their purchasing power. Since the publication of the Third World Food Survey many estimates of the number of hungry or malnourished have been issued by individuals and institutions and there has been considerable controversy in the interpretation of the concepts underlying these words. The Fourth World Food Survey has resulted in viewing the problem within the framework of poverty and the fulfilment of basic needs. In this connection, the households identified as having inadequate purchasing power but yet consuming more than the minimum standard of food supply are considered to be doing so at the expense of other basic needs, *e.g.*, clothing, shelter, etc., while those consuming less than the minimum standard despite an adequate purchasing power are considered as cases of voluntary deprivation and are, therefore, not included among the needy. Thus, the linking of the concept of undernutrition with that of poverty which is the plight of the bulk of the undernourished, enables a focus on those vulnerable population groups which call for policy measures to be adopted to ameliorate their living conditions.

Even so, as the Survey emphasizes, the estimates of numbers undernourished are only crude estimates to indicate the orders of magnitude at the country level. These are made by way of needed indicators to enable starting the necessary remedial action programmes which may themselves tend to focus greater efforts for improving the quality and coverage of the initial indicators. These may be considered not so much as absolute values by themselves but more as measures of efforts needed to improve the situation.

As an illustration an attempt is made to estimate the amount of additional food required to reduce the proportion of undernourished, in other words to estimate the calorie gap. The size of this gap will depend on how the problem of undernutrition is viewed and the measures proposed to be taken to alleviate the problem. One measure of the calorie gap can simply be based on the differences between the requirement per caput and supply. But this approach would only aim at a certain inadequacy of total food supply at the national level without confronting the problem of its unequal distribution within the country. That is to say that even if the average per caput availability were raised to the requirement level, there is no assurance that the problem of undernutrition would disappear or reduce to a certain minimum level. An alternative approach to estimating the calorie gap could consist of estimating the quantities of food required to provide through a direct intervention programme

every individual considered undernourished with food to bring his intake to equal or exceed a desired level. This approach would obviously assume that it is possible to identify those individuals in the undernourished category and to provide each of them with a certain amount of additional food. The calculation of the calorie gap on the basis of either of the above two approaches provides indications of the dimension of the food problem at only one point of time. For a practical solution of the problem it is necessary to analyse it in a dynamic setting over time taking into account rising population, growth in food supplies and a reduction in the inequality of food distribution. The Survey therefore illustrates a third approach where it is assumed that the countries with undernutrition problems will not only increase the available food supply but also pursue policies aimed at reducing the inequalities in their distribution. Policies to include food distribution could involve increasing the purchasing power of the poor by provision of adequate productive employment, land reform and timely and effective assistance to rural landless and subsistence farmers particularly in times of poor harvest, etc.

It is assumed as an example that the objective is to reduce the percentage of the undernourished to not more than 5% of the total population by the year 1990. The mathematical procedure used for estimating the additional food requirements essentially consists of estimating the levels to which average food supplies should be raised corresponding to different degrees of inequality in food distribution as measured by the standard deviation. In many developing countries the existing inequalities in food distribution are relatively large corresponding to a standard deviation of more than 700 calories. It has been shown that unless steps are taken to reduce the standard deviation to a level well below 700 calories the proportion of the undernourished in these countries cannot be reduced to less than 5% of the population without increasing the average supply to about 3,000 calories per caput per day from the current level of about 2,000 calories. It is unlikely that many developing countries would be able to achieve an average per caput food supply of 3,000 calories per day within the medium-term future. Thus, it is almost imperative to reduce the extent of the existing inequalities in the food distribution, while taking measures to increase food supplies. The greater the extent to which inequalities in distribution are reduced, the lesser would be the required increase in the per caput food supplies to achieve the desired objective.

Calculations presented in the Survey assume that (*i*) the average per caput per day supply of calories would be raised to at least 2500 calories by the year 1990 for all developing countries where it was below this level in 1972-74, (*ii*) the standard deviation of the distribution of the food supplies would be reduced to 600 calories by that time, and (*iii*) the population growth rate would follow the UN medium variant population projections.

It has been shown that in wheat equivalent the developing countries would need to increase the total of their food supply by oxim ately 363 million tons for the period up to the year 1990. This amounts to an average annual increase of about 21 million tons so far as the individual countries are concerned. It has also been shown that this will correspond to an average annual growth rate in food supply of about 4% in most of the countries.

I have dwelt on the content of successive world food surveys as these are also indicative of the growth in the coverage of basic international agricultural statistics used in the analysis presented therein. I may give some facts in this cennection. The FAO Production Yearbook now reports data from 211 countries and territories for about 140 agricultural commodities and 39 items of means of production like fertilizers, pesticides, agricultural machinery, etc. The FAO Trade Yearbook covers reports from 197 countries and territories on the trade of about 120 commodities. The first set of three-year average food balance sheets for 30 countries was issued in 1958 covering the period 1954-56, the second for 43 countries in 1963 covering the period 1957-59, the third for 63 countries in 1966 covering the period 1960-62 and the fourth in 1971 for 132 countries covering the period 1964-66. The latest food balance sheet publication issued by the FAO relates to the period 1972-74 and covers 162 countries and territories. Information relating to the distribution of food supplies within countries between socio-economic groups of population have been documented in periodic Reviews of Food Consumption Surveys published by the FAO in 1958, 1962, and 1970. The country coverage of these publications has been increasing during the years. The latest Review is published in two volumes—Vol. 1 covers countries of Europe, North America and Oceania and came out of the press last year; Vol. 2 of the same publication covers the developing countries and is expected to be released in a couple of months time. These Reviews describe the methodology followed in carrying out these surveys as well as presenting the data tabulated in a certain standard form giving the expenditures of various food groups classified in general by income or expenditure classes and location,

It is of course true that the expansions which have occurred in the assembly, analysis and publication of international agricultural statistics is a reflection of the greater availability of basic data from the countries themselves. However, I would like to draw attention to the fact that it has become part of the responsibility of FAO to make its own estimates for the substantive items of food and agricultural statistics which are not available from official national sources. In doing so the best possible use is attempted to be made of whatever scanty information may be available from indirect sources and utilizing to the extent possible appropriate techniques of estimation, like time series analysis and extrapolation. At the same time, every effort is made to enter into dialogue with the countries to arrive at the most reasonable figures. This is somewhat of a departure from the earlier practice of publishing in the FAO Yearbooks only those statistics which were officially available from the respective governments or semi-official recognized sources. If one looks at the yearbooks published in the 1950s and the early 1960s, one would be struck by the rather substantial number of gaps in the various publications relating to crop and livestock production indicating the non-availability of the data from recognized national sources. You will not find these gaps in the more recent issues of the Yearbook. The estimates presented to fill in these gaps can be considered a part of the FAO's own effort in assessing the world's current agricultural situation. The fact is that the international organizations like the FAO are themselves involved in assessing and monitoring, and in some sense participating in planning the development of the world's agriculture. The World Food Surveys mentioned above represent part of the periodic assessment exercise. Certain major aspects of the current agricultural situation are reviewed annually in the State of Food and Agriculture and FAO Commodity Review and Outlook. The Indicative World Plan for Agricultural Development published in 1970 was a major expression of FAO's involvement in the planning exercise. Work is currently under way on Agriculture Towards 2000 as a continuation of the same process. FAO's work on Commodity Projections, already published in 1962, 1966 and 1971, is another major activity related to the planning and assessment exercise. A more recent set of commodity projections is expected to be issued within a few months.

The increasing involvement of the FAO in the assessment, monitoring and planning exercise could not but have a significant impact on the processing methods for the compilation and analysis of the statistical data. A large part of FAO's data processing is

computerized but the computerization was not merely a question of handling large masses of data and doing the tabulations and analysis more quickly. The essential point was that it was no longer meaningful to deal with individual statistical series like those of production, trade, etc., separately. The separate series by themselves were no doubt important but it was equally important to establish simultaneously the links between them. In other words, one has to deal with flows and matrices rather than with individual pieces of data. The statistics of any single commodity has to be traced all the way from its production and utilization to its final consumption. The processing in this fashion could only be handled through appropriate computer programmes. I am mentioning this fact also because our experience in this field may be found of some use for adaptation at national levels. As a consequence of maintaining our data series in this interlinked fashion, it has been possible to compute a variety of derived statistics and indicators relating to food and agriculture in a consistent manner from the same central data storage. It may incidentally be mentioned that FAO's statistical yearbooks like the Production and Trade Yearbooks are now processed as outputs of the same data storage system. The publication of these yearbooks are no longer separate projects by themselves as in fact they used to be some years ago.

The computerized processing of our data series has also helped in simplifying our dialogue with the countries in our request from them for the national data series. Our questionnaire on area and production of crops and on livestock and livestock products is now completely computer processed which permits not only the preparation of a questionnaire specifically tailored to each individual country but also the submission of the historical data series either provided by the countries themselves in the earlier years or estimated by FAO for their further comments and revisions. I may just remind that our earlier questionnaire was a general questionnaire covering all commodities which may or may not be applicable to any particular country. Besides, with the earlier method of printing the questionnaires there was hardly any possibility of inserting the historical data series in these questionnaires.

Questionnaires sent out by international organizations have sometimes been the subject of criticism at the national level. One criticism refers to the problem of duplication between questionnaires sent out by different international organizations. Recently this has

been th e subject of a special study by the Statistical Commission of the UN on the basis of consultations with a few selected countries and perhaps the matter will be kept under review during the next few years taking into account the experience of all the countries who are themselves members of this Commission. My own feeling is that the duplication, if any, is of a marginal nature. The real problem seems to be that the national authorities have to make special efforts for filling up international questionnaires. This obviously can become a burden when the information compiled for the international questionnaire is not in a form for the countries' own requirements. This burden will be a minimun if the compilations made in the countries' own statistical office can readily be transferred for filling up the international questionnaires. In an ideal situation, all international compilations should follow readily from the national tabulations. To arrive at this ideal situation there is need for efforts from both directions, namely from the international office as well as at the country level. The tailoring of the FAO Production Questionnaire, which I have mentioned earlier, to suit specific country situations is a step in this direction.

The gathering and dissemination of statistical data on a world-wide basis furthermore calls for the adoption by countries of certain uniform standards and classifications. The development and promotion of such standards and classifications is therefore one of the major statistical activities of international organizations. Notable examples are the Standard International Trade Classification (SITC) linked to the Brussels Trade Nomenclature now called Customs Cooperation Council Nomenclature (CCCN) and the International Standard Industrial Classification (ISIC) of all economic activities, work on which has been the responsibility of the UN Statistical Office with the participation of the concerned agencies in their respective fields of specialization. Similarly, the ILO and the UNESCO have had the main responsibility respectively for the International Classification of all Occupations and International Standard Classification of Education. In the specific field of agriculture the successive programmes of the World Census of Agriculture have been important instruments for promoting uniform concepts and definitions in the countries. A comprehensive effort is now under way in FAO to prepare and publish a Glossary of Agricultural Statistics. Broadly speaking, it will comprise of two main parts, the first dealing with the basic concepts and definitions of production and utilization statistics and the agricultural census programme taking into account the recommendations adopted at various FAO meetings on

the subject. The second main part should illustrate the technical terminologies used in the methodologies adopted for the collection and analysis of data in food and agriculture. In particular, it should cover sample surveys in agriculture, household surveys on food consumption and expenditure and design of experiments used in agricultural research. We hope this would serve a standard reference document for many aspects of international agricultural statistics.

There is a problem in international tabulations of statistical information which normally does not occur at the national level and which is more pertinent to agricultural statistics than to statistics of other sectors. This is the question of time reference. As we know, the growing and harvesting of crops occurs at different times in different parts of the world. The difference in timing becomes wider as one goes down the latitude. In the more northern parts of the World the cold winter is a natural end to the crop season. This is obviously not so as we go further down to the tropical areas and the seasons south of the equator are just the reverse of the northern pattern. In order to make international tabulations of crop production statistics one always requires a certain reference period. The earlier practice in the FAO was to leave this reference period somewhat undefined and a crop year was designated by two calendar years between which it fell though this meant different periods in different countries. This matter in the past has been discussed a number of times not only within FAO but also at other forums including the International Statistical Institute (Rome, 1953) and the Statistical Commission (Geneva, 1954). It is obvious that there could be no perfect solution to the problem and therefore certain conventions have to be adopted. The conventions we finally adopted as a result of deliberations of our Statistics Advisory Committee is to adopt the calendar year as the standard reference period allocating crops whose harvests straddle over a year to the particular year when the bulk of the harvest takes place. The adoption of this convention permits aggregation over commodities as well as over countries and thus facilitates standardized computations for food supply analysis and overall production accounts, etc. This, of course, does not prevent adoption of other reference periods as appropriate for specific commodities separately, say for purposes of market analysis.

The quality and coverage of international agricultural statistics will, of course, depend on the quality of the data available from the basic national sources. It has, therefore, been an essential part of the

activities of the FAO to promote the development and improvement of agricultural statistics in the countries. In the early years, this effort was very largely confined to the formulation of the agricultural census programme and its dissemination to the countries. The advent of the UN programme of techical assistance in the 1950s brought FAO some new resources which also facilitated the direct assistance which could be rendered to developingc ountries for improving their agricultural statistics systems including census taking. This came soon after the FAO headquarters were moved from Washington to Rome. This also coincided with the transfer of P.V. Sukhatme from the Indian scene to the international scene when he took over the direction of the statistical work of FAO for the next two decades. The work which he and his colleagues, like Panse, Koshal and others, had accomplished in India in the field of large-scale crop surveys came in very handy by way of transfer of technology and rendering technical assistance to a number of developing countries in Asia, Latin America and Africa. Their work can in fact be said to have catalyzed the increasing adoption of sampling methods and objective techniques for the collection of crop production statistics in many parts of the world especially during the late fifties and early sixties.

A good part of FAO's effort for improvement of national agricultural statistics continues to be focused on helping countries in carrying out their agricultural censuses. Over the years the concept and the scope of the agricultural census itself has been in a process of evolution. In the programme for the First World Census of Agriculture, *viz.*, the one of 1930, sponsored by the International Institute of Agriculture, it was stated that "perhaps the most important object to be secured by the census is an approximately accurate knowledge of the various products entering into consumption". In stating the objects of the 1940 World Census the programme still placed in the forefront the determination of accurate and comparable information on the area under crops of international importance and on numbers of livestock, though the second object was to determine the principal features of agricultural holdings. In contrast the 1950 FAO programme considered that to obtain information on number of agricultural holdings and their principal characteristics was the primary purpose of the world census. These differences are not incidental. During the two intervening decades the views in many countries on the role of governments in relation to agriculure had changed considerably. More consideration had been given to structural problems of agriculture and the study of the holding was

recognized as of paramount importance for influencing the pattern of agricultural production.

In the years since 1950 there has been little change in the concept of the main purpose of the agricutural census, namely to obtain information on the structure of the agricultural holdings and their characteristics like tenure status, land use, cropping pattern and agricultural practices. The main developments are in relation to the methods followed which improved considerably the coverage of the national census programmes. Sampling methods were used extensively in the collection of many items in the censuses carried out during the 1960s and 70s. As Sukhatme wrote in 1968 "there is scarcely a country which has not initiated some kind of sample survey programme in order to collect data for decennial censuses of agriculture sponsored by FAO". The increasing utilization of sampling methods coupled with availability of improved technology for storing and processing of data, led further to the realization that the agricultural censuses should no longer be considered as an operation conducted once in 10 years and in practice more or less detached from other agricultural statistics activities. On the contrary, high priority should be given to the development of integrated systems of agricultural statistics of which the agricultural census should form an important component. The census information and lists of villages or communes, rural households and agricultural holdings prepared as part of the census operation could serve as an essential basis for efficient design of sample surveys and for the collection of other food and agricultural statistics during and following the census year. Conversely, other statistical activities will be of great value in planning and in the execution of the agricultural censuses. The development of an integrated system of food and agricultural statistics should, therefore, be of immediate concern in the preparation of national agricultural censuses, appreciably contributing to improve the scope, reliability and timliness of agricultural statistics generally. This aspect has been particularly emphasized in the Programme for the 1980 World Census of Agriculture, issued by the FAO a couple years ago.

It is difficult to contemplate at present the precise nature and content of the agricultural census programmes and the development of current agricultural statistics for the years beyond the 1980s. Certain trends could however be noted. First of all, there is the question of the periodicity of census taking. Perhaps decennial programmes are no longer valid. Quantifiable changes in agricultural structure are no doubt slower than many other phenomena

relating to agriculture. Yet it is realized that information on characteristics like size distribution of holdings need to be recorded more frequently. In any case, there is the increasing demand for altering the land holdings and tenure structure which were not necessarily designed for the greatest good of the largest number. In fact, a number of countries have already decided to undertake agricultural census every five years instead of the present decennial programmes. A reduced time interval between two censuses is also dictated by the desirability of establishing closer links between the census operation and those relating to current agricultural statistics already mentioned above. Furthermore, there are new experiences in the methods of data collection itself. The recent Indian experience of utilizing computer retabulations of land revenue and cadaster records for obtaining holding-wise information on land use, tenure, etc., has potentialities which may be of considerable interest to a number of other countries. The demand for more timely and frequent data on agriculture has prompted some countries to build up files, or registers, of agricultural holdings containing regularly updated information. The use of computers has facilitated the maintenance of such registers which enable the monitoring of the developments in agricultural structure. Development planning experience has brought to the forefront the importance of statistical information on characteristics of small villages and communes. Since the agricultural census operations extend over all rural areas, socio-economic characteristics and other community statistics are likely to be included within the scope of the agricultural census.

Advances in remote sensing, especially the successful use of satellite imagery and use of aerial photography for estimation of crop areas in some countries may have important bearing in future on programmes of agricultural statistics. However, the high costs involved in these techniques have discouraged their further use in the developing countries and it is hoped that further research in this field will in due course reduce costs and also overcome other technical difficulties such as those due to cloud cover, small sizes of fields, presence of mixed crops and varying crop densities. Research is in progress with a view to overcoming the difficulties and to reducing costs.

The agricultural statistics programmes are also likely to be modified in the light of data requirements for formulating and monitoring programmes for agrarian reform and rural development. Such programmes, in addition to effecting the desired land and

tenancy reforms, seek to optimize the utilization of all resources available locally. The most important and potentially effective endowment of an area is obviously the people belonging to that area. Statistics of agricultural population and employment are a major component of the statistics needed for agrarian reform and rural development. Experience during the last 30 years of countries' participation in the three decennial world censuses of agriculture shows that fully meaningful and comprehensive information on agricultural population and employment cannot be obtained through the agricultural holding only as the unit of data collection. The problem has been examined in some detail in a recent study prepared by the FAO entitled "FAO Guide for Collection of Statistics on Agricultural Population and Employment" which is being issued as a supplement to the Programme of the 1980 World Census of Agriculture. The basic fact is that a large body of economic and social information about the people are commonly obtained with the households as the unit of enumeration. To collate such data meaningfully with those collected form holdings is a problem which deserves the urgent attention of agricultural statisticians. As I see it, this may not be entirely a question of developing appropriate analytical techniques but linkages may need to be established at the data collection stage itself through appropriate sampling techniques. This is an area in which intensified ex perimentation and research appears fully justified and results may indeed be very rewarding.

There are, of course, a number of challenging problems even in relation to collection of basic items of agricultural statistics. Take for example the problem of mal-nourishment which I mentioned before mainly referred to the calories gap, because this is the first essential nutrient. This does not mean that no attention should be given to the other nutrients like protein and vitamins. Broadly speaking, it is an established fact that in the staple diets like those obtaining in India comprising cereals and pulses, the deficiency of protein is very closely correlated with the deficiency in calories. In other words if the calories are adequate the protein requirements are almost automatically met for the bulk of the adult population. There are, of course, special requirements for growing children, lactating mothers and other valunerable groups whose protein intake may need to be supplemented through milk, milk products and other animal products. But as is well known statistics of livestock is one of the weakest links in the agriculture statistics system of many countries. Concerted efforts will be needed for improving their quality and coverage. Similarly, fruits and vegetables are

essential for the intake of adequate amount of needed vitamins and minerals. There is considerable scope to increase the area of fruits and vegetables in the developing countries. Unfortunately, the availability of data on fruits and vegetables is very poor. Suitable methodologies for collecting these statistics even if practised in a few countries have yet to be promoted and adapted to the conditions of the developing countries of the world.

I will conclude by just giving one more example.....The FAO has recently started giving some thought on exploring the possibility of developing a procedure which would enable it to monitor as much in advance as possible, the anticipated production of major crops in the world with a particular reference to possible shortages in specific countries or areas within countries. The FAO has designated this as Global Information and Early Warning System on Food and Agriculture. It is obvious that the success in this endeavour cannot be easily ensured unless the member countries extend fullest co-operation to make the warning system scientific. There is need of undertaking a number of methodological studies. It is well known that weather factors considerably affect the prospects of crop yield, particularly so in the developing countries. Statisticians, Agricultural Scientists and Meteorologists have to put their heads together to establish a suitable model giving the relationship between crop yields and weather factors. Other approaches like use of biometrical characters need also to be investigated possibly in conjuction with the weather factors. Indian Statisticians whose contribution to the methodology of collection of crop production statistics to which I have already made a reference will, I very much hope, make significant contribution in tackling this challenging problem as well.

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