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## THE CONSUMPTION APPROACH TO MEASURING AGRICULTURAL PRODUCTION OF FOODSTUFFS†

### *Introduction*

The Conference of the FAO at its Fourth Session in Washington in 1948 recommended that all member governments should prepare food balance sheets which would be used as an analytic tool in the estimation of food consumption levels. The food balance sheet technique has since been developed to show the quantities and types of food available for consumption and also the content of the food supply in terms of nutrient value per capita for the country concerned.

It is usual to construct food balance sheets from quantitative data on food production which is then adjusted for imports and exports of food and changes in the stock position. Amounts are also allowed for seed, animal feeding, and loss in storage. Population data is then applied to obtain per caput consumption of each foodstuff and these are converted into nutrient values.

In many countries in Africa, however, where farming is mostly undertaken on a small scale by large numbers of farmers, the collection of statistics on agricultural production is extremely difficult. Under such conditions the estimation of consumption levels can probably be more efficiently and accurately obtained by the technique of the household expenditure survey. Further, provided the household expenditure survey is based on a random sample drawn from a frame of the whole country, and providing the survey represents in duration the main crop seasons, it should be possible to use the data, by applying techniques of raising and conversion factors, as a means of projecting aggregate food crop production. It must be noted that by doing this the methodology of compiling food balance sheets is thus reversed; consumption data is used to project agricultural production.

The purpose of this paper is to illustrate this approach by the use of household

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expenditure data in the projection of agricultural production levels in Ghana. Here as in many African countries the quantitative data relating to domestic food production is not yet sufficiently developed to enable an accurate assessment of total food production to be made. The Economic Survey of 1962 makes the position in Ghana quite clear. "A study of the country's agricultural industry is severely handicapped through the lack of statistical data" and "the reorganization of the Ministry of Agriculture has made it a bit difficult to obtain the subjective judgments of experienced agricultural officers which formed the basis of the evaluations in previous years" (4, p. 28).

It is hoped that the Census of Agriculture, now nearing the completion of Phase 1, will ultimately provide adequate production data. Meanwhile it is proposed here to use, quite independently of the Agricultural Census, and before the results of that Census are known, statistics available on the consumption of local foodstuffs and to project these figures to arrive at estimates of food production.

The material for this approach has been obtained from data collected by the Central Bureau of Statistics in the 1961 Household Expenditure Survey (which will often be referred to as H.E.S.). This survey recorded in monetary and, in certain categories, quantitative terms the consumption and expenditure of nearly 3,000 households selected at random from all parts of Ghana on the basis of the enumeration areas used in the 1960 Census of Population. This formed a sample of about 14,000 persons representing the total population of Ghana by 1:500. This survey has been described, together with the results of the hand analysis of one third of the data, by Golding (5).

In using the data to project aggregate agricultural production estimates the Household Expenditure Survey has several limitations. The sample consisted of only those households where the head of the house earned less than £600 per annum; but inasmuch as the per capita national income in Ghana in 1961 was about £70 per annum the sample obviously represents the great majority of the population. A more serious limitation arises because the expenditure data were collected for a period of three months only, and in two regions, Brong-Ahafo and Ashanti, only six weeks were covered. This means that the data will be biased by the crop harvesting seasons which were taking place during the survey, but an adjustment can be made by taking into account information on the seasonal production of crops. In the final section some crude adjustments for this factor are offered in connection with the attempt to derive rough estimates of production on the basis of the estimates of food consumption.

### *The Consumption Data*

The material presented in Table 1 has been calculated from the quantitative data of the sample used by Golding covering the consumption of "local foodstuffs." This includes both those items which were paid for in cash as well as items appearing under the column "Consumption of own produce." All items of local foodstuffs purchased or produced for consumption were evaluated in the number of units of produce consumed. The units took a variety of forms, e.g. pounds weight, tubers, bottles, numbers, bundles, sticks, and other measures of goods, for example cigarette tins. In converting the measures to pounds weight, and subsequently to grams, the following assumptions have been made.

TABLE 1.—APPROXIMATE PER CAPITA DAILY CONSUMPTION OF "LOCAL FOODSTUFFS" IN URBAN AND RURAL STRATA—"AS PURCHASED" BASIS\*

Foodstuff	Urban		Rural		Weighted average	
	Grams	Calories	Grams	Calories	Grams	Calories
<b>Cereals</b>						
Maize, whole, shelled . . .	55	197	45	158	47	171
Guinea corn . . . . .	5	17	42	144	34	116
Millet . . . . .	6	20	33	116	18	62
Rice <sup>a</sup> . . . . .	20	71	11	39	13	46
<b>Prepared cereals</b>						
Corn, dough or ground . .	12	45	12	45	12	45
Kenkey, abolo, kakro . . .	—	—	4	16	3	12
<b>Roots and tubers</b>						
Cassava . . . . .	607	661	646	707	637	694
Cocoyam . . . . .	100	109	258	281	223	243
Sweet potato . . . . .	10	1	8	8	5	5
Yam . . . . .	317	284	507	456	465	418
<b>Plantain and banana</b>						
Plantain . . . . .	120	90	206	154	187	140
Banana . . . . .	9	6	7	5	8	5
<b>Nuts</b>						
Breadnut . . . . .	—	5	—	5	—	—
Dawadawa . . . . .	2	5	2	5	2	5
Groundnut . . . . .	5	30	4	24	5	27
Palmnut, sheanut, palm kernel nut . . . . .	8	19	4	9	5	10
Coconut . . . . .	—	—	6	2	5	2
<b>Meat and fish</b>						
Fish <sup>a</sup> . . . . .	66	132	48	96	52	104
Meat . . . . .	31	46	9	14	17	25
<b>Oils</b>						
Sold in bottles . . . . .	8	68	7	57	7	60
Shea butter . . . . .	2	14	6	53	5	44
Total . . . . .	...	1,820	...	2,394	...	2,234

\* Calculated from the 1961 Household Expenditure Survey for Ghana. See text for explanation. The relatively low figure for urban consumption is due in part to the omission of bread and sugar. See Table 2.

<sup>a</sup> Includes imports; see text.

*Tubers.*—Cassava, yam and cocoyam were recorded in terms of the number of tubers consumed. In converting these I have been guided by the weights used in the reports on prices of local foodstuffs which, until recently, were collected by the Agricultural Economics Section of the Ministry of Agriculture. Thus the average weights per tuber have been taken to be: cassava, 3 pounds; yams, 7 pounds; cocoyams, 10 ounces.<sup>1</sup>

<sup>1</sup> I have been notified by Mr. Golding that a check on the weights of yams consumed from own produce was made after the H.E.S., and this showed them to be on the average 25 per cent less in weight than those offered for sale. As yams were recorded in numbers of tubers, an allowance has been made for this in Table 1. (Personal communication from Mr. Golding.) See also P. T. F. Golding, "Some Methodological Problems of the Social Survey in a Developing West African State (Ghana)." Unpublished thesis, Goldsmith Library, University of London.

*Fowl*.—The edible portion of fowl has been taken as 2 pounds.

*Oils*.—Where oils have been purchased by the bottle, a standard 20 ounce bottle has been assumed. This may, however, lead to an overestimate of consumption because some oil is now sold in the smaller 10 ounce bottles which have recently been introduced for the sale of certain soft drinks. No distinction between these smaller bottles and the 20 ounce bottles was made in the collection of the data; the quantity of oil sold in the smaller bottles was probably not of much importance in relation to the total sold.

The data relating to Brong-Ahafo and Ashanti has been doubled to give a standardized period. In all regions except these two the survey took place between about mid-August and mid-November 1961. In Brong-Ahafo and Ashanti it took place between mid-January and mid-March 1962. The consumption data is thus obviously affected by the seasonality of certain foods so that the consumption of those which were being harvested at the time of the survey are, in comparison to an annual average, biased upwards, whereas those not being harvested at the time of the survey are biased downwards.

The data on quantitative consumption was extracted in aggregate and no regional breakdown is possible here. If it were, it could be presented to show the average per caput consumption in Brong-Ahafo between January and April, and in the other regions between August and November.

The localities in which the survey took place were divided into rural and urban strata. The Population Census 1960 defines localities with a population of 5,000 or more as urban and those under 5,000 as rural.<sup>2</sup> By this definition, the urban population in 1960 was 1.55 million and the rural population 5.175 million; these figures were used to calculate the weighted average consumption of the total population. (A 2½ per cent population growth rate has been used to arrive at the 1961 population.)

The conversion into nutrient values has been made using FAO food composition tables, but wherever possible I have used food values relating to Ghana foods.<sup>3</sup> These latter cover maize dough, kenkey, banku, abolo, white rice, fresh cassava, kokonte, garri, plantain, beans, and some other vegetables, and palm oil.<sup>4</sup>

It must be noted that the weights for food consumption are gross and include wastage after purchase. For certain foods the percentage going to waste at home is quite high. For instance, the allowance for waste and inedible portion is estimated at 22 per cent for cassava and 40 per cent for plantain.<sup>5</sup> The calorie values are calculated in terms of the retail weight "as purchased."

Although Table 1 refers to the consumption of "local foodstuffs" as they were listed in the recording schedule used in the Household Expenditure Survey, some of these items include a proportion of imported food which it would be difficult for a housewife or a field enumerator to distinguish from the local product. This is especially the case with those foods which are sold unpacked or unlabeled and which are distributed through the markets more often than through the stores

<sup>2</sup> Taken from an advance report of Volumes III and IV of the 1960 Population Census of Ghana.

<sup>3</sup> Calculated by Miss P. Whitby, Nutrition Board, Accra. Otherwise nutrient values are from 1.

<sup>4</sup> Kenkey is boiled dough made from maize; banku is a thick maize porridge; abolo is baked maize dough; kokonte is dried cassava; and garri is cassava meal which is made by roasting cassava that has previously been grated and then fermented for two or three days.

<sup>5</sup> P. L. P. Davey, FAO, Accra. Personal communication.

so that it may be more difficult to assess the source of the goods. Three such foods are rice, fish, and fresh meat.

Rice is sold loose in the market and though the polished imported rice is different in appearance from the locally produced unpolished rice, a distinction between the two sources of supply has not been made in the collection of the data. A large proportion of rice consumed in Ghana is undoubtedly imported. No current statistics on the production of rice in Ghana in 1961 are available, but the quantity produced in 1961 was thought to be small (probably less than 10,000 tons) and confined to certain localities in Brong-Ahafo, the Northern Region, and also west of Takoradi.<sup>9</sup>

Imports of rice in 1961 totaled 46,337 tons which, assuming all this was consumed, amounts to 15.1 pounds weight per caput per annum (3). Using the data of the H.E.S. to project total consumption of rice yields an annual per caput figure of 10.4 pounds is calculated. The discrepancy between this figure and the quantity of imported rice consumed per caput may partly be explained by the fact that the demand for rice is income-elastic and the H.E.S. did not cover those higher income households where the head of the house earned more than £600 per annum. A more likely explanation is that there may have been a certain increase in commercial stocks in 1961 as a result of the 1961 Budget which heavily increased the import duty on rice, thus leading to a rise in its retail price and a probable reduction in sales.

Turning now to fish, it is very difficult to distinguish imported fish (apart from canned fish) from the locally produced fish, especially since most imported fish is in fact caught in waters off shore from West Africa. All canned fish was recorded as imported and no fish canning is at present undertaken on a commercial scale in Ghana. Most of the fresh fish and all the smoked, dried, and salted fish recorded in the H.E.S. was listed under local foodstuffs. Fish imports in 1961 totaled 46,299 tons (3) made up of the following:

Fresh .....	23,520 tons
Smoked, salted, and dried .....	8,420 tons*
Stockfish .....	459 tons
Canned .....	13,900 tons

\* 4,825 tons came from countries neighboring Ghana.

In addition to supplies from abroad, local fish produced in 1961 has been given as 34,000 tons (4, Table 27). Thus the total supplies of fish available in Ghana in 1961 were some 80,000 tons, of which 66,000 tons might be classified as "local foodstuffs" by persons not knowing the origin of the fish. Using the H.E.S. figures on fish consumption to project total supplies of fish, the figure of 128,000 tons per annum is obtained. This level of consumption is obviously too high, even allowing for the small quantities imported from countries neighboring Ghana which might have escaped the customs records. The discrepancy between these two total figures has probably arisen because the fish for consumption which was recorded in the H.E.S. was not weighed by scales but was estimated. Although it is possible to train field enumerators to estimate fairly accurately the

<sup>9</sup> All information on rice production at this time was based on subjective estimates. This estimate was obtained from the Planning Commission.

weight of roots and tubers from their size, and the weight of other foods from the size of the container in which they were retailed, it is much more difficult to train enumerators to estimate the weight of fish. The weight of fish depends very much on its water content which is difficult to assess when fish is cured by smoking, salting, or drying. The lower figure giving the available supplies of fish at 80,000 tons is taken here to calculate the per caput consumption.

An analysis of meat consumption into imported and locally produced meat presents some difficulties as there are no statistics giving meat production in Ghana. Wilson, however, gives an approximate cattle population of 480,000 head of cattle weighing 400 pounds on the average and 1.7 million sheep and goats weighing an average of 50 pounds per head (6). He estimates the annual take-off rate to be about 10 per cent and the dead weight of carcass meat to be about 50 per cent of live weight. On the basis of these figures, which are necessarily only rough approximations, the total annual production in Ghana of beef would be about 4,300 tons, and meat from sheep and goats about 1,900 tons.

There are, however, considerable imports of cattle, sheep, and goats on the hoof from other West African countries, especially from Togo, Mali, Upper Volta, Ivory Coast, and Nigeria. In 1961 these imports into Ghana totaled 137,748 head of cattle, 109,058 sheep and lambs, and 143,644 goats (3). These figures represent a 24 per cent increase over 1960. It is not known what proportion of these imports represent increases to stock in Ghana; we have assumed here that all were used for consumption (which is not unreasonable since the 1961 increase followed a rising trend). On that basis, these imports would yield 12,300 tons of beef and 2,730 tons of meat from sheep and goats, using the same conversion factors as above. Imports of meat in 1961, as distinct from live animals, totaled 7,456 tons (3). On a per capita basis the daily consumption of imported and locally produced meat (excluding canned meat), amounts to about 11 grams per day or 4 kilograms per annum yielding a daily calorie intake of 16.5 which is lower than that given in Table 1.<sup>7</sup>

The only item of local foodstuffs which may be subject to serious criticism is the level of consumption of kenkey, abolo, and krakro, mostly made from maize. There are regional differences in the consumption of these products and it would be difficult to generalize about the extent of their use. The lack of data in Table 1 for these items in the urban strata must, however, be attributed to underreporting.

In discussing the nutritional level of consumption it is necessary to take into account not only those foodstuffs which are produced for consumption locally but also imported foods. In addition to rice, fish, and meat, imports of wheat flour and sugar are of substantial importance in Ghana.

Wheat flour is used in local manufacture of bread and cakes, mostly the former. The consumption of bread is noticeably underrecorded in the Household Expenditure Survey, probably because it was not specifically listed amongst the items of consumption in the recording schedules. Bread and other wheat products are made from imported flour so it is possible to estimate consumption on

<sup>7</sup> Another indication of the level of meat consumption in Ghana is given in an FAO report on Ghana's livestock industry (2). According to this report, the average consumption of meat in 1959 was less than 5 kilograms per person per annum; the level of consumption given in Table 1 for 1961 would total 6 kilograms per annum. Canned meat imports, which totaled 2,616 tons in 1961 (3), could not be mistaken for locally produced meat as there is no meat canning in Ghana at the present time.

the basis of import statistics. In 1961, 61,531 tons of wheat flour were imported (3). Assuming no change in stocks during the year, this represents per caput consumption of 25 grams of flour (equivalent to 87 calories) per day. Noting that one pound of flour yields approximately two pounds of bread, this corresponds fairly well with Davey's estimate of bread consumption in Accra. His estimate for Accra of 57 grams (two ounces) of bread is somewhat higher, but it is to be expected that bread consumption in the urban centers is above average.

Estimating consumption of sugar is more difficult. Nearly 62,000 tons of sugar were imported in 1961 (3), but a substantial fraction of this was used in manufacturing industries, notably the beer and soft drink industries. A small amount of sugar cane is produced in Ghana, but this is either eaten as cane or used in the manufacture of alcohol. Approximately one-third of the sugar imports are in the form of cube sugar which is used almost entirely for household consumption. Estimating direct household consumption on the basis of imports of cube sugar gives a daily intake of 25 grams or 95 calories per caput.

Imports of canned fish and canned meat also added a little to the calorie content and somewhat more to the protein content of the diet. The effect of taking account of imports of wheat flour, sugar, and canned meat and fish is shown in Table 2 where the estimated calorie contribution of those foods is added to the estimated calories available from local foodstuffs. The figure for local foodstuffs is the weighted average for rural and urban areas, but consumption of imported food is probably concentrated fairly heavily in urban areas where average incomes are higher.

Table 1 shows differences between the urban and rural consumption patterns. First there is a much greater consumption of roots and tubers in the rural strata, totaling some 1,400 grams per day compared with about 1,000 grams in the urban strata. The consumption of plantain too is much higher in the rural than the urban strata (206 compared with 120 grams). On the other hand, the foods which have an income-elastic demand such as rice, fish, and meat are consumed in greater quantities in the urban than the rural strata. The higher average calorie intake in the rural strata emanates from a diet high in starchy foods but low in proteins. Diet in the urban strata is, however, better balanced in this respect.

The low level of vegetable and fruit consumption in both the rural and urban strata must be mentioned. These have not been recorded in Table 1 partly because, on a daily basis, their consumption is negligible but also because they have a low calorie value. For instance, the fruit which had the highest level of con-

TABLE 2.—PER CAPITA DAILY ENERGY VALUE OF "LOCAL FOODSTUFFS" AND THE MAIN IMPORTED FOODS NOT INCLUDED IN "LOCAL FOODSTUFFS"\*

Foodstuffs	Calories
Local foodstuffs from Table 1 .....	2,234
Sugar .....	95
Wheat flour .....	87
Canned fish and meat .....	33
Total .....	2,449

\* Consumption of imported foods calculated on the basis of trade statistics as explained in the text.



sumption in both rural and urban areas was oranges, but in the rural strata the average consumption was one per person per week and in the urban areas it was one every ten days. The consumption of vegetables is made up largely of four items, tomatoes, okra, onions, and garden eggs (eggplant or aubergine). In both the rural and urban strata the consumption of these considered together amounted to one pound (454 grams) per week yielding about 13 to 15 calories per day.

Seasonal differences in the nutritional status of Ghanaians in the lower income groups are undoubtedly of some importance, especially in the rural areas where diet tends to be correlated with harvest seasons. It must be stressed that the figures given in Table 1 are averages for the whole country and relate to a certain period of the year only.

### *Projections of Agricultural Production*

Using the quantitative data from the Household Expenditure Survey it is now possible to discuss its use in projecting agricultural production of foodstuffs. The first column of Table 3 gives the annual production of the main food crops in Ghana using a straightforward raising factor to cover the entire population, but giving different weights to the urban and rural strata. These crude estimates can be refined somewhat by considering the seasonal changes in production, the type of demand for consumption, and the storage and other losses between production and the "retail level."

The adjustments suggested in the second column of Table 3, and explained in the following paragraphs, are extremely tentative and are intended mainly to illustrate some of the problems involved in deriving production estimates from consumption data. The margin of uncertainty is particularly large with respect to the adjustments intended to offset biases introduced by the fact that the survey data relate to a three-month period—and only a six-week period for two regions. Repeat surveys for a sub-sample covering consumption in at least four different agricultural seasons would obviously have provided a better basis for making ad-

TABLE 3.—APPROXIMATION OF CROP PRODUCTION FROM CONSUMPTION DATA  
WITH SEVEN-YEAR PLAN TARGETS FOR 1963-64\*  
(1,000 metric tons)

Crop	Approximate production		Seven-Year Plan target
	Crude	Adjusted	
Grains			
Maize .....	151	200	212
Rice .....	...	10	25
Guinea corn and millet .....	130	153	185
Roots, tubers, and plantain			
Yam .....	1,090	1,230	413
Cassava .....	1,750	1,500	767
Cocoyam .....	500	500	309
Plantain .....	430	660	766

\* Crude approximations of production separately weighted for urban and rural areas are derived directly from Table 1 on the basis of population data. See text for explanation of figures in the adjusted column. The Seven-Year Plan targets are from Ghana, *Seven Year Development Plan, 1963/64 to 1969/70* (Accra, 1964), Table 4.4.

justments for the seasonal variation in food consumption which is often of considerable importance.

*Cassava.*—Certain foods can be considered as inferior goods in the economic sense, notably cassava, cocoyams, and plantains. Thus projections based on lower income group consumption would bias the data upwards. Cassava, which is in good supply all the year, is probably more in demand when other staple foods are in short supply. Thus cassava consumption would be affected by the harvest seasons of other staples, notably yam and maize. Yams are harvested between the months of June and November and are preferred to cassava if there is no shortage and prices are not unduly high. Maize, on the other hand is harvested mostly in July or January, and cassava would thus provide an alternative to maize during the period in which the H.E.S. was undertaken. It is thus possible that the crude estimate of cassava production of 1.75 million tons may be too high, though allowing for wastage after harvesting, thought to be around 10 to 15 per cent, a production estimate of 1.5 million tons may be arrived at.

*Yams.*—The annual production of yams projected in Table 3 is probably over-estimated because the survey took place during the main yam harvesting season. To allow for the lower consumption at other times of the year a total annual consumption of 800,000 tons may be more realistic. In calculating production, however, an addition of 10 per cent between harvesting and retail should be made; and further allowance of about 20 to 30 per cent of the total crop for seed would raise the gross production to some 1.2 million tons.

*Maize.*—Maize was not being harvested in great quantity at the time of the survey and the annual production projected here is therefore too low. In adjusting this figure allowances must be made for the greater consumption of maize during its main harvest seasons and also for underreporting of kenkey and other maize products in the H.E.S., for seed requirements, and for the loss due to wastage in storage. Allowing 5 per cent for seed and 15 per cent wastage in storage but adding a further 5 per cent for underrecording the production estimate is thus revised to a level of 200,000 tons per annum.

*Plantain.*—Unfortunately 1961 was a bad year for plantains owing to drought. Further, the main plantain harvest is between April and July so the period covered by the survey would not in any case represent average consumption. The figure given in column 1 may be an underestimate by some 40 to 50 per cent, but in addition an allowance for losses between production and "retail level" of about 20 per cent must be made as plantain is a perishable crop. By making these allowances a figure of 660,000 tons is obtained which is probably more realistic.

*Cocoyam.*—Cocoyam is an inferior food and the effect of this on the estimates for national production may counter the allowance of 10 to 15 per cent which would have to be made for wastage in storage. The production figure of 500,000 tons remains.

*Guinea corn and millet.*—The total production of these given in Table 3 is 130,000 tons. Both grains can be stored for some time without much deterioration so seasonal variation in consumption may not be large, but an allowance of 15 per cent must be made for loss in storage. This would then raise the production to 153,000 tons.

It is tempting to compare the agricultural production figures projected here

with those given in the Seven-Year Plan, and the comparison is given in Table 3. It must be noted, however, that the Plan figures are based largely on subjective estimates made earlier and projected to allow for certain desirable changes in the demand for local agricultural products and the consequent alteration in the structure of agriculture. These desired changes consist largely of shifts from the consumption of tubers to that of grains. Thus the figures in the Seven-Year Plan giving agricultural projections for 1963 may well overestimate grain production and probably underestimate tuber production and thus cannot be considered as statements of actual production.

The validity of using Ghana's Household Expenditure Survey as a basis of projecting agricultural production may well be questioned. Its value in this respect is limited, as stated earlier, by the shortness of the period during which recording took place, and, less seriously, by the restriction to income levels of up to £600 per annum. The pattern of consumption of local foodstuffs varies throughout Ghana depending on the crops which are grown in each area. Vegetation in Ghana varies from tropical forest to guinea savannah and even a semi-arid zone, and these different conditions give rise to different crop zones. A more accurate projection of food production could be made if the regional patterns of consumption were known, and this will be available when the H.E.S. data is processed in more detail.

In designing household expenditure surveys it is worthwhile considering the possible uses and interpretations to which the resulting data may be put. It is suggested here that, providing the survey is designed to cover the whole population by a sample randomly selected, and covering the major crop seasons at least for a sub-sample, its use as a basis for food production projections is probably valid. Its use in this respect is more valuable in newly developing countries than elsewhere, especially since household expenditure surveys are often the first statistical surveys to be carried out in such countries. They are often instigated for a variety of reasons, for instance to establish weighting systems for the compilation of price indices, or to assist in the assessment of real wages and the fixing of wage rates or, more ambitiously, for the calculation of gross domestic expenditure figures for use in national accounts.

The popularity of using household expenditure surveys for a wide variety of purposes probably stems from the fact that they are easier to organize than other surveys, for example industrial and agricultural censuses. Their results are most valid when they are based on a sample taken at random from a population census, but nevertheless useful results can be obtained from much smaller and more localized sampling frames. In Ghana, for example, expenditure surveys carried out in four urban areas between 1953 and 1956 amongst household groups where the wage earner earned up to £180 per annum and when the survey lasted 30 days only have been used to provide data which has had very wide interpretation even to their use as the basis of projecting national statistics of domestic expenditure in the calculation of Gross Domestic Product.

In addition to the household expenditure survey, however, various other things need to be known to make the projections of food crop production reasonably accurate. Statistics of imports and exports and field data on land use, crop seasons, location of agricultural production, and also information concerning wastage in

storage and marketing of agricultural products would help to make the data more accurate.

It is not suggested here that a household expenditure survey would form an alternative to a full countrywide census of agriculture; but such a census requires a great deal of organization, expense, and training of field survey staff, and a newly developing country may not be in a position to provide these for a number of years. Until this is possible, however, a sound household expenditure survey could be used to provide a more scientific approach to the problem of estimating agricultural production than the subjective estimates of agricultural officers. And even when an agricultural census is possible, household survey data would still provide a useful cross-check.

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