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MANAGING PLANNED AGRICULTURAL DEVELOPMENT

ANNEXES

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ANNEXES

ANNEX A

Divisions, Major Groups and Groups under Major Division 1. Agriculture, Hunting and Fishing of the UN ISIC

Division
.
. Major Group
. .
. . Group

11 Agriculture and Hunting

111 1110 Agricultural and livestock production

Growing of field crops, fruits, grapes, nuts, seeds, tree nurseries, except those of forest trees, bulbs, vegetables, flowers both in the open and under glass; tea, coffee, cocoa and rubber plantations; raising of livestock, poultry, rabbits, bees, fur-bearing or other animals; the production of milk, wool, fur, eggs, honey; and silk worm egg and coccoon raising. Also included are establishments primarily engaged in landscape gardening, e.g., the planting and care of lawns, flower gardens, shade and ornamental trees. The processing of agricultural products on farms and plantations is covered in this group if it is not feasible to report separately on the production of agricultural products, e.g., grapes, rubber, tea leaves, olive oil, nuts, milk, and the processing of these commodities.

112 1120 Agricultural services

Agricultural, animal husbandry and horticultural services on a fee or contract basis, such as harvesting, baling, threshing, husking and shelling; preparing of tobacco for auctioning; animal shearing; pest destroying and spraying; seeding and spraying by aircraft; pruning; picking of fruits and vegetables and packing on the farm and on the account of the producers elsewhere; and the operation of irrigation systems. The provision on a fee or contract basis, of agricultural equipment along with the services of drivers and other attendants of the equipment, is covered in this group, but the letting of agricultural equipment solely, is classified in major group 833 (Machinery rental and leasing). Veterinary services on a fee or contract basis are classified in group 9332 (Veterinary services); establishments primarily engaged in the transportation of farm products are classified in the appropriate group of division 71 (Transport and storage); and the operators of horse and dog racing stables are classified in group 9490 (Amusement and recreation services, not elsewhere classified).

ANNEX A (continued)

Division	Major Group	Group	
	113	1130	Hunting, trapping and game propagation
			Commercial hunting and trapping, and game propagation for commercial purposes other than for sport.
12			Forestry and Logging
	121	1210	Forestry
			The operation of timber tracts; forest tree nurseries; planting, replanting and conservation of forests; gathering of uncultivated materials, such as gums and resins, wild rubber, saps, barks, herbs, wild fruits and flowers, mosses, leaves, needles, reeds and roots; and the concentrating and distilling of sap and charcoal burning when carried on in the forest. Establishments primarily engaged in providing forestry services on a fee or contract basis are included in this group.
	122	1220	Logging
			Logging camps, logging contractors, and loggers primarily engaged in cutting timber and in producing rough, hewn, or riven forest or wood raw materials. Independent contractors engaged in trucking timber, but who perform no cutting operations are classified in group 7114 (Freight transport by road). However, the hauling and transportation of timber (trucking, rafting, etc.) up to the point of delivery to a transport or manufacturing establishment is included in this group. Logging and woods operation conducted in combination with saw mills, pulp mills, or other converting establishments which cannot be separately reported, are classified in group 3311 (Sawmills, planing and other wood mills), group 3411 (Manufacture of pulp, paper and paperboard) or group 3511 (Manufacture of basic industrial chemicals), respectively.
13			Fishing
	130	1301	Ocean and coastal fishing
			Commercial fishing in ocean, coastal, off-shore and estuary waters, including factory-type fishing

ANNEX A (continued)

Division	Major Group	Group	
	130	1301	vessels and fleets engaged in catching and processing. This consists of catching or taking fish, crustacea and molluscs; seal hunting; gathering of uncultivated sea weeds, sea shells, pearls, oysters, clams, lobsters, crabs, shellfish, sponges, turtles and other ocean and coastal water products. Factory-type vessels engaged in processing fish only, which can be treated as individual establishments, are classified in group 3114 (Processing of fish, crustacea and similar foods).
		1302	Fishing not elsewhere classified Commercial catching, taking and gathering of fish and uncultivated plant life in inland waters; operators of fish hatcheries and preserves; frog and goldfish farms; cultivated oyster beds and farms; and cultivated pearl and laver beds. Also included are fishery services on a fee or contract basis.

Source: United Nations. International Standard Industrial Classification of All Economic Activities. Statistical Papers, Series M, No. 4, Rev. 2. (New York), 1968.

ANNEX B

PROJECTING DEMAND FOR, AND SUPPLY OF, AGRICULTURAL PRODUCTS

A METHOLOGICAL RESUME

1. Demand Projections

Demand projections are crucial for the preparation of an agricultural plan, not only because demand influences agricultural output, and hence helps determine efficient allocation of scarce investment resources in less developed countries, but also because it affects internal and external trade, price stabilization schemes, national stock policies and development programs for industry and other sectors.

Since the variables which affect the demand for food may differ from those which affect the demand for agricultural raw materials, it is useful to separate the projections of demand for food from those for the demand for raw materials; and, for a similar reason, to project the estimated demand for food and raw materials for domestic consumption separately from the estimated demand for these commodities for exports. (4, p. 15)

a. Domestic Demand for Food

Many factors have an important influence on the growth of demand for agricultural commodities, including: (a) increases in population; (b) changes in the distribution of population, especially as a result of migration from rural to urban areas; (c) changes in family size, age and sex composition; (d) occupation; (e) growth in per capita incomes; (f) changes in the distribution of incomes; (g) price changes; (h) shifts in the pattern of consumption; (i) attempts to raise nutritional levels; (j) improved marketing arrangements; (k) social class; level of education; and climate. (119, p. M129; 120, pp. 35-36; and 121, p. 50)

The effect of each of these variables on future demand is likely to differ from the effects of the others. Some variables (like population growth and changes in income per head) generally have a direct and profound effect on the level and pattern of future demand; others (like changes in family composition and occupation) may have an indirect and lesser effect on future demand; (120, p. 35) some have a greater effect in the long run than in the short run (e.g., attempts to raise nutritional levels); some have a greater effect in the short run (e.g., seasonal price changes); while others make an impact in the short as well as in the long run (e.g., increases in population and prices).

Reliable data for measuring the impact of all major variables affecting future demand are almost never available. Moreover, some possibly important variables (such as social class and climate) are difficult to measure numerically and are therefore often ignored in estimating demand. (121, p. 50) Although the neglect of some factors may restrict the usefulness of demand projections, there is usually no practicable alternative to the preparation of projections on the basis of only two or three variables for which reasonably good data are obtainable. (119, p. M129) Even when data are available, it is advisable to first estimate the influence of what are believed to be the most important variables for determining demand before estimating the effect of the less important ones. (120, p. 35)

In projecting the domestic demand for food in low-income countries, the growth of population is generally considered to be the basic variable, since in many of these countries it is the high rate of increase in population which is the source of the greatest pressure on food supplies. And since an increase in national income is generally a major objective of development plans and programs, the second most important factor is usually considered to be the expected increase in per capita disposable incomes.

As long as data on the size of the population and its rate of increase are available, population presents no great problems since demand for food tends to expand by the same percentage as population.1/ But this is not true of income. As incomes rise, expenditures for food rise, but less than proportionately. However, since levels of consumption in less-developed countries are lower than in the more-developed countries, the rate at which food expenditures rise in poor countries when incomes increase is generally higher than in rich countries.

The rate at which expenditures change as incomes rise is measured by the income-elasticity of demand.2/ The general formula for calculating the income-elasticity of demand may be

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1/ I.e., on the assumption that there is no change in the age structure of the population. If the proportion of children to total population changes, the change may be accompanied by changes in the proportion of protein and calories consumed.

2/ The income-elasticity of demand is the proportional increase or decrease in demand (or consumption of, or expenditure) for a commodity or group of commodities in relation to a given proportional increase in income.

expressed as

$$E_i = \frac{\Delta Q}{Q} \div \frac{\Delta Y}{Y}, \text{ where}$$

E_i = the income elasticity

Q = the original quantity consumed

ΔQ = the change in the quantity consumed after the change in income

Y = the original per capita income

ΔY = the change in the level of per capita income (122, p. 13)

For example, if an increase of 10% in per capital income is accompanied by an increase of 8% in consumption, the coefficient of income elasticity is 0.8, thus

$$E_i = \frac{\Delta Q}{Q} \div \frac{\Delta Y}{Y}$$

$$= \frac{16}{200} \div \frac{10}{100}$$

$$0.8 = .80 \div .10$$

Studies have confirmed that in countries where the annual per capita income is about $100, an increase in income of one per cent will lead to an increase in demand for food of about 0.8 per cent or, to express the relationship as it commonly is, in countries with an annual per capital income of about $100, the income elasticity of demand coefficient for food is about 0.8 per cent.

(1) Estimating Domestic Demand

There are different ways in which the influence of income on consumption may be measured. Some methods of statistical estimation are simple, but the results obtained from them are not as useful for economic analysis as those obtained from more refined methods. But the more refined the function by which per capita income is related to per capita consumption, the more complex the computation is likely to be and the greater the data requirement. While the need for economic interpretation makes the more complex formulations preferable to the simple ones, paucity of good data may make it necessary for countries to settle for the simple techniques. Nevertheless, it is useful to know what the ideal models are, not only because they point up the crudity of existing techniques, but because they provide reference points for approximating the ideal in reality. (123, p. 1)

A simple way of estimating the impact of increased population and income on the demand for food is by the formula, $Y = a + bX$, where Y is the rate of increase in demand (or consumption of, or expenditures) for food, a is the rate of population growth, b is the coefficient of income elasticity of the demand for food, and X is the rate of growth in per capita incomes. (124, p. 47) If hypothetical numbers are substituted for the letters in the equation, it may be seen that the annual rate of increase in the demand for food, Y, would be 4 per cent if a were equal to 2.4 per cent, b to 0.8 and X to 2 per cent [$4 = 2.4 + (0.8 \times 2)$].

As long as b remains unchanged, and a and X continue to grow at the rates assumed in the formula, Y would increase at the compound rate of 4 per cent annually. At the end of five years this would yield an increase in the demand for food amounting to 21.7 percent. If the annual absolute demand for food is known at the start of the period (say that it is 60,000 kilograms), it thus becomes possible to project demand in absolute terms for the five-year period (60,000 x 21.7 = 13,020,000 kgs.).

The greater the disaggregation in estimating demand for food, the greater the possibility of error. Since agricultural foodstuffs are frequently substitutable for one another, it is difficult to project with reasonable accuracy the demand for one food in isolation. It is usually desirable, therefore, to first project demand for all food commodities, then for major commodity groups, e.g., cereals, and finally for the main individual foods, e.g., wheat. (120, p. 35) If this is done, it becomes easier to compare demand estimates for individual foods against demand estimates for broader groupings (e.g., corn in relation to cereals or all foods) and in relation to likely supply.

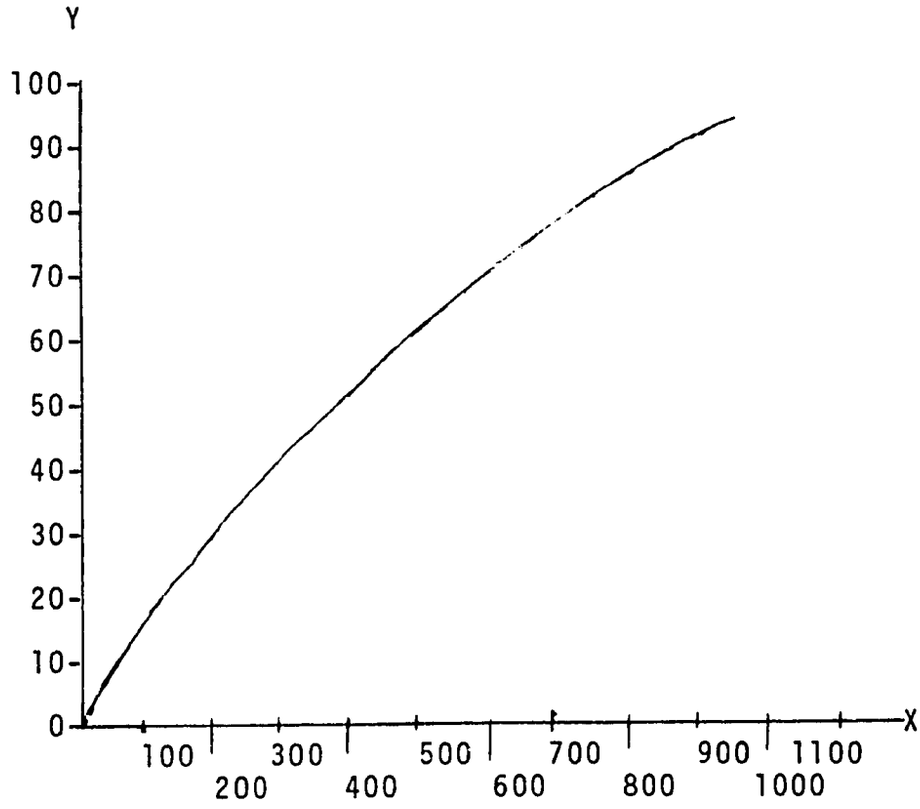
In the example given above, the income-elasticity of demand was assumed to be constant. While this may be true in the short run, over long periods of time, the income elasticity of demand is likely to change. A simple method of dealing with this problem is to divide the long-term projections into shorter sub-periods or different levels of income, for each of which a different elasticity is used. (125, p. 42) But if a long-term projection is made, functions which adequately reflect the changes in elasticity over time must be fitted to the data. The choice of the right function for projecting the total demand for food, groups of foods or a specific food is ultimately a matter of judgment based on information about the consumption habits of different parts of a population in the varying environments and at different income levels in a particular country. However, consumption in most developing countries tends to follow similar patterns. This makes it feasible to use the same set of functions to project demand in most of these countries.

Thus, $Y = a + bX$ is generally appropriate only for analyzing all expenditures for food over the very short run, since it assumes that regardless of the level of per capita income, demand or consumption will rise proportionally (e.g., a one-unit increase

in income will be accompanied by a half-unit increase in demand for, or consumption of, food). Graphically, with Y as the dependent, and X as the independent, variable, $Y = a + bX$ will be represented as a straight line, moving upward diagonally from left to right. This implies that the marginal demand is constant. Similar results, which give increments in demand in percentage rather than in absolute terms, may be obtained with the logarithmic function, $\text{Log}_e Y = a + b \text{ Log}_e X$ (where Y is per capita consumption, a is the rate of population growth, b is the income-elasticity coefficient and X is per capita income).1/ With this function, the demand curve may be represented as follows:

The Logarithmic Demand Function

FIGURE 1



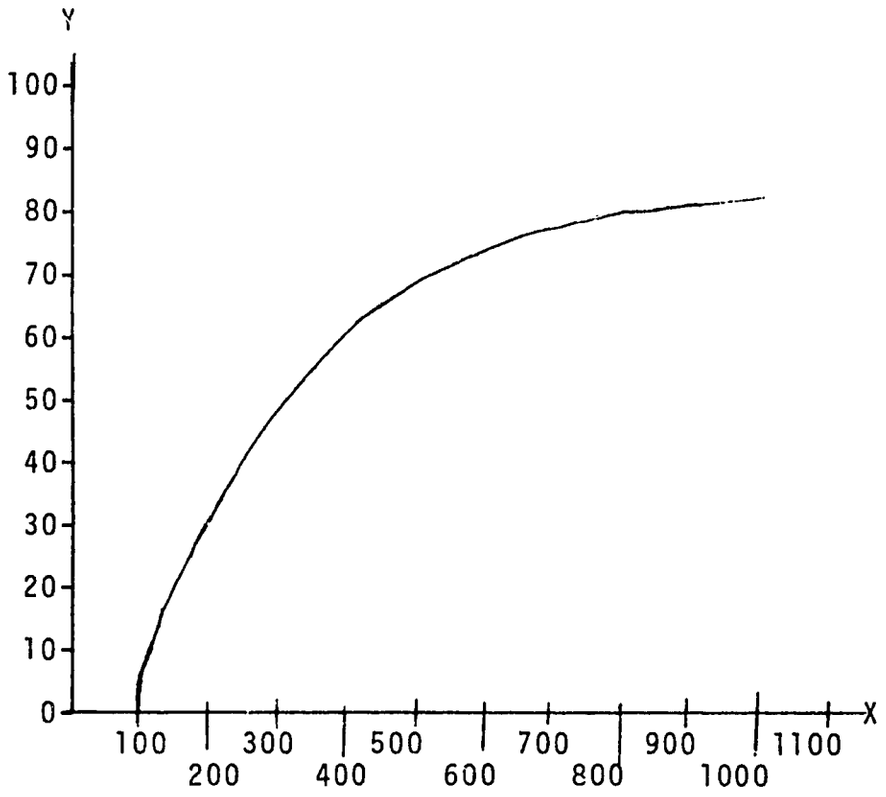
1/ As a general rule of thumb, growth in demand may be characterized as low when it is less than 3% per annum; moderate, when growth ranges from 3.0 to 4.5%; intermediate, when it ranges from 4.5 to 6.0%; and high when it is more than 6.0%.

Like $Y = a + bX$, $\text{Log}_e Y = a + b \text{ Log}_e X$ implies a constant income elasticity of demand, i.e., a constant ratio between the percentage increase in per capita demand and per capita income. Both functions are appropriate for analyzing expenditures on food when, as is true of the very poor, demand is likely to remain far below the saturation point during the projection period.

However, in most poor countries, the income-elasticity coefficient is likely to decline as consumption increases, long before the point of saturation or, in other words, that consumption increases at a declining rate as per capita income increases. In these circumstances, which apply to many individual foods, the simplest function used is the semi-logarithmic equation, $Y = a + b \text{ Log}_e X$. This function implies a decline in the absolute value of the income-elasticity coefficient represented by b/Y which is proportional to changes in the quantities of food consumed. This function may be represented graphically as follows:

The Semi-Logarithmic Demand Function

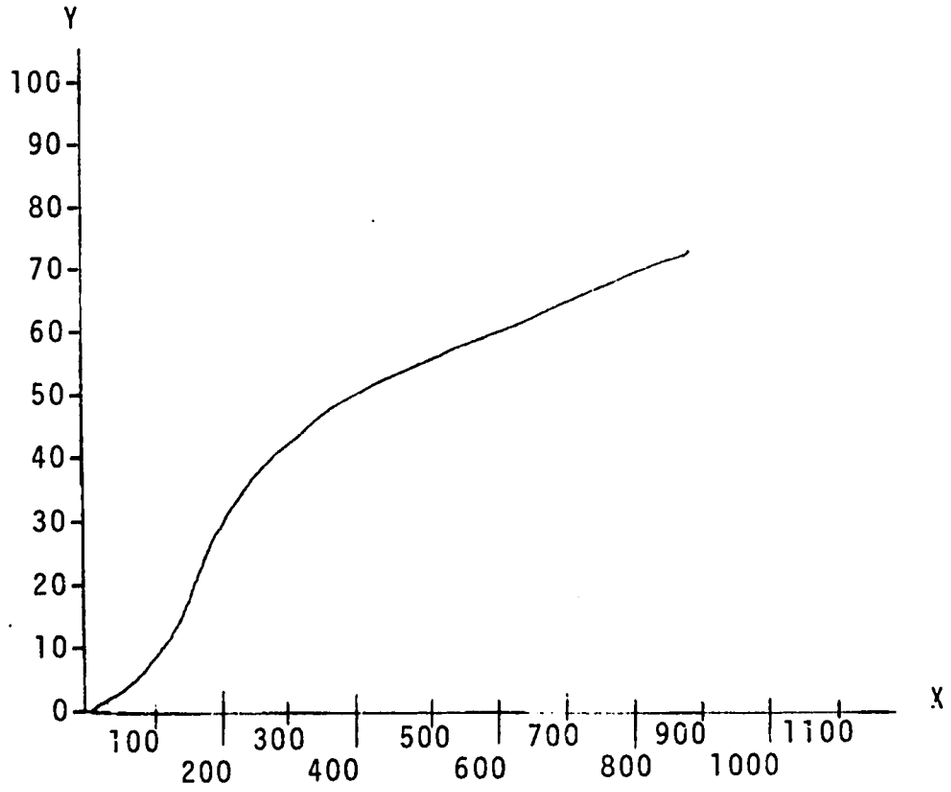
FIGURE 2



Where the total calorie intake is near the saturation point, or where consumption of certain foods (e.g., sugar, fats and oils), is already high and likely to be stabilized soon, it is more appropriate to use the log-inverse function $\text{Log}_e\ Y = a - b/X$, to analyze consumption or expenditures. This function implies a decline in the absolute value of the income-elasticity coefficient (represented by b/X) which is proportional to increases in per capita income. Graphically, $\text{Log}_e\ Y = a - b/X$ may be represented as follows:

The Log-Inverse Demand Function

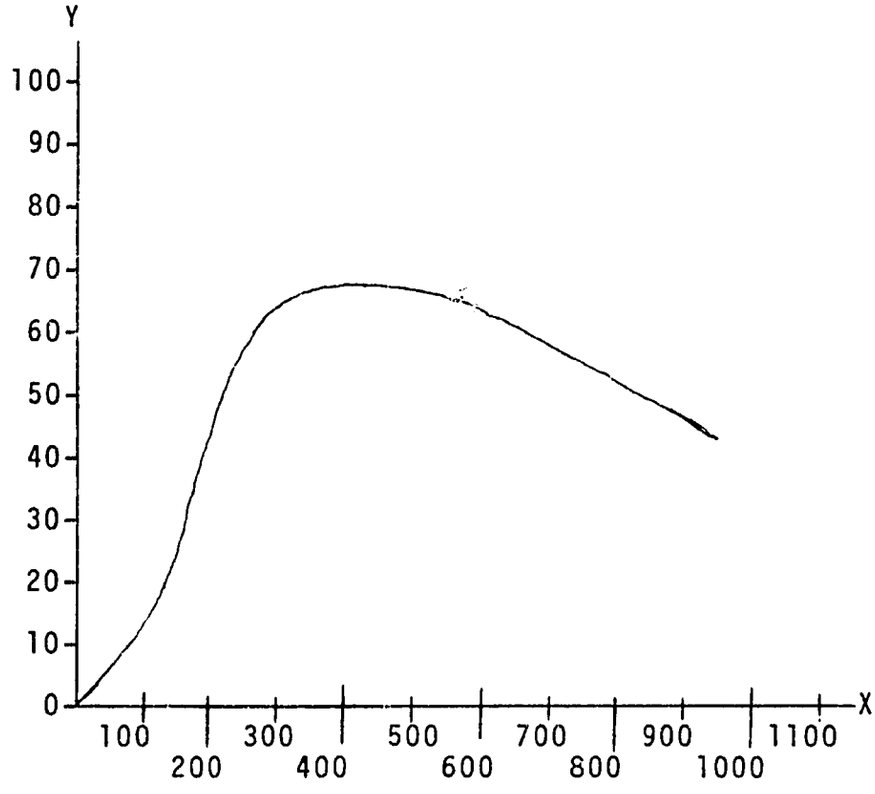
FIGURE 3



Finally, in poor countries where consumption of staple foods (e.g., cereals and starchy roots) starts at low levels when incomes are low, increases to a high point, and thereafter declines as incomes continue to rise, it is most appropriate to analyze food expenditures with the log-log-inverse function, $\text{Log}_e Y = a - b/X - c \log_e X$ (with the income-elasticity coefficient represented by $b-cX/X$). This function may be represented graphically as follows:

The Log-Log-Inverse Demand Function

FIGURE 4



(126, pp. 120-121; 120, pp. 38-41)

b. Constraints on the Approach

But for a number of reasons the method just outlined makes measurement of the demand-increasing effects of population and income growth seem easier than it is. Firstly, this is because it requires information for the year(s) selected as the base period for the projection which is not always available. If a year can be found which is "representative," in the sense that the influence of unusual factors is minimal, the base period may be one year. But if sharp and unusual fluctuations, which are characteristic of agriculture, make the choice of one year inadvisable, it is preferable to use statistical averages for two or three years to smooth out the fluctuations.

The statistics required for the base period include the size and composition of the population, its distribution between rural and urban areas, per capita income and consumption of food in rural and urban areas, income and price elasticities of demand for food, and trade data of agricultural food exports by volume and value. (120, p. 35) To the extent that these data are unavailable or unreliable, the projected percentage increases in demand, when converted into absolute figures, are undependable.

Secondly, the approach outlined ignores changes in real or relative prices which implies that supply will increase in proportion to demand. If prices are expected to increase because of short supplies or for other reasons, the stable price assumption must be modified and the demand estimates adjusted since price elasticities often have a significant effect on demand. However, the concept of price elasticity is complex and much less is known about it than about income elasticity.1/ Useful data on price elasticities of demand are rarely available in less-developed countries in the quantity and form required to permit reasonably precise adjustments to be made.2/ (14, pp. 562-63)

1/ The price elasticity of demand is the proportional decrease in demand for a commodity in relation to a given proportional increase in price or, conversely, the proportional increase in demand in relation to a given proportional decrease in its price. Thus, a price elasticity of demand of 0.5 means that a 1 per cent change in price will be associated with a change in demand in the opposite direction of 0.5 per cent. (127, p. 71)

2/ The computation of reliable price elasticities requires the comparison of quantity and price data obtained from monthly or quarterly consumption surveys over a period of years, surveys which most less-developed countries have not yet been able to carry out. (20, p. 15)

This shortcoming severely limits the reliability of demand projections in many countries. In the absence of dependable price elasticity data, planners usually assume for good theoretical reasons that prices will remain constant, even when they have reason to believe that prices will change over the period of the program.1/

This assumption may be justifiable when a commodity has no close substitutes, e.g., sugar, but it is not where, as in the case of many foods, e.g., corn, there are substitutes. In these cases, the price elasticity for a specific food is likely to be higher than the corresponding income elasticity. In fact, available information shows that for low-income countries, price elasticities are generally higher than income elasticities for food. (127, p. 72) Even when information on the price elasticity of demand is inadequate, therefore, there is something to be said for the planner to make the best possible estimates of price changes, where these seem likely to occur, and their probable effect on consumption.2/

A third limitation of the approach concerns the use of per capita income as a variable for gauging demand when it may not be suitable. This may be true, for example, in countries which curb consumption to increase investment. In these countries, a distinction needs to be made between per capita income and disposable per capita income, i.e., between the national income divided by the total population as against the actual amounts available per individual for expenditures for foodstuffs. (126, p. 117; 128, p. 45)

A country's per capita income may also be an inadequate measure of future demand where the distribution of marginal increases of national income is greatly skewed; and it may not reflect differences in urban and rural incomes or income variations among regions. Adjustments in the computation of future demand have to be made for these factors if there is reason to believe

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1/ E.g., cf. 14, p. 562; 15, p.i.; 30, p. 31; 31, p. 10. See also, 20, p. 15, which states that "When no other information is available, and when the possibilities of substitution are limited, the absolute value of the price elasticity of a food commodity at the retail level may be taken to be roughly equal to the value of the income elasticity."

2/ In Israel, demand projections for domestically-consumed commodities were made on the basis of prices equal to their marginal long-term costs of production in the marginal producing regions of the country. In the case of vegetables, an assumption was made that the average price in the preceding three years was equal to the marginal cost. (31, pp. 15-16)

that they will seriously affect the reliability of projections. Moreover, per capita income is difficult to estimate in the subsistence part of an economy because the value of home-produced food consumed on farms has to be taken into account as part of family income. Such estimates necessarily involve a considerable amount of subjective judgment by those who make them.

The consumption of income elasticities of demand is also subject to another, a fourth, constraint. As already indicated, in a developing country, income elasticities are not likely to remain constant for more than a few years. It is because the percentage spent on food begins to decline after a certain point as incomes rise (the widely accepted principle known as Engel's Law), that account must be taken of this tendency when coefficients of income elasticity of demand are calculated. Furthermore, the rate at which demand changes as incomes rise often varies for different foods and may vary between negative elasticities to elasticities of 1.7% and even higher.1/ (129, p. 40) Consequently, available information on the relationship between income and demand must be analyzed, and curves fitted to the data to derive appropriate income elasticity coefficients for different foods.

This is not an especially difficult task technically if the necessary data for different foods are available. But they rarely are. In a country where the data are lacking or inadequate, income elasticity coefficients based on the income-demand relationships in other countries (many of which have been estimated by the Food and Agriculture Organization of the United Nations and other agencies) have been used on the assumption that they approximate the income-demand relationships in the country where they are applied.

Since income elasticities for overall food requirements for a nation are averages, they may differ greatly from the average for specific population groups or foods.2/ Cultural, regional,

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1/ E.g., a study in Taiwan indicated that the effect of income on consumption varied greatly among commodities. Low and sometimes negative income elasticities were obtained for starchy foods, while high income elasticities were obtained for animal products. (130, p. 4) Calculations made in the FAO Indicative World Plan estimate that for all Asia by 1985, the demand for cereals will increase by 200, for milk by 230 per cent, and for meat, fish and eggs, as a group, by 250 per cent. (120, pp. 40-41) The FAO has compiled a useful set of elasticities for different kinds of foods in many countries and regions.

2/ E.g., the income elasticities of high-priced foods like meat and poultry are likely to be higher than those of lower-priced staples like rice, corn or root crops. Even the income elasticity of demand for the same food may be an average of income elasticities of different end-uses of the food. For example, in Taiwan it was determined that the demand elasticity for

climatic and psychological differences often account for considerable variations in consumption patterns and hence for differences in income elasticities. But the most striking contrast is the variation between rural and urban groups.1/

Not only do rural diets usually differ in some respects from urban diets,2/ but the income elasticity of the demand for food is likely to be different in rural as against urban communities. Thus, where the overall income elasticity of demand for food is 0.5 (the coefficient which international comparisons estimate prevails when annual per capita incomes are about $500), the average is more likely to be as high as 0.6 for the rural part of a country and as low as 0.3 for the urban part. (127, p. 39) Furthermore, the rate at which demand elasticities change in response to changes in income is likely to differ in the farm and non-farm (or rural and urban) sections of a country's population. (131, p. 343)

Since a shift of rural populations to cities is a characteristic of developing countries, projections based on a national income-elasticity of demand coefficients for food are likely to be less precise than projections of demand obtained from the consolidation of rural and urban estimates of demand based on separate rural and urban (or farm and non-farm) demand coefficients.3/

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the direct use of soybeans and peanuts was 0.60, while for oil processing, the elasticities were 1.16 for soybeans and 0.28 for peanuts. (130, pp. 3-4) With variations of these magnitudes, it should be evident that really accurate demand projections may require differentiation of demand in great detail even for the same food.

1/ In general, in the poor countries rural diets rely more on cereals or root crops than urban diets do, while urban diets rely more on fruit and meat and other animal products than rural diets do.

2/ A National Family Survey made in Venezuela in 1965 revealed that the rural population tended to consume more of the less-processed commodities, while the urban population consumed more processed commodities. The urban population also tended to consume somewhat larger quantities of food than the rural population. (132, p. 7)

3/ Sometimes, the population may be divided into more than two groups. For example, in Venezuela, the sample of the urban population used was divided into persons living in towns of 5,000 to 25,000 inhabitants (intermediate urban) and those living in

Calculation of separate rural and urban income-elasticity coefficients not only requires data for each group,1/ but also estimates of population changes in urban and rural areas during the period of the projection.2/

Other problems arise in the calculation of coefficients of income elasticity of demand. As already indicated, as population increases, demand tends to expand by the same percentage for each kind of food. In contrast, as per capita incomes increase, demand for some commodities will rise more rapidly than for others and may even decline for a few. (127, p. 65) This change in the structure of demand as incomes rise is important for the planning of production since resource requirements may vary for the production of different crops.3/ (127, p. 65) Because of this, the

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towns of more than 25,000 inhabitants. Those living in towns of less than 5,000 inhabitants were considered to represent the rural population. (132, p. 5) In calculating price elasticities of demand for rural or farm population, it is desirable to distinguish between the elasticities for home-produced and purchased foods, since the two are likely to differ.

1/ Time series data for either rural home consumption or marketed surpluses at different income levels are important for this purpose because the extent of rural demand determines the supply marketed. Experience shows that as incomes of farmers rise in poor countries, they consume more of the food they grow because they can afford this when the financial return is greater from the quantities they sell. If the amount grown does not increase at least as much as the additional food consumed, the marketed surplus declines. (20, p. 14)

2/ However, in some countries (particularly in Africa), where the availability of land is not a great constraint, demand arising from population increases in subsistence farming areas is usually met by expansion of subsistence cropping, supplemented by hunting and fishing. If no attempt is to be made to raise the existing quantitative and qualitative dietary levels in the subsistence areas, demand projections are simplified since they are largely reduced to estimation of urban demand.

3/ E.g., some crops may require irrigation while others may not.

calculation of income elasticities of demand should go beyond the determination of demand elasticities for the aggregate of food products and include some income coefficients for at least each of the more important foods consumed.

The calculation of income elasticities in less-developed countries involves a certain amount of compromise. The ideal way to estimate income elasticities is through the accumulation of time series which relate changes in income to changes in total consumption of different foods over a period of several years. However, the scarcity of comparable data on incomes and consumption for a sufficiently long time and other problems1/ make it very difficult to produce reliable income-elasticity of demand coefficients by time series analysis in most low-income countries. (20, p. 14; 127, p. 60)

Income elasticities are sometimes derived from current income and consumption data obtained from sample household surveys of consumer income and expenditures on various foods. The data derived from a sample survey are used to calculate income-elasticity coefficients on the assumption, which cannot be proved of course, that if income levels increase, consumers at low-income levels will alter their consumption patterns to conform to that of consumers at higher income levels, as revealed in the consumer expenditure survey. (127, pp. 60-61)

A good sample survey covers consumer expenditures for food products at different income levels, and provides data on the consumption of individual foods and total consumption of foodstuffs at different income levels in a fixed period. If the sample is well-prepared, it will be representative of the whole population in a country and distinguish among families of different size (with or without children), since the consumption patterns of families of different sizes differ, especially at upper income levels. (133, p. 123) In large countries with considerable regional differences in diets, the sample survey must be large enough to take these, as well as rural and urban, differences into account. If there are seasonal variations in consumption, surveys must be made at different seasons to take account of variations. And since tastes for food change, especially at upper income levels, sample surveys should be taken annually. They rarely are, however, and may be out-of-date when the data obtained from them are used as a basis for making projections.2/

1/ For example, the problem of separating changes in consumption induced by factors other than income (e.g., price changes) from those induced by changes in income.

2/ For example, in Iran, the survey data on which income elasticity of demand coefficients were computed were collected in 1958 for the agricultural program included in the Plan for 1962/63-1966/67. (30, p. 33)

Often, the use of household survey data is restricted because they were collected on the basis of outdated theoretical frameworks without a clear notion of the use to which the data would be put. Many surveys in less-developed countries do not include information on current income and the data furnished are frequently unsuitable for use in commodity projections. (134, p. 46)

For most developing countries, annual budget expenditure series do not exist or, if they do, cover too short a time period or are unreliable. (134, p. 12) Because of this and the dim prospects in the short-run for getting periodic budget surveys going in many developing countries, cruder methods of estimating demand elasticities have often been used. (134, pp. 51-52)

Since a major use of income elasticities of demand is to help determine the volume of production required for each kind of food, it is desirable to compute income-elasticity of demand coefficients on the basis of the quantity of each commodity consumed rather than the expenditures for it. An income-elasticity of demand coefficient based on expenditures is second-best because it may include increasing costs of processing or other services associated with the food, as well as changes in the quantity of the food consumed.1/ If the elasticities are calculated for classes of foods, e.g., cereals, the expenditure elasticity conceal shifts in consumption from one cereal to another (e.g., from less expensive millet to more expensive wheat).

There may be significant differences between elasticities computed on the basis of quantities consumed as opposed to elasticities calculated on the basis of expenditures for a food or group of foods. For example, if the cost of processing or market services, or both, increases sufficiently, expenditures for the individual food or group of foods concerned may rise while the quantities consumed may fall. In these circumstances, the expenditures elasticity would show up as positive while the quantity elasticity may show up as negative. (122, pp. 13-14)

Nevertheless, in practice, income-elasticity of demand coefficients are often computed on the basis of expenditures for food rather than on the quantity consumed because it is easier to do it that way. The expenditures are then converted into physical quantities by the use of coefficients which relate prices to quantities. Despite the limitation of demand-elasticity

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1/ Another reason for the preference for quantity instead of expenditure demand-elasticity coefficients is that it is sometimes desirable to determine the level of nutrition in poor countries. For this purpose, there is need to convert the quantity of different foods consumed into the major nutrients to compare these with nutritional requirement standards. (131, p. 328)

coefficients based on expenditures, they are accepted as reasonably good approximations of the physical amounts of food consumed in low-income countries because in these countries, in contrast to high-income countries, increased expenditures for food are presumed to be made largely for unprocessed farm produce with a minimum of additional costs for other marketing services. (127, pp. 61-62) In fact, however, this is more likely to be true in rural than in urban areas. (132, p. 7)

Where consumer expenditures are for foods which include appreciable costs for processing, transport or other services, the cost of these "value added" services must be eliminated to determine the final demand for the commodity as produced on the farm. For example, expenditures for bread must be adjusted by an appropriate factor to determine the cost of the wheat used to make the bread. It then becomes possible to convert the cost of the wheat into physical quantities.

Where reliable data on income elasticities are not available for a country, income elasticities of demand of other nations have sometimes been substituted on the assumption that tastes for food at different income levels are likely to be similar from one country to another.1/ While this assumption is a dubious one for specific foods, especially in the short-run, studies indicate that for broad classes of foods, and for long periods,2/ income-elasticity of demand coefficients are surprisingly similar among countries. (127, p. 62)

Often, income elasticity of demand coefficients are calculated by pooling time-series and cross-section data. Thus, in some countries, where partial time-series data are available, they may be combined with data obtained from a sample survey of consumer expenditures, or each set of data may be projected separately and compared. The results are analyzed and the most plausible projections are selected;3/ in other countries, data from a survey

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1/ The Food and Agriculture Organization has calculated coefficients of income elasticity of demand for groups of foods in various regions of the world in Agricultural Commodities -- Projections for 1970. FAO Commodity Review Special Supplement. Rome, 1962.

2/ For long periods because there are likely to be greater differences among countries in the short run than in the long run. Over longer periods of time, income elasticities are likely to be generally similar in most developing countries.

3/ This was done in Venezuela. (132, p. 5)

may be combined with data obtained from other countries; and in yet other countries time series are combined with international comparisons.1/ In short, what is actually done to obtain income-elasticity of demand coefficients must be determined by the data available in a country and by the prowess of its planners.

c. Domestic Demand for Agricultural Raw Materials

Projections of demand for agricultural raw materials must take account of programs of industrial development wherever these are available. But where information about these programs is unobtainable, as is true of many low-income countries (and there is an absence of other reliable information to guide agricultural planners), the methods employed to project domestic demand for agricultural raw materials usually are like those used to project domestic demand for processed foods.2/

The projection of demand for some agricultural raw materials encounters special problems. The variables involved may be different from those which affect the demand for processed foods. For example, the demand for wood pulp or other agricultural raw materials used in the manufacture of "cultural" paper products like newsprint and writing paper depends primarily on the degree of literacy in a country rather than on population or income; while the demand for wood used as fuel depends on climate.

Furthermore, some agricultural raw materials, including wood, rubber, jute and textile fibers, have several end-uses. This may complicate the task of projecting demand for them. The task requires, among other things, an assessment of the projected demand for each of the major end-uses and the calculation of a conversion factor for each end-use to translate the final demand for the end-use product into the intermeditate demand for the agricultural raw material.3/ (20, p. 17)

1/ This was done by the Food and Agriculture Organization of the United Nations. (126, p. 121)

2/ I.e., a projection is made of the processed food and then converted into the original form equivalent of the food by use of an estimated coefficient which represents the proportion of the original food in the processed one. (Cf. 14, p. 564; 135, p. 49)

3/ A similar problem is encountered for some foods, e.g., milk, but the problem is more commonly associated with raw materials.

Projection of demand for major end-use products usually requires special investigations to obtain data on income elasticity of demand plus other factors affecting the demand for each product, as well as information on population growth and per capita incomes. These investigations must also assess the possibilities of substitution of other commodities for the raw material concerned (e.g., synthetic for natural rubber), the likely impact which technological progress may make to reduce the input of the raw material,1/ as well as the influence which a change in relative prices may have on the demand for the raw material and the end-product.

However desirable they may be, such investigations require an intimate knowledge of each end-use product. This has often proved to be beyond the capacity of agricultural planners in developing countries. In practice, therefore, simpler methods of projecting demand for agricultural raw materials in low-income countries have been used. These projections have usually been based on an extrapolation of historical consumption of the raw material related to expected increases in income, perhaps with one or two additional variables which are considered important in the country concerned.

d. Foreign Demand for Agricultural Commodities

Methods of projecting exports often differ according to the nature of the commodity, and the provisions under which it is exported. Where exports of a commodity are determined by international agreement, the agreement becomes the basis for the projections.2/ Agricultural exports are sometimes estimated as a residual after subtracting projected domestic demand for agricultural commodities from projected production. But since this approach ignores world demand, it is not to be recommended, especially in countries where the share of agricultural exports in the gross national product is large. It is preferable to project exports of each major commodity independently of domestic production and demand, and balance exports with production and demand afterwards. (120, p. 44) If a commodity has a predominant export market, a two-step procedure is followed. First, a projection is made of total demand for the commodity in the major importing country.3/ Second, this quantity is multiplied by the exporting country's share as derived from historical data. If a commodity is exported to many countries, none of which accounts for a preponderant quantity of the total import volume, the exportable quantity may be derived by fitting a trend line to time series data and extrapolated into the future.4/ But is is not

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1/ Cf. 120, p. 43 for a method used to estimate the intermediate domestic demand for agricultural raw materials.

2/ This was the case with sugar in Taiwan. (130, p. 28)

3/ As was true for bananas in Taiwan. (130, p. 28)

4/ This approach was followed in a study for Taiwan. (130, p. 28)

enough to estimate future exports solely by the extrapolation of past export trends because this does not take account of the factors which determine foreign demand.

Projection of the export prospects for each major agricultural commodity should be made in two stages. The first stage requires an analysis of the likely world demand for the commodity which takes account of likely changes in consumption in importing countries, the production outlook in major exporting and importing countries (including the possibility that importing countries will increase their production of the commodity), the effect of synthetic and other substitutes,1/ and possible input-reductions of the commodity in processing or manufacture as a result of technological progress. (120, p. 44) Protectionist and trade preference policies of importing countries, unified agricultural and other policies of common markets, (e.g., the European Economic Community), international commodity agreements, as well as the effect on foreign demand brought about by likely shifts in relative prices of agricultural commodities, must also be evaluated. While some less developed countries have the commodity specialists required to follow world market trends for specific agricultural commodities, most countries must rely on forecasts of world demand and supply of each commodity prepared by international agencies like the FAO, the OECD or UNCTAD or the World Bank.2/

Within the framework of these forecasts agricultural planners must, in the second stage, make an informed judgment of the likely share of the world market which their country is likely to obtain, taking into account recent trends in the country's share of the market. (14, p. 564; 126, p. 132) In projecting demand for a country's traditional agricultural exports, an analysis

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1/ E.g., the effect of demand for synthetic rubber on natural rubber; the growing use of inedible animal fats in the manufacture of soap, and of lard and marine oils in the manufacture of margarine on the demand for vegetable oils; the substitution of synthetics in the manufacture of shoes on the demand for hides, skins and leather; and the increasing use of synthetic fibers on the demand for cotton and wool.

2/ Some methods and techniques for making projections of exports in advanced countries are discussed in detail in 172. See, also, 136, pp. 120-149 for a well-detailed explanation of methods used in projecting exports of countries in the Overseas Sterling Area in 1975. The World Bank has a Commodity and Export Projections Division in its Economic Analysis and Projections Department which makes continuing supply and demand projections for major agricultural commodities. These projections are published from time to time.

must be made of the past trend and direction of each major commodity exported as a guide for judging its prospects in the future. This requires for each major country likely to import the commodity, analysis of the factors determining access to, and the probable size of, the market, including the importing country's economic prospects, trends in its population and per capita income growth, likely changes in the income elasticity of demand for the imported commodity, competition likely to be encountered from substitutes, as well as likely costs of production and transportation to markets as compared to those of competitor countries. The analysis must also take account of special factors affecting each commodity, including bilateral trade agreements between the exporting and importing countries.

Careful attention should also be given to possibilities of increasing exports through reductions in costs, (137, p. 28) improvements in quality or better handling and marketing procedures. It should also be determined whether it is possible to expand seasonal or uncertain export markets into year-round or more stable and reliable markets.1/

But export demand projections must go beyond mere extrapolation of past exports of traditional products to established markets within the framework of global commodity forecasts prepared by international agencies. Efforts must be made to stimulate exports of non-traditional commodities. This almost invariably means that research must precede production. The experience of countries which have had great success in promoting non-traditional agricultural exports reveals that the process by which such exports are increased usually begins with careful investigation and analysis of potential markets to determine the extent and nature of existing or latent demand for agricultural commodities in foreign markets, followed by the establishment of producing and marketing systems which insure that the right varieties of the selected commodities are produced, sorted, packed and shipped and that quality and costs are controlled to meet the standards of the foreign markets.

The dramatic increases in coffee and tea exports from African countries in the last 20 years suggest that considerable potentialities exist for increasing agricultural exports from less-developed countries. (137, p. 29) This is also true of Thailand's increased maize exports to Japan. Israel, Pakistan and Taiwan

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1/ For example, by substituting canned, frozen or dried vegetables, fruits or other agricultural products for fresh varieties usually exported. It should be noted, however, that in some countries, domestic conditions make it unfeasible or impossible to increase production for export, even if demand exists. In this case, demand is determined by production. This was the case with citrus fruits and avocados in the case of Israel's agricultural plan. (31, p. 12)

provide additional examples of countries which successfully increased foreign exchange earnings by stimulating exports of non-traditional agricultural commodities and by opening up new foreign markets.1/ The experience of these countries, and others, underscores the fact that, from the planner's point of view, innovative and dynamic assessment of export opportunities is a prerequisite for adequate projections of foreign demand. (14, p. 564) While those who conduct a stocktaking and diagnostic survey cannot themselves carry out the investigations required to identify specific commodities and markets, they should endeavor to indicate which markets are likely to be able to absorb commodities produced by the country for which the survey is being conducted.

For a country whose volume of exports of a commodity is too small to greatly affect world supplies and prices, little consideration needs to be given to the possible effect of an increase in its exports on world prices. But for countries which are major suppliers of a commodity on the world market, a possible increase in exports requires evaluation. For these countries, studies should also be made on the possible short- and long-term impact of increased exports on world market prices, as well as the possibility of reducing costs as a result of increased production of the commodity to meet higher export demand. (20, p. 20)

e. Demand Projections: Conclusion

Figure 5 shows the various components which go to make up demand (consumption of, or expenditures) for agricultural commodities. As the Chart indicates, the sum of domestic and export demand of an agricultural commodity for human consumption and industrial use

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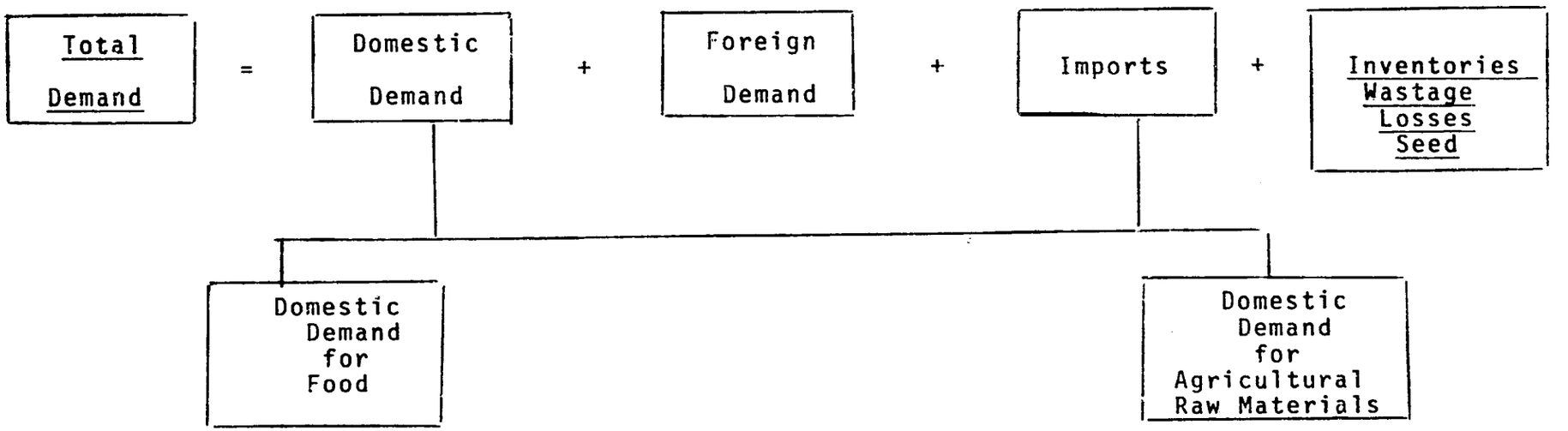
1/ Between 1964/65 and 1971/72, Israel was able to increase its exports of vegetables and strawberries from 1.3 thousand tons to 51.8 thousand tons and flowers from $0.2 million to $8.5 million. Israel has not only made extensive surveys of demand in European and other markets, but has set up marketing boards to supervise production and marketing activities of major crops. Modern technology has been introduced in production, sorting and packing activities, much attention has been given to quality control, and packing and shipping costs have been kept low to insure that Israeli agricultural exports are competitive in foreign markets. In 1952, Taiwan's major agricultural exports were limited to two commodities, sugar and rice. By 1968, 90% of Taiwan's agricultural exports were composed of canned mushrooms, pineapples, asparagus, tea, citronella oil, and fresh fruits and vegetables. (130, p.1) To achieve these results, Taiwan sent market intelligence teams abroad in the early 1960's in search of new agricultural export markets. These teams brought back information which was used to guide farmers, farm associations and processors to produce canned pineapple in the Federal Republic of Germany and the United States, bananas in Japan, etc., which conformed to consumers' tastes in these countries. (138, p. 39)

FIGURE 5

COMPONENTS OF DEMAND FOR AGRICULTURAL COMMODITIES



is less than the total requirements for the commodity. The total of domestic and export demand must be adjusted to allow for the maintenance of working stocks or inventories which are likely to be held by private traders and government,1/ wastage, losses in processing, feeding of livestock, and need for seed. Few less-developed countries have reliable estimates of the quantities required for each of these purposes. Since adequate statistics are often unavailable, allowance is usually made for these factors by a pro-rata percentage adjustment which is equal to the total change projected in demand for domestic human consumption, industrial use and exports.2/ (20, p. 20)

In countries with much reliable statistical data and a supply of trained technicians, it is possible to use advanced techniques with several equations to construct demand projections. It has also been possible to carry out sophisticated projections of demand once or twice in some less-developed countries with the aid of foreign technical assistance.3/ But, for most less-developed countries, there is little alternative to the use of the simplest projection methods, utilizing linear equations of two or three variables. (139, p. 20)

In summary, it may be useful to visualize the projection of demand for agricultural commodities in simple terms for a program period, for, say, five years, as a series of procedures to be carried out in three stages:4/

Stage One: The projection of domestic per capita demand for food on the assumption of constant relative prices.

(a) Calculation of the urban and rural income elasticities of demand for each food, and their combination into weighted average income elasticities for the population as a whole. If the income-elasticity coefficients have been calculated on the basis of values, they need to be converted into quantity elasticities. Let us suppose that as a result of the above calculations, the

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1/ Cf. 20, pp. 18 and 19 for a discussion of the considerations involved in estimating stocks as reserves.

2/ Thus, if demand for domestic human consumption and industrial use, plus exports, increases by 15 per cent during a period, a similar increase in requirements is included for the other factors.

3/ For example, see 132 for such a projection in Venezuela.

4/ In practice, one stage is likely to overlap with others.

quantity of income elasticity of demand for wheat has been estimated at 0.5.

(b) Estimation of the expected increase in disposable per capita income by the last year of the program period. Let us assume this is estimated at 10 per cent.

(c) Multiplication of the income elasticity of demand for each food by the expected increase in per capita income to determine the projected percentage per capita increase in the consumption of food by the end of the program period. If the figures in (a) and (b) are used, the calculation would be 0.5 x 10.0 = 5 per cent.

(d) Adjustment of the estimated increase in demand to take account of the probable effect of pertinent factors not previously included in the demand projections, such as expected changes in the age structure of the population or expected shifts in the distribution of per capita income.1/ For example, these factors might require a 1 per cent upward adjustment of the per capita increase of the demand for wheat from 5 per cent to 6 per cent in the 5-year period of the program.

(e) Estimation of per capita annual consumption in the base period for each major agricultural food (converted where processed into the final demand for the farm product) and its projection to the last year of the program period.2/ For example, if the per capita annual consumption of wheat in the base period was 100 lbs., the projected per capita demand for the last year of the program period would be increased by 6 per cent to 106 lbs.,3/ or an annual average increase of 1 2 per cent in the 5-year program period.

1/ Thus, if account is not taken of expected egalitarian changes in income distribution, projections may underestimate the demand for foodstuffs in general and specific foods in particular.

2/ The per capita annual consumption for each major agricultural food in the base period is obtained by dividing the amount of the population into the final consumption of each product as obtained from the following relationship: Final Consumption = (Production + Imports) - (Intermediate Uses + Capital formation + Exports + Increases in Stocks). (140, p. 142)

3/ If consumption is required in terms of market prices, it is obtained by multiplying the quantity consumed by the retail prices of each commodity in the base period or in some other appropriate period. (140, p. 142)

Stage Two: The projection of total domestic and foreign demand for all agricultural commodities on the assumption of constant relative prices.

(a) The total domestic demand for each food for the last year of the program is determined by multiplying the projected per capita demand for each food by the estimated population in that year. For example, if population during the program period is estimated to increase by 15 per cent from 1 million persons to 1.15 million persons, the total estimated demand for wheat would increase from 100 million pounds in the base year (1 million persons x 100 lbs.) to 121.9 million pounds (1.15 million persons x 106 lbs.) in the last year of the program period, or an increase of 4.1 per cent in the 5-year period. By converting the expected percentage increase in demand to the corresponding quantity, it is possible to determine the demand for each food, assuming no substitutions occur, for any year of the program period.

(b) The method of which the total domestic demand for agricultural raw materials is determined will depend on whether planners obtain their estimates from projections based largely on population growth and income elasticities or from the end-use approach. If projections are obtained by the first method, the procedures used will be like those outlined above for processed foods; if by the second method, the procedures may be quite complex, involving the use of a combination of correlation models, time-trend extensions and special investigations. The projection of demand for a raw material by the end-use approach includes the following steps:

i. Definition of the different end-uses of the commodity.
ii. Calculation of the demand for each end-product.
iii. Determination of the raw-material input coefficient for each end-product with account taken for likely technological improvements which affect the input.
iv. Multiplication of these coefficients by the output of each end-product.
v. Adjustment of the results to allow for possible synthetic or other substitutes which compete with the raw material. 1/ (120, p. 43)

(c) Projection of the future export demand for agricultural foodstuffs and raw materials basically involves analyses of a country's specific export prospects juxtaposed with the general

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1/ See 120, p. 43, for a hypothetical projection of the demand for jute which employs the end-use approach.

outlook for the output of, and demand for, individual commodities in international markets. For most low-income countries, these analyses require data produced by international organizations as a basis for projecting external demand.

Stage Three: Projected demand for each agricultural commodity on the assumption of likely changes in relative prices.

If there is reason to expect a change in relative prices, an estimate of the increase in prices should be made1/ and the demand projection for each commodity adjusted to take account of the expected price changes. This may be done by constructing a quantity-price demand schedule on the basis of the demand previously projected at constant prices and the estimated value of the price elasticity of demand for each commodity.

2. Projections of Output and Supply

a. The Effect of Price on Output and Supply

Besides affecting demand, price changes influence production, and supply. Price changes affect output and supply indirectly by encouraging or discouraging the introduction of inputs and farming practices which make a direct contribution to output and productivity.2/ (120, p. 46) Farmers generally have considerable latitude to substitute production of one commodity for another. Where conditions permit, therefore, a change in the price of one commodity relative to others will usually stimulate farmers to adjust output positively in response to the change in relative prices.3/ The response may take the form of changes in acreage under that commodity, as well as changes in the amount of inputs employed in its production.

1/ No attempt is made here to indicate what techniques are to be employed for making these estimates which, experience shows, may vary from crude, ad hoc methods to such sophisticated methods as sensitivity analysis involving many commodities.

2/ However, to the extent that price changes determine the extent to which quantities produced by farm families are retained for their own consumption, price changes affect supply directly.

3/ The problem of response to price changes is complex, not only because farmers do not react simply to the price of one commodity but to the relative prices of different commodities; but also because they react to their expectations concerning future price levels and not only to current price situations. Moreover, they are influenced by profitability more than by price. (141, p. 103)

However, farmers' responses to price changes are sometimes inhibited by the conditions under which they operate. This is true, for example, when heavy overhead investments are useable only to produce one commodity. Thus, farmers find it harder to respond to price changes when they grow tree crops rather than annual crops, at least in the short run.1/ Farmers also have fewer choices for changing crops on rain-fed than on irrigated lands. And in subsistence farming areas, where marketable food surpluses are generally marginal, farmers' choices for producing food crops may be almost independent of relative price levels and changes. (142, p. 94) Because farmers' responses to price changes are influenced by many factors, some of which may have a stronger influence than the price factor, it is difficult to predict the extent and timing of output changes induced by a specific price change.

This is so even when farmers are free to make choices about what they produce. In part, it is because output is affected by uncontrollable, and often unpredictable, exogenous factors such as crop diseases and weather (especially on unirrigated lands);2/ in part, because output often depends on decisions of many small- and medium-sized producers who use varying inputs and technologies; (120, p. 46) and, in part, because the level of production is determined not only by inputs and technology, but by institutional and human factors whose effects can only be assessed imprecisely.3/ (127, p. 385; 145, p. 89)

1/ In fact, one writer suggests that the "short-term supply (price) elasticity for tropical perennial crops on plantations seems to be essentially zero, while for small holders it is positive, but relatively low (say, around 0.2). (143, p. 202) A group of investigators in Nigeria concluded that for cocoa, oil palm and rubber, "little disinvestment should be expected in response to adverse prices. This is what has been observed. Conversely, little investment response should be expected from modest increases in prices though price increases large enough to cover the acquisition cost of modern planting materials should be expected to increase investment and, with maturity, output." (144, p. 42)

2/ In traditional and subsistence farming areas, climate is the most important determinant of output. In Northern Nigeria, annual variations up to 40 per cent in the production of groundnuts and cotton have been attributed mostly to climatic factors. (142, p. 93)

3/ Studies indicate that only a portion of past increases in output can be attributed to increased use of land, labor and capital, leaving a large residual that has been ascribed to other factors, such as increased productivity. (14, p. 570) Unfortunately, it is difficult to calculate in advance how much productivity can be increased through such inputs as better research, improved extension work, more credit to farmers, better marketing procedures or pest control activities. (102, p. 177)

Apart from the inherent difficulty of predicting the future level of prices,1/ these factors make it hard to forecast the impact of specific price changes on output and market supply. Another factor which makes it hard to project with assurance the effect of a given price change on agricultural production and supply is the difficulty of estimating the time lag between a change in price and farmers' adjustment to it. Uncertainties about the duration of time lags are also a problem for estimating the introduction of new technology.2/ For all these reasons, projections of output and supply are technically much more difficult to make than projections of demand.3/

b. Projecting Production

Output projections involve forecasting (a) the area planted to a crop and (b) the average yield per unit of land.4/ In Latin America and Africa, expansion of cropped area has been more important than increases in yield in the growth of output; but in Asia, yield increases have been more important. Although much unused cultivable land remains in Latin America and Africa, much of it can be brought into production only by improvements in tenure arrangements and agrarian reform in the broadest sense, i.e., introduction of price and tax policies, and government services which stimulate agricultural growth. Because these changes

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1/ This is the problem even in the United States. The Washington Post of August 19, 1973 quotes Mr. Gary Seevers, a member of that country's Council of Economic Advisers, as saying that food prices were going to be higher than they were in the past, "Perhaps substantially higher. But how much higher I don't know."

2/ For example, a study in Mysore, India, showed that the average length of time which elapsed between the time farmers first became aware of an innovation and when they adopted it was over seven years for improved seed, a little over five years for chemical fertilizers and four years for the adoption of an improved method of paddy cultivation.

3/ The difficulties of projecting output and supply are much more acute for annual crops than for perennial crops because producers usually find it easier to shift out of and into annual crops than perennial crops. The long period over which perennial crops produce makes it easier to project their output, although the fact that they often take a number of years to reach full production makes it necessary to know the age of the trees covered by the projection. Despite this limitation, output projections for perennial crops like tea, rubber, coconuts and coffee are generally easier to make than for annual crops because there is little likelihood of a shift from one crop to another, a major source of uncertainty in projecting output. (142, p. 90)

4/ If measured in terms of value, output projections have to take account of shifts to higher- or lower-value crops.

are likely to be slow in coming, an increasing proportion of future growth in output will probably come as increased yields from lands already in cultivation rather than from expansion of cropped areas.

The area planted in a particular crop depends mostly on farmers' price expectations, but average yield per unit of land depends on many factors. These include the quality of the inputs employed, technological change, lags between the availability of inputs and their use by farmers, shifts in relative prices of agricultural commodities, government policies, institutional factors, and changes in farmers' attitudes and behavior. The effect of each of these factors on output is difficult to isolate and measure. Moreover, while it is possible to estimate with reasonable accuracy increases in long-term yields following improvements in cropping practices and planting of improved varieties, it is more difficult to forecast annual yields because many factors which affect annual yields like weather and disease, are beyond farmers' control. Because of the problems involved, projection of average yields is technically much more difficult than projection of area planted. It is therefore well to make these projections separately.

(1) Projecting Area Planted

Because of the direct connection between cropped area and output, the first task in projecting production is to estimate the amount of cropped area during the plan period. This may be done by preparing land utilization sheets, along the lines in Figure 6 below, which give for each region,1/ and by summation, for the country as a whole (1) the uses which have been made for available lands in recent years and (2) a first approximation of the uses to be made of them during the period of a forthcoming agricultural plan.

1/ Ideally, the country should be divided into agriculturally homogeneous regions, but it may be necessary to settle for administrative regions, even if they are not homogeneous, because available statistics are organized, and measures for agriculture are frequently if not always taken, by administrative units. (126, p. 134)

FIGURE 6

First Approximation of
Land Utilization for the (Named) Region in (Years Listed)
(Acres, Hectares or other Units)

Land Use	Base Period t-1 t-2...t-n	Plan Years t t+1 t+2...t+n
1. Total land use		
2. Forests		
3. Land under tree crops		
4. Permanent grazing and pasture lands		
5. Other land not available for cultivation		
6. Arable land		
7. Net area sown		
(a) irrigated		
(b) unirrigated		
8. Gross area sown (which takes account of multiple cropping)		
(a) irrigated		
(b) unirrigated		

Source: Modified from 126, p. 135; 120, p. 47.

Since the projection of future land use requires knowledge of past and present trends, the greater the number of years immediately preceding the year in which the plan is scheduled to start (t) for which data are available, the better. If regional land utilization sheets are prepared for about 8 or 10 years before the year in which the plan is scheduled to start and are then consolidated into land utilization sheets for the whole country, a solid basis exists for estimating future regional and national land use patterns, taking due account of differences in land quality and the suitability of land for the various crops to be grown. The data may show that a recent year is sufficiently representative of past production to be used as a base period for projections, but is is more likely that annual fluctuations in output need to be smoothed out by the use of averages for several years, usually three to five. A multiannual base period is especially desirable when there is a lack of information for more than a very few recent years.

More than one projection should be made. The first projection could be a simple extrapolation of past trends based on existing land use programs and practices, on the assumption that no measures will be taken to alter the existing trend. (126, p. 134) Other projections might be based on the different assumptions about likely, feasible or desirable measures which would alter the trend in one way or another. In every case, projections would assume

constant prices. The projections would also have to be adjusted if further expansion of any land use is likely to be restricted by lack of suitable land.1/ At a later stage in the planning process, when targets are set, adjustments will have to be made to take account of likely price changes and policies and measures which are adopted to achieve development objectives and targets.2/

After completion of the land utilization sheets, with their first approximation of the land use pattern during the plan years, the second step is to prepare area, yield and production sheets, with projections of the way land would best be allocated to major crops to meet demand, production potential or other development objectives on the assumption that prices remain constant.3/ The crops for which estimates are made may be classified in whatever way aids analysis and the setting of targets. For example, crops may be divided into foods and raw materials; commodities for domestic consumption and export; or annual and tree crops. These divisions may be subdivided again into crops grown, e.g., on plantations and other lands; with mechanized and manual cultivation; or on irrigated and unirrigated lands.

Figure 7 is a sample area, yield and production sheet classified for illustrative purposes by annual and tree crops, with a further subdivision of annual crops into those produced on irrigated and unirrigated lands. For each region, the Table shows the irrigated and non-irrigated areas allocated to each major annual crop and the areas allocated to each major tree crop,4/ as well as yields and production, for the past years which compose the base period and for each year of the proposed agricultural plan period.

1/ In which case, an appropriate non-linear function which reflects this limitation should be fitted to the data. (120, p. 47)

2/ The adjustment would be based on an assessment of the likely resporse to the adoption of institutional and economic measures such as the provision of credit, marketing improvements and price stabilization programs, as well as land settlement programs, the construction of feeder roads, etc. (142, p. 95)

3/ The basis for the projections, and the assumptions made in preparing the projections, should be stated.

4/ Since the number of trees are more significant than area in the case of tree fruits, it may be desirable to furnish the number of trees on the area given, if these data are available. In horticulture, where there is much double-cropping or intercropping, it may be difficult to deduce yields from gross output and area figures. (142, p. 71)

FIGURE 7

Area Allocated, Yields and Production for Major Crops in the (Named) Region in (Years Listed)

	Base Period			Plan Years								
				1			2			3		4...n
	Area	Yield	Production	Area			Yield			Production		
Annual Crops												
Wheat												
irrigated												
non-irrigated												
Cotton												
irrigated												
non-irrigated												
Tree Crops												
Coffee												
Palm Oil												

Source: Modified from 126, p. 136; 120, p. 47.

As with land utilization, the more years immediately preceding the plan period for which data on past areas allocated, yields and output for each crop are available, the firmer the foundation for making projections of the areas to be allocated to each crop, as well as yields and production, during the plan period. In extrapolating past trends, the main factors accounting for the trends should be identified and adjustments should be made for factors which make deviations from past trends probable, even if the availability of land is no limitation to further expansion.

Since the amount of additional arable land is usually limited, output of a given crop obtainable on all land likely to be available for that crop during the plan period may be below the level of expected demand, if base-period yields remained unchanged. To assess the feasibility of raising the output of a crop to the level of expected demand, it is useful to estimate the extent to which yields would have to be increased to equate estimated output and demand during any year in the plan period. How this estimate may be made is shown in Figure 8.

FIGURE 8

Yield Required for Output to Equal Estimated Demand for Year One of the Plan Period

	Base Period			Year One		
	(1)	(2)	(3)	(4)	(5)	(6)
Crop	Production	Area	Yield	Projected demand at farm level	Estimated available area	4/5 Yield target
A	1000	100	10	1550	110	15

In the hypothetical example in Figure 8, an average of 1000 units of crop A was produced during the base period (column 1) on 100 units of land (column 2) to provide an average yield of 10 units (column 3). The demand projected for crop A at the farm level in year one of the plan period is estimated to be 1550 (column 4), while the estimated area available for crop A in year one (as determined by projections like those described for Figure 7) is 110 units of land (column 5). Division of the projected demand for year one (column 4) by the estimated available land for crop A (column 5), gives the yield required to bring output to the level of estimated demand in year one (column 6). Similar estimates for each major crop, on irrigated and non-irrigated lands, should be made separately for every year of the plan period. It then becomes possible to calculate an average yield target for equating the proposed average production of each crop with the estimated average demand during the plan period.

(2) Projecting Inputs

Increased yields depend, among other things, on the availability of labor and other inputs, such as improved seeds, fertilizers, insecticides, agricultural machinery and water. It is therefore important to take stock of the main inputs available in the base period and project their prospective supply over the period of the plan. Because of the lack of data in less developed countries, projection of labor supply and demand, especially on a regional basis, is generally more difficult than projection of other inputs.1/

1/ Except for water supply, which is the most difficult of all because supplies must be estimated not only by zone or region, but also by origin and by seasonal variation in availabilities. (120, p. 49)

FIGURE 9

Labor-Utilization Sheet
(thousand man/years)

Regional Supply and Demand	Base Year(s)	Plan Years 1	2	3	4	5
Region I						
Labor Force						
Supply						
Demand						
Difference						
Wheat						
Rice						
Cotton						
Region II						
Labor Force						
Supply						
Demand						
Differnce						
Wheat						
Sugar Cane						
Region III						
Supply						
Demand						
Corn						
Cotton						

Source: Modified 120, p. 49.

But because labor supply and demand projections are useful for the adoption of appropriate measures for rationalizing the use of labor and improving its efficiency,1/ an attempt should be made to prepare these projections. Even in areas which normally have a labor surplus, seasonal shortages may arise during periods of peak demand, e.g., at sowing and harvesting times. For this reason, labor projections should be made for peak demand periods as well as for the overall supply and demand in each year of the proposed plan period. To this end, labor-utilization sheets, like the one illustrated in Figure 9, may be compiled. The labor-utilization sheet is based on man-years, which requires that woman and child labor be converted into man-year equivalents. (120, pp. 48-49)

For all major inputs, knowledge of likely availabilities and demand during the plan period is essential for proper planning of their use. To meet the need for this information, it is essential that estimates be made of the use of other major inputs, like seed, fertilizers, insecticides, tools and machinery during the base period, and that the demand for each be projected for the plan period. (120, pp. 48-49) If prospective supplies of inputs promise to be lower than needed to raise crop yields to required levels, ways will have to be found to increase supplies, where this is possible, either by expanding domestic production or by imports. In the case of labor, it may be necessary to change the cropping pattern to conform to the available labor, alter the factor proportions between labor and other inputs, bring about a shift in the regional distribution of labor, or take other action to bring supply and demand into equilibrium. The pro's and con's of these alternative courses of action need to be evaluated.

(3) Contribution of Inputs to Output

After the supply of each major input for the base period and for each year of the plan period has been estimated, it becomes possible to estimate their contribution to output. Since the combination of inputs varies among crops, as well as among regions for the same crop, it is desirable to prepare for each crop separate estimates of the effect of varying combinations of technology in different regions or subregions. Figure 10 illustrates how this may be done. When the subregional tables are combined, regional and national estimates may be obtained of the contribution of major inputs to output.

1/ The measures might include action to change (1) the cropping pattern to conform to the amount and kind of labor available, (2) factor proportions between labor and other inputs and (3) the regional distribution of labor.

FIGURE 10

Contribution of Listed Inputs to the Output of Commodity (Named)

A. Area (named) in acreage, hectares or other	Base Period	Plan Years 1	2	3	4	5
1.0 Irrigated land						
1.1 with improved seeds						
1.2 with improved seeds and fertilizer						
1.3 with improved seeds, fertilizers and pesticides						
1.4 with improved seeds, fertilizers, pesticides and other input(s)						
2.0 Unirrigated land						
2.1 with improved seeds						
2.2 with improved seeds and fertilizers						
2.3 with improved seeds, fertilizers and pesticides						
2.4 with improved seeds, fertilizers, pesticides and other input(s)						
B. Yield (lbs. per acre, kgs. per hectare, etc.)						
3.0 Irrigated land						
3.1 with improved seeds						
3.2 with improved seeds and fertilizers						
3.3 with improved seeds, fertilizers and pesticides						
3.4 with improved seeds, fertilizers, pesticides and other input(s)						
4.0 Unirrigated land						
4.1 with improved seeds						
4.2 with improved seeds and fertilizers						
4.3 with improved seeds, fertilizers and pesticides						
4.4 with improved seeds, fertilizers, pesticides and other input(s)						

FIGURE 10 (continued)

	Base Period	Plan Years 1	2	3	4	5
C. Production (1,000 tons, etc.)						
5.0 Irrigated land						
5.1 with improved seeds						
5.2 with improved seeds and fertilizers						
5.3 with improved seeds, fertilizers and pesticides						
5.4 with improved seeds, fertilizers, pesticides and other input(s)						
6.0 Unirrigated land						
6.1 with improved seeds						
6.2 with improved seeds and fertilizers						
6.3 with improved seeds, fertilizers and pesticides						
6.4 with improved seeds, fertilizers, pesticides and other input(s)						
TOTAL PRODUCTION (5.0 + 6.0)						

Source: Modified from 120, pp. 52-53.

c. Projecting Output

Agricultural output may be predicted by (1) extrapolating past trends, (2) relating output to expected changes in G.N.P., (3) estimates derived from international comparative studies, (4) judgments of experienced experts, or (5) relating output to inputs. (125, pp. 45-47) Unfortunately, each of these methods has serious shortcomings.

When attempts are made to predict output by the use of simple linear projections based on past trends, there is an implicit assumption that the factors which determined the area and (or) the yield of a crop in the past will continue to operate with the same intensity and timing in the future. But there can be no assurance of this.1/ Similarly, attempts to predict agricultural output by relating it (by regression) to G.N.P. or its components where the latter variables are obtained from an aggregate projection, assume a stable relationship between sector and aggregate output which cannot be justified on logical grounds. But demand and supply interrelationships between agricultural output and G.N.P. are much too complex to be stated in terms of fixed relationships.2/

It sometimes is recommended that a country without enough reliable data to predict future output seek out a second country which is similar "in character, pattern of farming and general line of economic development" with good statistics. If one can be found, it is considered legitimate to use the relationships in that country to project output and other variables in the first country. (146, p. 52) But while this appears to be a plausible approach, it is hard to see how one can be sure that reliable estimates of output for a country are obtainable in this way.

The projection of output by combining estimates produced by technical, administrative or other experts familiar with the agricultural sector also has serious deficiencies since it necessarily introduces subjective factors which may or may not add up to good projections. Experts from different disciplines may have only a partial view of the agricultural sector and may, in addition, use amateurish methods to predict output. (146, p. 52)

1/ The conclusion in 28, p. 1175 is that the use of trends to project output in the United States appears to have been of little value.

2/ Moreover, in many less developed countries, GNP data are unreliable.

Attempts to forecast production on the basis of inputs applied also raise problems. Among these, is the fact that in addition to the quantities of inputs used, crop yields depend on the quality of inputs, the level of technology, as well as the way resources are combined and managed in the production process. The productive quality of land can vary widely, even within short distances; the extent to which capital goods are employed can greatly affect output; and the appropriate organization and management of complementary strategic resources can produce interactions with dramatic effects on production. (147, p. 53) These factors are frequently difficult if not impossible to quantify. Nonetheless, attempts are frequently made to express relationships quantitatively between inputs and output through one of the four following means: (1) a production function, (2) an input-output matrix or table, (3) linear programming, or (4) "yardsticks."

The ideal way of assessing the contribution which inputs make to output is with a production function.1/ A production function may vary from the simple to the complex. In agriculture, returns to inputs typically tend to increase more than proportionately at first, then level out and finally, decline more than proportionately. However, the statistical, technical and economic data required to construct a production function which accurately describes output in terms of increasing, constant and decreasing returns is rarely available in developing countries.2/ Even when accurate data are available from carefully controlled conditions on experimental farms, the results may not be applicable on ordinary farms, even in the same area. Moreover, although many variables are usually associated with changes in output, it is very difficult to construct an

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1/ A production function is an equation which expresses mathematically a given change in output associated with a given change in the quantity of one or more inputs of specified quality, with all other inputs remaining constant. In more general terms, it may be viewed as a statistical expression of the proportions in which land, labor, fixed and working capital are combined in production. (11, p. 18)

2/ Because of the difficulties inherent in constructing production functions with variable coefficients, production functions frequently use constant coefficients. This makes these functions more suitable for short-term rather than long-term projections. The use of constant coefficients can lead to distorted results, especially in developing countries where their employment may mean that estimators beg the question they should be answering, i.e., to what extent are the assumed relationships being modified as a consequence of development?

appropriate production function which includes more than a very few relevant variables. As a result, most production functions formulated in developing countries cannot explain past changes in output over time on the basis of the inputs applied. (14, p. 570)

Since a production function that cannot satisfactorily explain past output can hardly be used to project future changes, production functions have not been used widely in developing countries, except for functions applicable to a few research, plantation-type or model farms which are rarely representative of conditions prevailing on most farms. (14, p. 570; 120, p. 50)

An input-output table1/ is also difficult to prepare and employ effectively in developing countries. To be useful for projecting production, an input-output table must be disaggregated sufficiently to show major commodities or subgroups of commodities separately. To the extent that the table combines these commodities into groups so that it is no longer possible to identify them separately, the input-output table has reduced value for projecting the output of each major commodity.2/ However, the scarcity of data in developing countries, especially for inputs, often makes it too difficult to construct an input-output table which is sufficiently disaggregated to be of much use for forecasting production of each major commodity.3/ (120, p. 50) Even if data

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1/ Besides being potentially-useful in estimations of output based on inputs, an input-output table can be useful in forecasting demand for farm products by non-agricultural sectors of an economy. It also may make it possible to trace the total direct and indirect demands on different sectors originating from an increase in demand for an agricultural commodity. These direct and indirect demands can then be translated into the need for additional productive capacities in each sector. (148, p. 8)

2/ This is because it is unlikely that a group of commodities is likely to be so homogeneous as to be representative of each commodity in the group.

3/ The data problem is aggravated by the fact that the concept of investment in developing countries is less clear-cut in agriculture than in other major sectors of an economy. Thus, grain is a consumption item when eaten, but an investment good when used for seed; an animal is a consumption good when it is eaten as meat or when its hide is converted into a final consumption product, but an investment good when used as a source of power; and an animal by-product, like cow dung is a consumption good when burned for heating or cooking, but an investment good when used as fertilizer. These characteristics of the output pattern make conceptual distinctions between consumption and investment (or savings) complex. (150, p. 297) They also make it difficult to obtain reliable estimates of inputs needed for a given increase in agricultural output. (4, p. 121)

are available to prepare a sufficiently disaggregated input-output table for a country, it is not likely to be applicable to different regions in the country because of the frequently considerable regional variance in types of farms and farming conditions.1/ (149, p. 274)

Moreover, the usefulness of an input-output table is limited where there is only a small degree of inter-sectoral interdependence in an economy. The lack of sectoral interdependence is typical of peasant agriculture in less developed countries because it does not use many inputs from other sectors and because much of the output goes directly into final consumption in producers' households. (145, p. 90; 29, p. 20; 2, p. 125)

Input-output tables have other important limitations. A major shortcoming is their use of fixed coefficients, a use which implies a linear relationship between input and output. In fact, however, most agricultural relationships are subject to diminishing returns, a non-linear relationship. The use of fixed coefficients makes an input-output table a static model of production, in which the elasticity of inputs is constant over time, when the very nature of the development process is dynamic, i.e., one in which the elasticity of inputs varies over time. It varies because price and income elasticities of demand, technical processes, capital and labor productivity, substitutions of one input for another, etc., are likely to change as development proceeds. These changes usually generate changes in input requirements and coefficients. Moreover, since changes are likely to differ from one region to another, coefficients prepared for a nation or for a specific region are likely to be inaccurate in varying degrees from region to region. (148, p. 6)

A cardinal feature of the input-output table is the assumption of constant prices. But this is an unrealistic assumption for planning purposes since development usually changes relative prices of products in each sector. It is not easy to make adjustments for these price changes and the resultant changes in the composition of inputs and outputs. (148, p. 7)

Since an input-output table refers to a particular year in the past, it is applicable to future years only on the assumption that the input-output coefficients in the table will prevail in the future. But this may be an invalid assumption. For one thing, weather (the impact of which is inseparable from other determinants of output), may differ in the future from the past, with profound

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1/ Some northern European countries use the concept of "the national farm," composed of all farms in a country, to estimate inputs and output. Data derived from a sample study of different farms in a country are then used to formulate input-output data for all farms. (151, p. 194) This approach is obviously more suited to a developed than a less developed country.

effects on input-output relationships. For another, technical progress may also make a difference in these relationships. It is possible to adjust coefficients in an input-output table on the basis of assumptions concerning the impact of technical progress. But there is no scientifically reliable way of doing so. (20, p. 48) It can therefore be a disadvantage in developing countries, where the objective often is to change past ratios of capital, labor and other inputs to land, to make output projections on the basis of input-output tables (or production functions, for that matter), which are necessarily tied to the past.

In this respect, linear or nonlinear programming techniques have an advantage, since they permit the systematic exploration of alternative assumptions concerning the effect of inputs on output. This approach allows projections to be made on the basis of changes considered desirable, within specified constraints, in the proportion of resources used, the mix of commodities to be produced, the proportional contributions to different regions to output, or other structural relationships. (152, p. 357) However, linear programming is a refined mathematical technique which depends heavily on the accuracy of the data used; and although the data requirements for linear programming models are usually more modest than for income-output tables and production functions based on time series, they are still great, even where only two variables are involved. Where only two variables are employed, the problems which linear programming can solve are restricted; and where more than two variables are used, linear programming usually requires computer facilities which are lacking in most less developed countries. Moreover, good results from linear programming depends on realistic assumptions, and it cannot always be expected that such assumptions will be made. (151, p. 194)

Nevertheless, there is little question that linear programming can be helpful, where the required data, sound assumptions and computer facilities are available, in determining how scarce resources should be allocated to yield the highest income, or in determining what combination of inputs will provide the highest output at lowest cost. In the developed countries, as well as in a few developing countries with the required resources, these potential benefits have stimulated the use of linear programming.1/ But the lack of data, computer facilities and other resources in most less developed countries have encouraged the use of less formal techniques than linear programming despite their yield of less than optimal solutions to projection problems. (153, p. 200)

A fourth way of expressing the relationship between inputs and output is by means of "yardsticks" or response coefficients. These are essentially ratios which estimate required inputs

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1/ In the Sudan, linear programming was used to measure the economic benefits from crop rotation practices. (154, p. 5)

or predict specific crop yields for a given resource input; and are norms calculated from field data which provide estimates of the likely contribution of specific inputs to specific crops.1/ If the yardsticks are derived from a sufficiently large number of trials for individual crops at the farm level under average conditions (not experimental farms where conditions are likely to vary substantially from those on most farms), in different ecological regions and subregions, with due account of differences in soil, etc., their application to specific farms should be more realistic than coefficients obtained from an input-output table or a production function.2/

Although the yardstick as a concept is easy enough to understand, it is often difficult to apply. One limitation of the yardstick is that it is likely to vary from one ecological area to another; a second limitation is that technological change may make it necessary to revise yardsticks frequently; a third limitation applies to yardsticks expressed (as they often are) in value instead of physical terms during periods of changing prices; (155, p. 8) a fourth limitation is that it implies constant returns to additional inputs, in defiance of the principles of diminishing or increasing returns; and a fifth limitation arises from the need for "composite yardsticks," which are difficult to calculate, rather than yardsticks which measure the effect on output of one input in isolation, since several inputs are usually used together.3/

1/ There are two types of yardsticks. One type is an "acreage yardstick," which gives the area benefitted by a unit of a particular input. For example, in India, a masonry well has been assumed to irrigate, on average, five acres; or one ton of ammonium sulphate has been assumed to provide 20 lbs. of nitrogen per acre when applied over 22 acres. The second type is an "output yardstick" which indicates the additional average production which accrues from a unit of input or from one acre of area benefitted. For example, one ton of fertilizer is assumed to yield additional output of two tons of foodgrains; or one acre under irrigation is assumed on average to give an additional production of one-fifth ton per acre. (20, p. 35)

2/ Yardsticks are generally derived from information on material inputs going into actual production as a consequence of a program and the expected benefits from each unit of input. The production capacity or potential created by the program is then worked out as an input-output ratio. (20, p. 35)

3/ Because of the complementarity of inputs, a composite yardstick is likely to provide a different norm than the sum of all the individual yardsticks for the inputs included in the composite yardstick. In practice, it is usually impossible to determine separately the contribution of each of a series of inputs to increases in output. 120, pp. 50-53 explains how to go about calculating individual and composite yardsticks.

Yet, despite these limitations and although yardsticks provide much less information than production functions, input-output tables or linear and non-linear programming, they are to be recommended for developing countries, especially in the earlier planning stages, since they are simpler to apply than any other device. (20, p. 49)

It should be clear from the preceding account that there is no way of projecting agricultural output without allowing for wide margins of error. The actual methods used to forecast production must depend on conditions prevailing in the country concerned. Despite its deficiencies, extrapolation of past trends is a widely used technique, in India among other countries. (149, p. 275) The Food and Agriculture Organization of the United Nations counsels the use of yardsticks as the best available means to project output on the basis of inputs in developing countries. Whatever the means employed however, there is always need to use the best available judgment to adjust the results obtained.

d. Projecting Supply

The projection problem is complicated further because for the preparation of an agricultural plan the ultimate requirements usually are not estimates of future production so much as estimates of future supply; and, unfortunately, estimates of future supply are surrounded by even greater uncertainties than estimates of future production. For any period, the supply of a commodity is the algebraic sum of production plus imports, minus exports, plus additions to or subtractions from stocks carried over from preceding periods. Thus, in addition to estimation of production, supply projections require the estimation of future foreign trade movements and domestic changes of stocks. In the short run, estimation of future production and foreign trade may be feasible, but estimation of future changes of stocks is always a hazardous undertaking because of uncertainties about the factors which influence the expectation of holders of stocks. The task of estimating supply in the long run is likely to be even more troublesome because of the difficulties of predicing technological changes, shifts in prices of agricultural inputs and outputs, the speed with which farmers will react to the promise of more profitable production than in the past, as well as long-term movements of foreign trade and stocks.1/

1/ The problem becomes even more formidable if estimates of marketed surplus available for urban consumption are required. Since farmers may market less than they previously intended if prices turn out to be higher than the expected prices, estimators must somehow foresee actual as well as expected prices!

Attempts to predict supply response have been made by various methods, including budget analyses of modal-type farms, linear programming, and analyses of time series data. In addition, the construction of agricultural supply models has become a common econometric exercise among scholars who seek to ferret out appropriate quantitative relationships which would provide reliable estimates of changes in output associated with changes in inputs and prices.

Because the supply of agricultural commodities depends on output to a considerable extent, special attempts have been made to derive commodity supply elasticities and supply functions from production functions. Supply functions are mainly concerned with the way the output of a commodity is likely to vary with price in a specified technological and economic environment.1/ But the results obtained thus far from supply functions based on production functions have not proved to be empirically reliable. Aside from the fact that it is exceedingly difficult to construct appropriate production functions, and to obtain production and supply data, it has proved impossible thus far to identify ex ante the inputs which will actually be employed by farmers.

Official input targets are sometimes used to project output, but there are likely to be great differences between input targets and inputs actually available, as well as great differences between inputs available and those actually applied by farmers. Yet it is the inputs actually applied, not input targets or total available inputs, which determine the yields realized. (149, p. 277)

Unless and until it becomes possible to predict with reasonable certainty such factors as relative prices of commodities; production costs; availability of inputs and funds for their acquistion by farmers; the lag between the availability of inputs and the means to acquire them, on the one hand, and producers' use of the inputs, on the other; as well as technological change and the impact of policy and institutional factors in raising productivity per unit of input; a supply function derived from a production function can only be expected to serve as one among several guidelines in the estimation of supply. (147, p. 55)

The considerations which have thus far reduced the usefulness of production functions for estimating future supply are also generally applicable to attempts to project supply on the basis of input-output matrices and linear programming. Although research

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1/ The goal often is to predict how much price would have to change to stimulate a specific change in supply.

to devise reliable econometric techniques for projecting production and supply is going forward, until now the determinants of output, and the inputs which farmers actually employ in production, have proved to be too elusive to enclose in an econometric function.1/

In the absence of acceptable econometric means for making direct estimates of market supply and indirect estimates of supply with production functions, input-output tables or linear programming, simpler empirical techniques have usually been employed in less-developed countries for these purposes. These usually relate supply to variables like acreage, output or incomes. Since out-out is generally considered to be the best of these points of reference, most projections employ average sales-to-output ratios of different crops, estimated from surveys, to project market supply. However, the use of constant sales-to-output ratios is likely to produce inaccurate projections of marketed surpluses. (149, pp. 276-77) Furthermore, estimates of supply obtained from sales-to-output ratios are subject to even wider margins of error because the output estimates on which they are based are themselves frequently only rough approximations.

3. Reconciling Demand and Supply

When projections of demand for a commodity have been made independently of those of supply, it is necessary to balance the two. The Food and Agriculture Organization of the United Nations recommends that this be done by the construction of a "balance sheet" for each major commodity which shows the volume and value of the commodity (either in aggregate or per capita terms) likely to be available and the uses to which it is to be put in a given year. A commodity balance sheet is generally expressed in the following form:

$$\underbrace{\text{Initial stocks plus production plus imports}}_{\text{Supply}} = \underbrace{\text{direct consumption plus consumption by processing industries plus exports plus seed, feed and waste plus final stocks}}_{\text{Demand}}$$

1/ Professors Raj Krishna and D.G. Johnson consider production and supply projections to be useful although they are subject to substantial error. But both express some pessimism about the prospects for reliable projections of agricultural output and supply. After indicating how seriously wrong agricultural output and supply projections have been in the United States and in the U.S.S.R., Dr. Johnson says (in 28, p. 1177): "If it has so far proved difficult to make reasonably accurate (supply) projections for the United States or the Soviet Union, one can hardly be sanguine about the possibilities for Africa, Asia, or South America" (cited in 149, p. 277).

The left side of the equation represents the availability or supply of the commodity, and the right side the uses or demand for it. (120, p. 54)

If prepared as indicated, balance sheets will contain the information needed to identify deficit and surplus commodities and to made adjustments required to equate supply and demand. If demand exceeds supply, one or more of the following adjustments is required: (a) the area in the crop concerned must be increased, either by transfer of land from other crops or by additional investment in land reclamation and (or) irrigation; (b) the rate of yield from land must be raised by intensified use of inputs; (c) demand must be reduced by appropriate price and (or) other policies; (d) imports must be increased to cover the deficit; or (e) stocks must be reduced. However, if supply exceeds demand, one or more of the following adjustments is required: (a) the area in the crop concerned must be reduced by transfer of the cropped land to other uses; or by reduced investment in land reclamation and (or) irrigation; (b) yields must be lowered by reduced use of inputs; (c) demand must be increased by appropriate price and (or) other policies; (d) exports must be increased, or (e) stocks must be increased. (120, p. 54)

As is apparent from this listing, the determination of the relative shares of total supplies to be met from domestic production and imports, or the allocation of resources between agricultural production for domestic consumption and for exports involves the making of choices. Since the same land, labor and financial resources may be used to produce alternative crops, decisions on the best balance between production and imports, production for domestic consumption or export, or the regional location of production require consideration of the cost-benefit relationships involved. If it is considered desirable that the choices made should result in the best use of available resources in accordance with the principle of comparative advantage, appraisals of costs and benefits in this context should be made. If foreign exchange, skilled labor or other scarce resources are constraints, this will have to be considered in estimating costs; or if employment, foreign exchange earnings or savings are considered important, the benefits to be expected from programs in these fields will have to be taken account of. In making choices, indirect as well as direct costs and benefits must be considered.

It is no easy matter to make the right choices among all possible alternatives. (36, p. 39) In practice, however, many factors tend to simplify the comparative cost-benefit appraisal process because the possibilities for increasing production of a commodity during the period of an agricultural plan are usually restricted. For example, the extent to which irrigation works can be completed during the period of a medium-term plan are limited by the capacity of the construction industry; the availability of extension workers is limited by the time required for recruitment and training; and the pace at which farmers adopt new production techniques is governed by traditional, institutional and sociological factors. Because of such factors, there are likely to be only a few practicable alternatives from which to choose. (20, pp. 39-40)

Moreover, choices involving the allocation of resources and the determination of the shares of total demand to be met from domestic production and imports cannot be made without reference to national conditions and objectives. Where total imports, both non-agricultural and agricultural, exceed total exports, it may be necessary to revise agricultural production goals and resource allocations. For this reason as well as for others, it is essential that the cost-benefit relationships for all practicable alternatives be explored during the period of the stocktaking and diagnostic survey to allow planners the maximum flexibility in setting targets during the planning process.

While commodity balance sheets are attractive media for equating supply with demand, they have disadvantages. For one thing, the data required for their construction are often hard to obtain. Perhaps the most difficult problem is to estimate subsistence supplies -- those produced by farm and other rural households for their own consumption of for local barter. (131, p. 330) The construction of commodity balance sheets is also a time-consuming task. Moreover, commodity sheets may be unnecessary for crops in which little change in supply is required to meet demand, or vice versa. The preparation of commodity balance sheets also may be unnecessary where shortfalls in some crops are compensated for by surpluses in others. These considerations help account for the fact that the commodity balance sheet approach has taken hold in only a few developing countries thus far.

ANNEX C

TERMS OF REFERENCE FOR A STOCKTAKING AND DIAGNOSTIC SURVEY OF THE AGRICULTURAL SECTOR IN (COUNTRY)

TO: The Head of the Survey Team, with copies to all members of the Team

FROM: The appropriate official in the agency or organization arranging for the Survey

1. You will participate in a stocktaking and diagnostic survey in (country) and will be there from about (date) to (date). Thereafter, you will have until (date) to prepare your report, which will consist of:

a. a main report of no more than fifty pages summarizing the Survey Team's principal findings, issues and proposed alternative solutions for dealing with these issues. The main report should call to planners' attention the matters which the Team believes require attention in the formulation and implementation of a plan for the agricultural sector;

b. a number of analytical annexes, as may be considered appropriate, elaborating upon points of special interest and importance, in support of the findings and conclusions in the main report;

c. a number of descriptive appendices, as may be considered appropriate, giving the salient statistics and data and (or) sources of important statistics and data on the agricultural sector.

2. The purpose of the stocktaking and diagnostic survey is to provide information needed to prepare and implement a ten-year plan for the agricultural sector within the following constraints:

a. The survey and reports must be completed by the time fixed in paragraph 1, above.

b. The information provided in the survey must be directed toward helping achieve the following plan objectives:

(TO BE GIVEN)

c. The agricultural sector shall be deemed to include forestry and fisheries, animal husbandry, and forestry as well as annual and tree crops, but shall exclude hunting.

d. Wherever possible, information, issues and methods of dealing with them should be shown for the nation as a whole, as well as for the following regions and subregions:

(TO BE LISTED)

3. The Survey Team shall be headed by _____, who will be responsible for assigning and coordinating the work of members of the Survey Team and for the preparation of the Team's report. He will also initiate and maintain appropriate contacts with the Resident Representatives of the UNDP, FAO and the bilateral aid agencies in (country). _____ will be the Deputy Head of the Team. Aside from acting for the Head of the Team during the latter's absence, he will have such duties as may be assigned to him by the Head of the Team.

4. The appropriate authorities in (country) have been requested to have available for the Survey Team, information which they believe will be helpful to the Team. In addition, a specific list of information (See Annex C), has been requested from these authorities. On the basis of this information and such other information which the Team may obtain, as well as discussions between Team members and those concerned with agriculture in (country), the Survey Team will:

a. Examine the country's basic agricultural data; and organize it in a form which will be useful for preparing an agricultural plan; incorporate the data in such form in the descriptive appendices referred to in paragraph 1, c of this Annex; evaluate the data with special attention to their timeliness, coverage, comparability and accuracy; as well as the extent to which they are useable or perfectable.

b. Take an inventory of the natural, capital, institutional and manpower resources currently and potentially available for the production and distribution of agricultural commodities; examine the effects of climate, rainfall, water resources, topography, soil characteristics and available arable land or output; classify all land available for agriculture within each farming area in accordance with its potential to achieve plan objectives; describe and analyze the main private and public sources of financing investment and working capital; evaluate the main national, regional and local institutions connected with agriculture; and indicate the size, composition, distribution and changes in the agricultural labor force.

c. Analyze the role of agriculture and its contribution to the economy; review the recent performance of agriculture; review current plans and programs for crops, forestry, livestock and fisheries, and the extent to which these plans and programs are being implemented.

d. Review and analyze the degree of development in the agricultural sector, in each major region of the country; describe the structure of agriculture, giving sizes of holdings, tenure arrangements, major cropping patterns and mobility of farm population; estimate the existing capacity of the sector, and its regional distribution and utilization; describe major production of crops, livestock, forest products and fisheries; analyze current use of inputs, including public and private investment in agriculture, farm credit, labor, irrigation, farm machinery and fertilizers;

review current agricultural policies and strategies; describe the institutional framework in the agricultural sector; prepare a descriptive analysis of how the sector functions in the various regions of the country; indicate the major constraints on production and distribution, and discuss other problems encountered; indicate the opportunities for improving performance, increasing income, and producers' well-being and employment; explain farmers' attitudes toward change and innovation; evaluate successful and unsuccessful past attempts to introduce changes in agricultural practices, and the reasons for the successes and failures; indicate ways in which farmers might be induced or helped to make desirable shifts in the use of resources in production and how marketing practices might be improved, and in this connection discuss credit, tax, extension, research, product and input pricing and distribution, transportation facilities, land and water development and conservation, land tenure adjustments, market development and stabilization, institutional reform, or other matters, as may be relevant.

e. Make projections of the demand for, and the supply of, the country's major agricultural commodities and, on the basis of a series of plausible assumptions, indicate alternative ways in which demand and supply of major commodities may be equated, either by increasing supply or by increasing demand. Demand projections for food should be made separately from those for raw materials; and the projections for the demand for food and raw materials for domestic consumption should be made separately from the export demand for these commodities.

f. Discuss the efficiency and effectiveness of the public services, including planning, for agriculture and desirable ways of improving the organization and administration of these services, as well as the quality and quantity of manpower available to the sector.

g. Identify possible investment opportunities for the next decade and, as far as practicable, indicate the likely effect of these investments on agricultural output, rural living levels, the demand for labor, and national growth and development. Particular attention should be given to the identification of projects suitable for early financing and indicate likely sources of such financing, either domestic, foreign or international.

h. List the major gaps in agricultural data required for preparing and carrying out an ongoing program for agricultural betterment, and analyze the shortcomings in the existing stock of information with a view toward laying a basis for a five-year program for improving agricultural statistics.

5. Subject to the above, as well as the terms of reference which the Head of the Team will provide, each member of the Survey Team will assemble and appraise the evidence relevant to his special area of responsibility as defined by the Head of the

Team, and make recommendations concerning his area of responsibility in written and (or) oral reports to the Head of the Team as the latter may specify. Subject to such changes as the Head of the Team may make, the general areas of responsibility for each member of the Team are as follows:

INDIVIDUALS	AREAS OF RESPONSIBILITY
A	Agricultural credit and cooperatives, including organizational matters; and cooperation with other Team members on matters of land tenure and agricultural taxation, as time permits.
B	The general setting of the agricultural development problem; intersectoral relationships; terms of trade; and manpower requirements.
C & D	Possibilities of expanding output of food, feed and industrial crops, including research and extension aspects; soil and water management systems. C will also monitor and integrate the Team's technical judgments.
E	Land development, including settlement; and to the extent feasible, jointly with L (see below) and others, identification and ranking of geographical areas in terms of desirable amounts and kinds of development expenditures.
F	The livestock subsector, including sheep and animal health; in cooperation with G, marketing of livestock products; in cooperation with C & D, pastures, forage and feed crops, and research and extension in these fields; and in cooperation with K, forestry.
G	Input and agricultural commodity pricing and marketing, including agricultural exports and agro-industry; and in cooperation with N, problems of demand.
H	Water resource development; and in cooperation with C, D & K, soil and water conservation.

INDIVIDUALS	AREAS OF RESPONSIBILITY
I	Organization and administration of the public and quasi-public services for agriculture, taking account of the Survey Team's view of what constitutes a desirable development strategy for the sector, and the outlook for the availability of technical and management personnel.
J	Coordination and integration of the economic judgments of the Survey Team, with special attention to the economic and financial aspects of potentially viable projects (including foreign exchange requirements, and required pre-investment studies); and, as time permits, evaluation of agricultural taxation, agricultural development planning, and the system for producing and distributing agricultural economic and statistical data and other information.
K	The forestry sub-sector, including conservation aspects.
L	Rural road development; ways of reducing costs of transporting agricultural inputs and commodities, and public organization and management in this field.
M	Land tenure, including nomadic pastoral communities; and jointly with other Team members, agricultural taxation.
N	Commodity output and resource use, including an appraisal of the outlook for demand of farm products, especially with regard to export possibilities.
O	Consultant to the Team during its final week in the field to discuss the Team's tentative findings, particularly with regard to ecological implications and practical feasibility.
P	Secretary to the Team.

ANNEX D

REQUEST FOR INFORMATION
REQUIRED FOR FORTHCOMING STOCKTAKING AND DIAGNOSTIC SURVEY

TO: The Appropriate Official(s) in __(country)_____

FROM: The Head of the Survey Team or another appropriate authority.

1. A Team of specialists is to begin making a Stocktaking and Diagnostic Survey of the agricultural sector, including crops, forestry and fisheries, but excluding hunting, beginning __(date)__. The Survey is intended to provide an extensive and detailed description and analysis of the agricultural sector to provide essential information required to prepare a ten-year plan for development of the sector.

2. Your cooperation with the Survey Team, which will be headed by _____ and include __(number)_____ specialists and a secretary, is requested. Members of the Survey Team will wish to hold discussions with you and other officials. In addition, they have requested that certain data be compiled prior to the inception of the Survey. In order to provide time to arrange the information so that it is in easily accessible form, it would be appreciated if you provided the information requested by (a date two weeks before the Team is to begin the Survey).

3. Where time series are requested, the period to be covered is usually given. Where the period to be covered is not given, it should include yearly figures for the period 1954-1973, inclusive. Where this is not possible, an attempt should be made to give annual data for at least the period 1964-1973, inclusive.

4. The information provided should include, but need not be limited to, the data listed below. In addition to the specific items requested, please assemble and transmit to me the following materials which may contain information which bears on the purpose of the Survey Team: all internal government or agency documents; annual reports; financial statements; charters and by-laws of organizations concerned with agriculture; statistical publications; census publications; committee reports (published or unpublished); marketing studies; reports or studies of special investigations; feasibility studies; articles in scientific journals or other periodicals; any other relevant documents not specifically mentioned.

5. BASIC DATA

A. Production, Exports and Imports (Annually for 1954-1973, inclusive)

(1) Volume, volume indices and value in constant and current prices for production and exports of principal commodities (including crops, livestock, forestry and fishery products).

(2) Volume, volume indices and value in constant and current prices for imports of principal agricultural products.

B. Land Use Pattern (Annually for 1954-1973, inclusive)

(1) Give principal land use pattern for crops, pasture, forestry, etc.

(2) Use of non-irrigated arable land by principal crops and pasture.

(3) Use of irrigated land by principal crops and pasture.

C. Yields and Farming Practices (Annually for 1954-1973, inclusive)

(1) Yields by crops.

(2) Livestock product yields, using production of meat per hectare, milk per cow, or other indicators of productivity.

(3) Application of inputs and the extent of use of: (a) fertilizers (show total volumes of plant nutrients and kilos per hectare (or acre) by principal crops); (b) insecticides; (c) improved seeds and improved varieties for fruit trees; (d) irrigation inputs (areas of irrigation systems completed and areas brought under irrigation); (e) livestock improvements; (f) use of commercial feeds; (g) other inputs.

(4) Progress made in adopting improved practices in forestry.

(5) Progress made in adopting improved practices in fisheries.

6. AGRICULTURAL RESOURCES

A. Natural Resources for Agriculture

(1) Description of agriculturally relevant climatic characteristics, including monthly rainfall by region, annual variations in rainfall, and minimum and maximum temperatures by region.

(2) Description of soils and topography by region.

(3) Natural pasture regions and forest lands as determined by rainfall, topography and soils.

(4) Irrigation water resources, including ground water resources, rivers, reservoirs, etc.

(5) Other relevant resources and factors.

B. Farm Size, Farm Fragmentation, Farm Consolidation and Land Tenure

(1) Relevant statistics showing changes since 1954.

(2) Description of relevant policies and programs from 1954; and progress made in implementing policies and programs to date.

C. Agricultural Cooperatives

(1) Description of organization; size of staff (by functions and education for 1964, 1968 and 1973); and facilities (for marketing, storage, processing, etc.).

(2) Description of scope and activity of cooperatives, their general situation, major problems, existing and foreseeable legislation, government policies and their cost, etc.

(3) Volume and value of agricultural products handled by cooperatives, and percentage shares of total principal products marketed which are and have been handled by cooperatives.

(4) For each year between 1964 and 1973, consolidated balance sheets, profit and loss statements, and other financial reports for major cooperatives and categories of cooperatives, as well as annual reports of major cooperatives.

D. Extension Services

(1) Description of scope of extension activities, indicating size of staff (by function and education for each year between 1964 and 1973); facilities; effect of extension activities and their annual current and investment costs.

(2) Description of extension work carried out by other than the regular extension service agency (e.g., by an agricultural bank). Describe these other extension activities, organization, staff, facilities, programs, costs and other relevant aspects.

E. Agricultural Research, 1964-1973

(1) Description of each research organization, size, function and educational qualifications of staffs; facilities; research programs and their objectives; and current and investment expenditures.

(2) Description of each research station; its program; the size, function and educational qualifications of its staff; and present annual cost of each research station.

(3) Give similar information for field demonstration activities.

F. Education and Trained Manpower

(1) Describe the main characteristics of, and changes in, the trained manpower and education situation in agriculture from 1964 to date.

(2) Give quantitative and qualitative description and evaluation of shortages by specific types of education required and by functions.

G. Agricultural Credit, 1964-1973

(1) Describe the principal sources of agricultural credit; agricultural credit organizations; and size, educational qualifications, and functions of their staffs in 1964, 1968 and 1973.

(2) Describe the agricultural credit situation, major problems and credit policies. Describe in detail the agricultural credit programs or measures carried out since 1964. Give the volume of lending each year from 1964, and the amounts of credit outstanding at the end of each year for each purpose (e.g., seasonal production loans, mechanization loans by item to be purchased, orchard planting loans by fruit species, etc.).

(3) Give statistics required to demonstrate loan repayment performance.

(4) Describe the prevailing agricultural lending criteria, lending procedures and interest rate structures. Give the interest rate structure for non-agricultural loans.

(5) Provide charters, by-laws, annual reports, financial statements and other principal documents of major agricultural organizations for each year from 1964 to 1973.

7. ROLE OF AGRICULTURE IN THE ECONOMY

Give all available information which would help evaluate the importance of agriculture to the economy. The information should include, but not be limited to, the following data:

A. The share of agriculture (as well as the crop, animal husbandry, forestry and fisheries subsectors) in:

(1) GNP;

(2) exports and imports;

(3) employment, and as a way of life for the proportion of the population concerned.

B. The rate of migration from agriculture to:

(1) non-agricultural sectors;

(2) abroad.

8. THE ROLE OF AGRO-INDUSTRY

A. Indicate the major types of agro-industries, including those which:

(1) process domestic agricultural output;

(2) produce agricultural inputs;

(3) produce other goods.

B. Indicate the extent to which agro-industries operate as cottage industries or as separate plants.

(1) Where is the bulk of each major type of agro-industry located?

(2) Indicate the size of plants of each major type of agro-industry.

C. Indicate the number of persons employed in each major type of agro-industry.

D. Indicate the source of financing for each major type of agro-industry making reference to investments by farmers, private investors, the public sector and joint ventures.

9. PRESENT STATE AND POTENTIALITIES OF AGRICULTURE

A. Prices, and Price and Other Agricultural Policies

(1) Yearly Prices for the Period 1964-1973

a. Current producers' domestic wholesale and retail prices and price indices of principal agricultural commodities.

b. Export prices and price indices for principal export commodities.

c. Support prices (whether in the form of guaranteed minimum prices, intervention prices or any other target prices), if they are not the same as the producers' prices requested in (a), above.

d. Current prices of, and price indices for, farmers' principal inputs, in luding fertilizers, insecticides, commercial feeds, wages, and the most important agricultural equipment.

(2) Support Policies for the Period 1964-1973

a. Describe current price, production, income and other support policies and measures for each commodity concerned. Indicate relevant characteristics of these policies, e.g., support criteria applicable to different size farms. Indicate when the support policies were introduced and describe any policy changes from 1964 to date.

b. Give the annual cost of each type of subsidy or other policy described under (a) of this paragraph.

c. Describe marketing operations carried out by the Government or government agencies to support prices of agricultural commodities. (The data should include for each principal product, volumes and values of commodities handled, stocks on hand at the end of each marketing season, government expenditures on these marketing operations, financing arrangements, and facilities employed to carry out the marketing activities.)

d. For each principal commodity, give the projection of estimated support expenditures for next year.

(3) Annual Production Subsidies for 1964-1973

a. If not provided above, describe subsidy policies on inputs and to support production. Include a description of each type of subsidy, showing payment criteria (e.g., whether paid per hectare or per unit of output); purposes of each subsidy; and total amounts paid.

b. Indicate all subsidies in force at the present time and make projections for each, showing estimated expenditures for next year.

(4) Import and Export Policies for 1964-1973

a. Describe policies and measures for regulating agriculture-related exports and imports.

b. Give the cost of these policies and measures.

(5) Price Controls in Consumers' Interest for 1964-1973

a. Describe policies and measures adopted to regulate wholesale and retail prices, marketing margins, etc., for agricultural commodities in consumers' interest. Describe the criteria used in applying policies and measures, and the agencies and procedures used to implement these policies and measures.

b. Give the annual cost of these policies, by policy and (or) measure.

B. Marketing, Storage and Processing for 1964-1973

Give a description of the situation, indicating problems and policies not covered in the discussion of agricultural support policies, above. The description should include:

(1) a detailed account of the marketing agencies, their organization, management, facilities and operating procedures, as well as government policies related to marketing for (a) each of the most important currently-produced commodities and (b) promising (i.e., growth) commodities;

(2) an account of the volume of storage operations, the capacity available for storage operations, the stocks on hand, and how they were accumulated over time;

(3) if not given in answer of one of the earlier questions, give the annual cost of the government's marketing and storage operations for each principal commodity;

(4) an account of marketing margins, with cost breakdowns which will permit an assessment of marketing costs for each of the most important agricultural commodities. For export commodities, the marketing margins should be based on c.i.f. prices of each product in principal export markets to permit an evaluation of the competitiveness of each export product;

(5) a discussion of the processing of agricultural commodities. The discussion should include the most important present and potential products, the institutional aspects (e.g., the government agencies, private firms, cooperatives or other institutions involved in the processing of the commodities), processing facilities, financing of processing activities, government policies, recent developments, problems, etc.;

(6) an account of the annual cost of government policies to promote processing, by policy and product.

C. Transportation - Internal and External

Describe the effects of the transportation pattern and transportation costs on agricultural production, exports and internal marketing.

D. Taxation of Agriculture, 1964-1973

Give a general account of the taxation of agriculture which includes, at a minimum, the following:

(1) the amounts collected annually, by kind of tax;

(2) the forms of collection;

(3) government policies;

(4) problems and issues.

E. Forestry for the Period 1964-1973

(1) Describe present forest resources and divide forested land areas into the following four classes: (a) protected forest, (b) normal production forests, (c) public timber plantations, and (d) private timber plantations.

(2) Give the existing volumes of commercial timber by type and (or) use; annual growth rates; annual cut and its utilization; potentialities for expanding timber output (indicating, for example, growing but not yet exploited timber resources, areas and (or) stocks; and areas available for reforestation or afforestation.

(3) Give the main characteristics of the wood processing industry; describe its organization; the capacity of processing facilities by main products; the volume and value of production of the main products; price trends; prospects and competitive positions of the industry in domestic and foreign markets; the potentialities for expanding forest industry; and the adequacy of the raw material supply, measures taken to expand timber supplies, and scope for expanding timber supplies.

(4) Description of the Government's forestry policy and programs.

(5) Description of the Government's forestry organization; size of staff, by function and education for 1964, 1968 and 1973; and main forestry facilities available.

(6) Annual current and investment expenditures for reforesting and afforesting areas, protecting forests, etc.

F. Fisheries for the Period 1964-1973

(1) Describe the situation in the fisheries subsector, indicating recent changes (from 1964 to date); problems and potentialities in fisheries; market prospects, marketing organization, including the processing industry and facilities; and government policies relating to the fishing (including the processing) industry.

(2) Describe the government organization to support fisheries, the size of the Government's fisheries staff, by function and education, and the facilities available.

(3) Give the volume and value of the annual fish catch, from 1954 to 1973, by the main types of fish; and the volume and value of the annual output of processed fish products, by main products, from 1954 to 1973.

(4) Give annual prices from 1954 to 1973 for fresh or unprocessed catch and for other appropriate marketing and processing levels; and annual prices from 1954 for principal inputs.

(5) Describe the main characteristics of the fishing fleet, and the main changes in the fleet and its productivity from 1964 to date. Indicate the fleet's competitive position, how it is financed, potentialities for its expansion, and other relevant information.

(6) Describe the main characteristics of the fish processing industry, including its organization and manufacturing facilities, and the main changes in the industry from 1964 to date. Indicate the industry's level of productivity, its competitive position, financing, potentialities for expansion, and other relevant information.

10. SUPPLY AND DEMAND

Provide commodity balance projections for the next decade for each major agricultural commodity, taking account of exports, imports, domestic and foreign demand, production, stocks, waste and feed. For purposes of comparison, projections should also be made for 1975, 1985 and other years for which FAO commodity projections are available. Indicate the sources and bases of the projections.

11. DEVELOPMENT PLANS FOR AGRICULTURE

A. Development Plans to Date

Describe the main features of the development plans for agriculture for the period 1964-1973, and give the following information:

(1) annual development expenditures, by main categories;

(2) progress made in carrying out major projects and programs;

(3) Wherever possible, the description should include physical progress made (e.g., acres of irrigation works completed or percentage of projects or programs completed).

B. Present Development Plans and (or) Development Plans for the Next Ten Years

(1) Describe the main features of development plans for agriculture in force or contemplated for the next ten years. Among other information, give:

a. the objectives of each development plan;

b. yearly investment projections (totals and by major categories, projects and programs).

(2) Describe the changes which each plan proposes to make in agricultural administration and institutions, including those engaged in research, extension and credit activities.

(3) Give manpower projections required to carry out each plan, and indicate the bases for the projections.

ANNEX E

PROJECT WORK SCHEDULING AND REVIEW

Before discussing how PERT is used, it would be useful to say why this approach is valued by its practioners. In chapters 11 and 12 the complexity of many agricultural and rural development projects is noted. Such projects often involve several ministries, private suppliers and firms, universities and parastatal and foreign assistance organizations. Within a project's area of operations may be thousands of farmers who are geographically widely dispersed. In these situations, coordination and communication for project operations are essential, and if not present, disorder will prevail in the form of missed deadlines, breakdown in supply of needed materials, duplicated efforts - or no one taking responsibility to carry out or follow up on essential task - setting of unrealistic lead times, and a variety of related problems.

Work scheduling and review techniques were designed specifically to help solve these problems, and to eliminate much of the "guesswork" from project management. (382, p. ix) There are numerous techniques available to assist project personnel in effective project planning and implementation, such as PIM, which are discussed in chapter 16, "Progress Reporting". Herein, the application of the Project Review and Evaluation Technique (PERT) to agricultural projects will be discussed.1/ PERT has been used most widely in industrial and engineering projects, but in the last few years has received more attention in development projects in agriculture, family planning, health care, and education. Despite such attention, its usefulness is more discussed than understood, and it is referred to more than applied.

1. Why PERT Was Developed

With the increasingly complex projects that have been designed in recent years, it was found that a way was needed to indicate interrelationships of many aspects of projects, and to answer such questions as:

1/ PERT originally stood for Program Evaluation Review Technique, but its major use has been in projects, as its changed name reflects. PERT and the Critical Path Method (CPM) originally differed somewhat in approach, but have a great deal in common now, while their differences are slight. (383, p. 5) The newest name for techniques of the PERT/CPM family is Precedence Diagramming Networks. Herein, we shall simply refer to the method as PERT.

-- how many people are needed at each stage and on each activity of the project?

-- what kind of training is needed and how long will it take?

-- how will a delay in arrival of supplies affect the completion of the project?

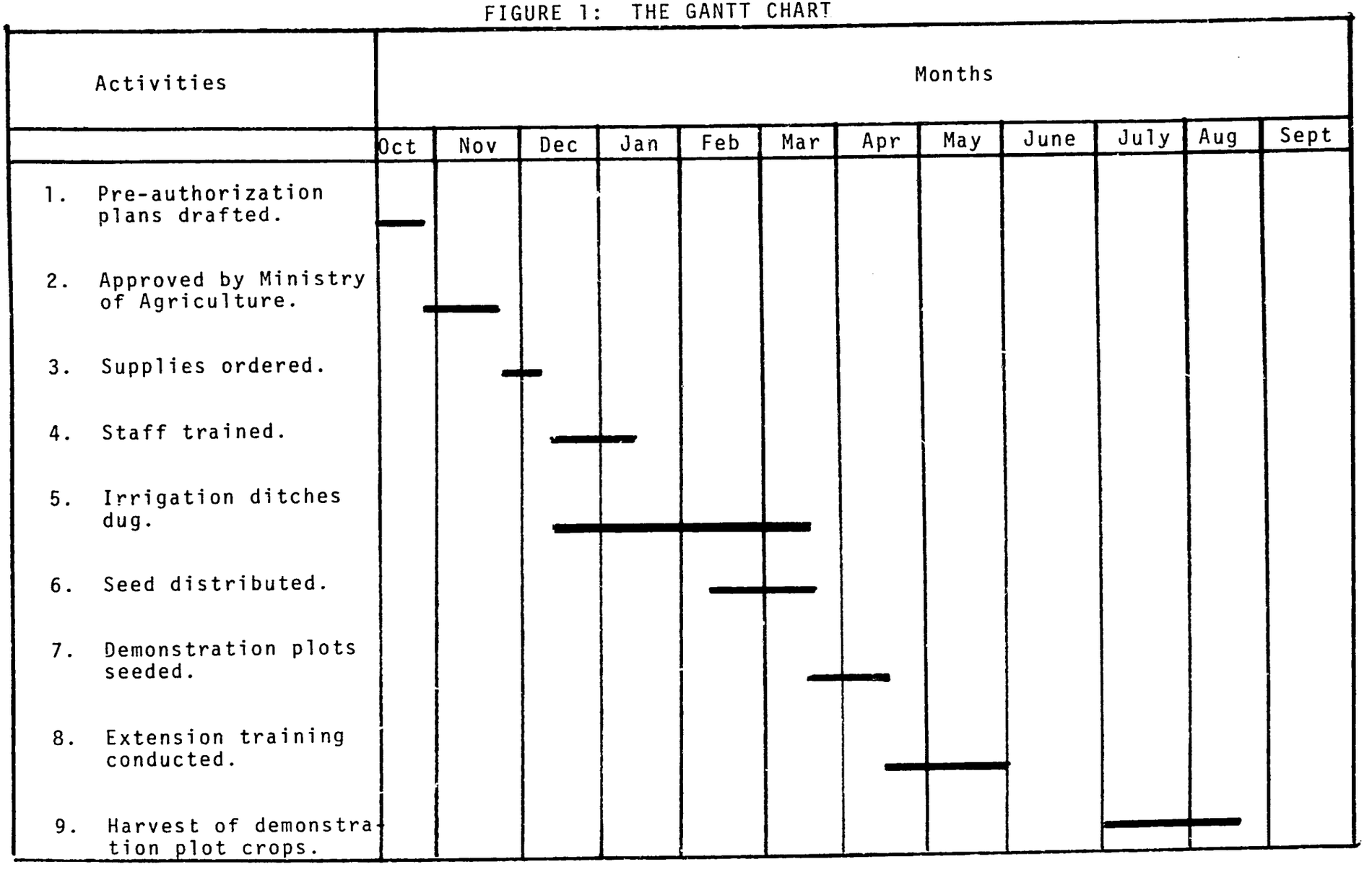
-- how long in advance must equipment and supplies be ordered and shipped?

-- how can resources be shifted to meet an earlier project completion date?

Early graphic techniques, such as the Gantt Chart and flow chart can show some of these things, but not all of them.

The Gantt Chart, created by Dr. Henry Laurence Gantt, is still in wide use today, and is one of the simplest, easiest to use graphic scheduling techniques. As shown in Figure 1, the Gantt Chart is similar to a bar chart in format, with each bar indicating major events which will take place in a project, and the time required to complete each event. This illustration is simplified, and no attempt has been made to list all the activities which would take place in an actual project. The virtue of the chart is that it facilitates planning, that is, analyzing the project, breaking it down into the steps or operations necessary for its completion, and sequencing the steps, or finding the order in which the steps must be done. (383, p. 39) It also facilitates scheduling, that is, estimating the time necessary to complete each step and the project as a whole. A great weakness of the Gantt Chart, however, is that it does not show interdependencies between events, so that people looking at the chart cannot determine how their activities will influence other people, or how they will be affected by the actions of others. (382, pp. 21-22)

FIGURE 1: THE GANTT CHART



Flow charting, or workflow process charting, is a second widely used graphic technique. This is often used in management or program analysis studies to examine, for example, the work steps performed by each person in an office or division, or each office in an organization, with regard to a specified function. It may be useful in locating time lags, duplicated efforts, and unnecessary clearance points. It will be seen that the flow chart method is limited by dealing only with a small aspect of a project or program or by dealing with larger aspects only superficially. Any number of other activities related to the one which is flow charted may be occurring at the same time, but the flow chart does not tell you what they are or what is their relationship to the other aspects of the project. Neither does it indicate time requirements. Figure 2 illustrates the processing of patient records from a rural clinic to the responsible Ministry of Health Office.

FIGURE 2: FLOW CHARTING (WORKFLOW PROCESS CHARTING)
RECORD PROCESSING OF CLINIC PATIENT

RECEPTIONIST	PATIENT	NURSE-MIDWIFE	CLINIC FILE CLERK	REGIONAL OFFICE	NATIONAL OFFICE
1. Greets client, provides medical and personal data forms.	2. Completes forms.				
3. Checks forms for completeness and accuracy. Places in Nurse-Midwife's work basket.		4. Reviews forms prior to treating or counseling client. Notes actions, places in outbox.	5. Records data in clinic master file; forwards necessary data to Reg. Office.	6. Extracts necessary data, compiles quarterly report. Forwards data to National office monthly.	7. Prepares annual and special reports and budget submissions.

PERT derives some of its characteristics from both the Gantt Chart and the flow chart, but combines these characteristics in such a way as to provide a more complete scheduling system than either of its forerunners. It separates the planning of the sequences of project activities from the scheduling of times for each activity, and clearly indicates interdependencies between jobs. By setting out the complete project plan for the examination of everyone involved in the project, it facilitates communication and through participation, helps to make the project belong to the people who will carry it out. It enables resource and time constraints to be evaluated. If several operations depend on a truck, but only one truck is available, this is a resource constraint. If fertilizer must be delivered by a certain date, this is a time constraint. (382, pp. 21-22)

2. Understanding the Basics of PERT

Before a technique such as PERT can be applied, it is essential that the objectives for the project are established - even if the objectives may be modified at some later date due to changed conditions. The determination of objectives is the most important single step in the management process. All organized activity must have as its motivating and guiding force the attainment of some predetermined objective, which will be the measure by which progress is determined. Peter Drucker has stated that:

> "Objectives are the basis for work and assignments. They determine the structure of the business, the key activities which must be discharged, and above all, the allocation of people to tasks. Objectives are the foundation for designing both the structure of the business and the work of individual units and individual managers." (384, p. 101)

With the objectives of the project firmly in mind, the use of PERT can begin. In using PERT, the planning of a job is separated from its scheduling. Briefly, the steps involved are as follows (383, pp. 9-10):

1. Analyze the project. Determine the individual activities or operations that are required.

2. Show the sequence of these activities on a chart called a network.

3. Estimate how long it will take to complete each activity.

4. Perform simple computations to locate the critical path (the chain of interdependent activities that determines the duration of the entire project). This step also provides other information that is useful in scheduling the project.

5. Use this information to develop the most economical and efficient schedule for the project.

6. Use the schedule to monitor job progress and to take corrective action.

7. Revise and update the schedule as needed throughout the execution of the project.

Each of these steps will be worked through in turn and related to a development project.1/

a. Analyzing the Project

The simplest and most effective way to begin is to develop a Work Breakdown Structure (WBS). This is a means of getting down on paper the major needs of the project. This can be done in a form similar to an organization chart. As depicted in Figure 3 it shows what is required in a project, but does not give times or interrelationships of components.

The purpose of the WBS is to list all of the major resources which will be used in a project. When this is done, there is less chance of omitting critical factors from the network diagram which will be developed. It is advisable to develop the list of resources needed in cooperation with specialists or people who are knowledgeable about the project needs, such as number and type of personnel and other resources required. Early and effective communication will help avoid problems in later stages of a project. However, a balance must be struck between listing all of the resources required, and listing too few to give an understanding of the project. Some practice in using PERT will help the manager to know just where to stike that balance.

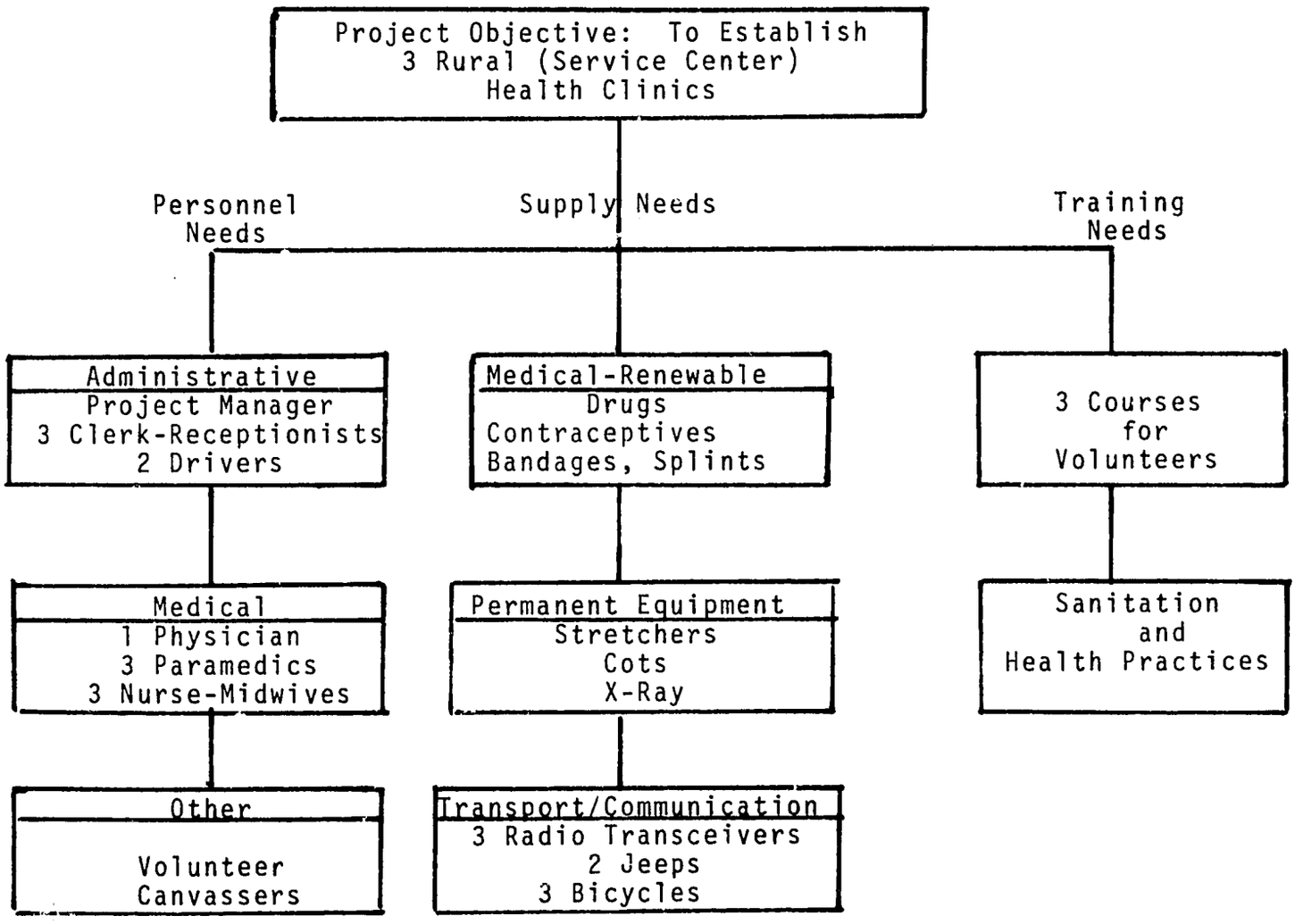
Figure 3 provides a simplified listing of some of the inputs for establishing three rural service-center health clinics. It indicates the major personnel, supply and training needs necessary to have the clinics fully functioning. Equipment, documentation and other categories may be added as required by specific projects. It is not necessary to list components in any ranked or sequential order at this stage. The list will have to be reworked as new thoughts occur in any event. When the major components have been listed, the second part of step one can be undertaken, This is the listing of all major activities in the project. Activities consist of such things as:

-- securing approval of the project plan;

-- obtaining the signature of a contract or subcontract;

1/ Earl M. Kulp and Kenneth F. Smith have been two of the pioneers in the application of PERT, as well as other modern management techniques, to agriculture and rural development projects. See 46 and 385 for a fuller description of their respective approaches.

FIGURE 3: WORK BREAKDOWN STRUCTURE

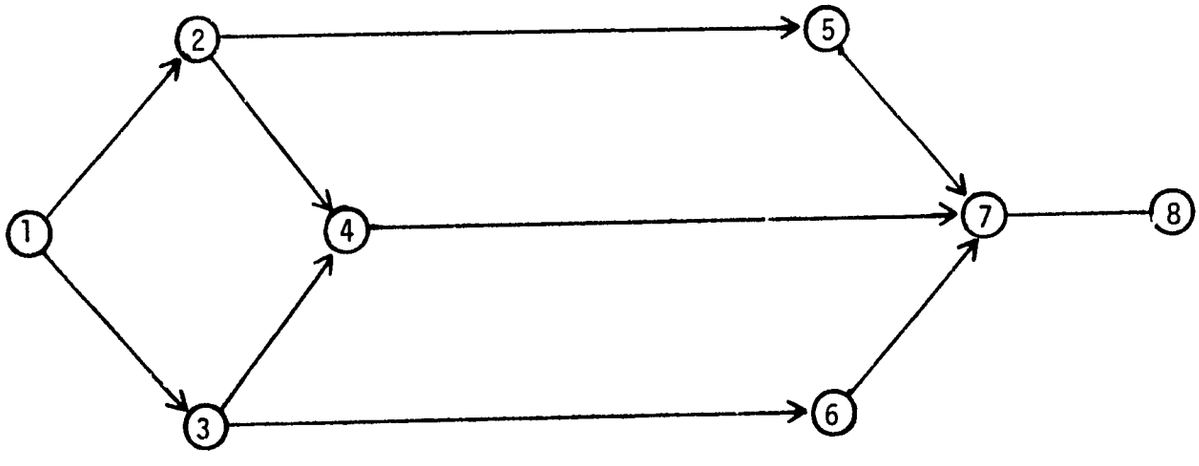


-- effecting the purchase of land, equipment or supplies;

-- preparing a training course.

Again, the list does not have to be in sequence initially. However, when all major activities are listed, they must then be put in sequence. This is done by constructing a network. Networks consist of events connected by activities. Within a network, events are represented by circles, and activities are represented by arrows, which link circles. Figure 4 shows a skeletal PERT network. Event 1 indicates the beginning of a project, event 8, the end of the project.

FIGURE 4: PERT SKELETAL NETWORK

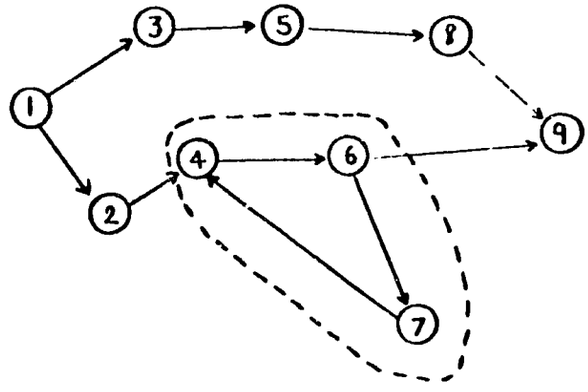


b. Building a Network

Events show points in time at which some activity is beginning or ending (such as, land purchased or course completed). They do not use up time or resources. Activities start and end in an event, but they do use time and resources. Activities are numbered according to the event with which they begin and the event with which they end. In Figure 4, activity 1-2 is the activity beginning with event 1 and ending with event 2; activity 4-7 begins at event 4 and terminates at event 7. Each event is numbered within the circle, and the numbering sequences generally goes from left to right and top to bottom, as in Figure 4. Only one activity can be shown by one arrow, and no activity can loop, or double back, to an event which has already occurred. Figure 5 shows activities 4-6, 6-7, and 7-4.

Event 6 must follow event 4, and event 7 must follow event 6, but event 7 cannot lead back to event 4, which has already been completed. Otherwise, the project would never end.

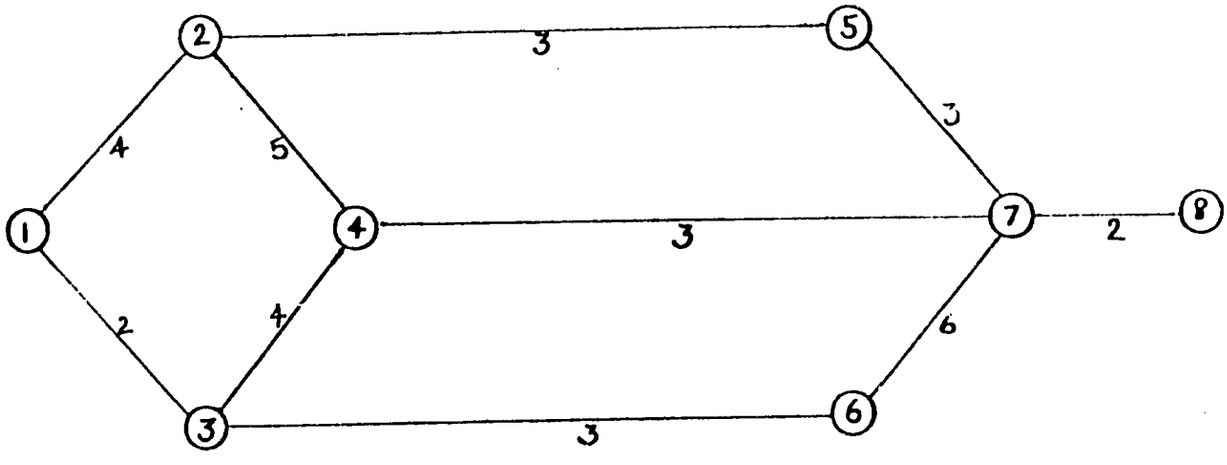
FIGURE 5: A PERT LOOP - AN IMPOSSIBLE SITUATION



c. Estimating Activity Time

From Figure 4 it is possible to tell only the number of identifiable activities in the project and which activities are interrelated. Flesh must now be put on the skeletal network. One of the first things is to list time estimates (Te) for each activity of the project. These estimates may be in terms of day, weeks, months or whatever unit of time is appropriate for a particular project. Months are used in this example.1/ The time estimates for each activity are written on the arrow between the events. Activity 1-2 requires 4 months, activity 1-3 requires 2 months, and so on.

FIGURE 6: PERT NETWORK WITH TIME ESTIMATES



1/ Kulp finds that weeks are the most useful unit for estimation of activity times in most rural development projects. (46, p. 440) However, whether months, weeks or days is selected will depend on several factors, including degree of detail one wishes to display, monitoring needs, the nature of the project, and the level of management at which the chart is used.

d. Determining the Critical Path

Once realistic time estimates have been developed for each activity in the project, it is possible to estimate how long it will take to complete the entire project. This is done by determining the Critical Path (CP). The Critical Path is found by adding the times of those activities which form the longest time span from the beginning event to the final event in a network. It is necessary to trace all of the alternate paths in the network to determine the longest one. The times of alternatives in Figure 6 are added to determine the CP, as follows:

Alternative 1	Alternative 2	Alternative 3	Alternative 4
Step 1-2 = 4 wks.	Step 1-3 = 2	Step 1-2 = 4	Step 1-3 = 2
2-4 = 5	3-4 = 4	2-5 = 3	3-6 = 3
4-7 = 3	4-7 = 3	5-7 = 3	6-7 = 6
7-8 = 2	7-8 = 2	7-8 = 2	7-8 = 2
14	11	12	13

Alternative 1 is therefore the Critical Path, as the project cannot be completed until the longest set of interrelated activities is completed.

e. Developing a Schedule for the Project

At this point, determination of the Critical Path allows a good estimate of how long it will take to complete the project. A schedule is formulated by assigning beginning and ending dates for each activity. If the project has a rather firm completion date requirement, it is usually best to start with that date (or an earlier one, if there are many uncertain time estimates or difficult intermediate deadlines) amd to work backwards from finish to start. Alternatively, the earliest possible start date may be chosen and the schedule developed accordingly.

f. Using the Schedule to Monitor Progress and Take Corrective Action

There are several ways of using PERT as a monitoring device. Two of the most effective are to use the diagram with a time chart superimposed; or to use a tabular schedule form. The first method, while easier to follow visually, requires more work if schedule changes are called for, because the diagram must be redrawn each time. The tabular schedule is more widely used for this reason. Figure 7 uses the time and activity data given in Figure 6 and provides for a progress and monitoring report in a tabular schedule format.1/

1/ More sophisticated schedules are possible, on which the earliest and latest start and completion dates for each activity, amount of slack time, and other data useful in monitoring, can be indicated. These will be provided in training modules, in the detail clients' needs dictate.

FIGURE 7: SIMPLIFIED TABULAR SCHEDULE FOR PERT PROGRESS REPORTING

Project Name: Millet Pilot Demonstration
Responsible Unit: Djouri Agricultural Extension Division

Activity					Planned2/		Actual3/	
Critical	Beginning Event	Ending Event	Description1/	Duration	Start	Finish	Start	Finish
*	1	2		4	July 1	July 28		
	1	3		2	July 1	July 14		
*	2	4		5	July 29	Aug 31		
	3	4		4	July 15	July 29		
	2	5		3	July 29	Aug 18		
*	4	7		3	Sept 1	Sept 21		
	3	6		3	July 15	Aug 4		
	5	7		3	Aug 19	Sept 8		
	6	7		6	Aug 5	Sept 15		
*	7	8		2	Sept 22	Oct 4		

Comments: Activity #

1/ For simplicity, descriptions are omitted from this example.

2/ These dates are calculated from the network diagram estimates.

3/ These will be filled in as the project progresses and corrective action taken where indicated.

g. Revising and Updating the Schedule

It was noted that communication with all the people responsible for implementing the project is essential in obtaining realistic time estimates during the planning stage. To insure that each activity of the project proceeds to be implemented as scheduled (or ahead of schedule), contact with the people responsible for completing the project is a continuing need. This will alert the project manager to problem areas and indicate where replanning and reallocation of people and resources is necessary. The network diagram shows where there is slack time in the project - that is, time involving activities that are not on the critical path. Therefore, in addition to concentrating on critical path activities which determine total project time, the manager can divert resources from non-critical to critical activities.

The network and schedule should be revised to reflect changes in project operations for two reasons: first, and most importantly, as project conditions changes, activities that were originally non-critical can become critical. For example, if the arrival of fertilizer is delayed due to lack of transport, all other activities depending on the arrival of fertilizer would also be delayed. If the delay is a long one, this could become the critical path. Such changes call for revised plans by the project manager. Secondly for accurate project reporting, it is necessary to have a record of changes from the original plan. Where certain problems recur, the project manager is alerted to the need to examine his assumptions and methods, and to seek better ways of attaining objectives.

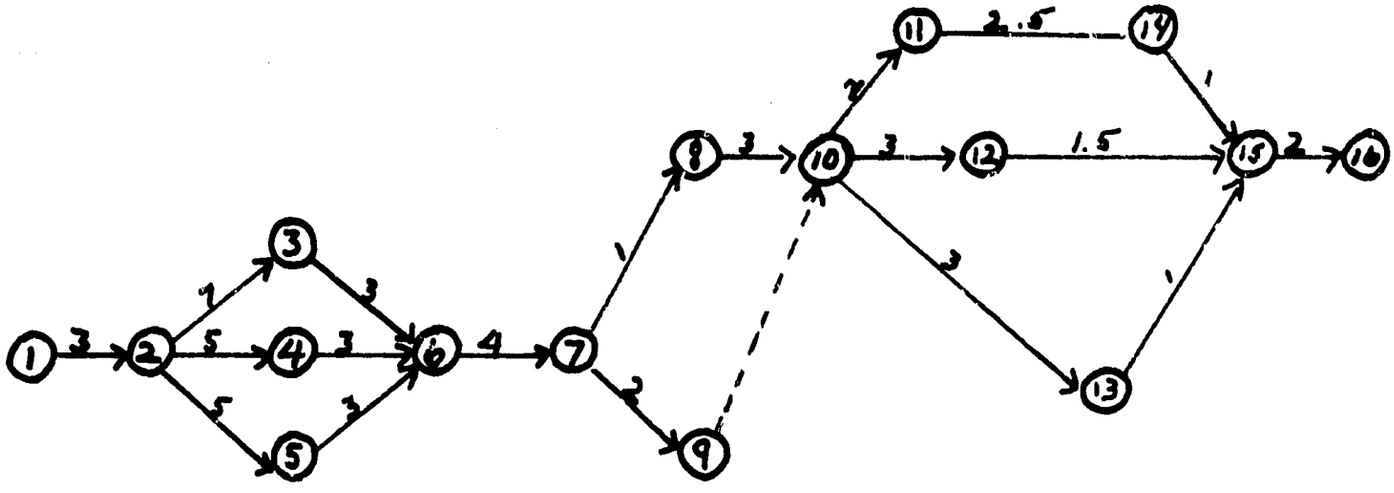
3. Applying PERT to a Development Project

It is now possible to examine how PERT can be applied to development projects. The example used will have as its objective, "To have conducted a training course for 100 indigenous midwives in Hillside Province." It is a simplified version of one country's actual program for training traditional midwives in order to improve delivery of family planning services.

In this illustration, activities, rather than events, are emphasized. This is because activities are the real essence of projects, whereas events are man-made concepts. Secondly, if one attempts to create a realistic network by listing all the events, some critical activities may be omitted. By concentrating on activities, one also does not have to wait until an event has occurred before corrective action can be taken. Events, however, may be emphasized in reporting to high levels of management, because there the concern is usually with the significant milestones of the project, rather than with the details of how those milestones are reached.

Even this simple project, with its nineteen activities, presente a variety of possibilities to those who planned and implemented it. For example: was it necessary for each activity to occur in sequence, or could some take place concurrently? Could total project time be shortened? What activities should receive priority attention? Figure 8 indicates the way the project was eventually planned and implemented.

FIGURE 8: OBJECTIVE - TO HAVE CONDUCTED A TRAINING COURSE FOR 100 INDIGENOUS MIDWIVES IN HILLSIDE PROVINCE



TIME SHOWN IS IN WEEKS

Activity Code:

1-2	Secure approval for project
2-3	Conduct study, "Determining Attitudes of Indigenous Midwives in Hillside Province"
2-4	Conduct second study, "Determining Role and Positions of Midwife in the Community"
2-5	Conduct third study, "Development of Procedures for Training Midwives"
3-6	
4-6	Integrate findings of studies
5-6	
6-7	Prepare for conference to evaluate studies' findings
7-8	Hold conference
7-9	Formulate recommendations to government for further research
8-10	Develop training course outline
10-11	Prepare and launch publicity for course
10-12	Select and brief course instructors
10-13	Select and/or prepare course materials
11-14	Screen and select midwives to attend course
12-15	Transport instructors to course site
13-15	Transport materials to course site
14-15	Transport midwives to course site
15-16	Conduct training course

Analysis of the network shows that several activities could be undertaken at the same time, a factor common to most projects. For example, the three studies (activities 2-3, 2-4 and 2-5) began at the same time. Because studies 2-4 and 2-5 were completed in five weeks, while study 2-3 required seven weeks, one way of shortening the project might be to transfer people from the completed study to the one still in progress. Network analysis makes evident many such possibilities, and opens more options to project planners and managers.

Preliminary estimates for construction of a simple network may be done by a project planner on the basis of the best readily available information. For truly realistic estimates of project duration, however, it is essential to prepare estimates with the people responsible for carrying out each specific activity. Estimates may still contain some inaccuracies, but if people are responsible for estimates of their own work, it is more likely that they will try to meet their own deadlines. It is the responsibility of the project planner to insure that each person understands what is required of him or her, and makes an estimate accordingly. To minimize the effectiveness of bad estimates1/:

(a) Require an estimate for each individual activity. For a fairly large or detailed activity, it may be desirable to create a sub-network.

(b) "Normal" conditions should be emphasized for time estimated unless there is a clear reason why action would be faster or slower than usual.

(c) When estimates are being obtained from people, the planner should not take activities in sequence, so that the estimator will not add up total time in his own mind as he goes. Should he do so, his estimates will be affected, because he may not want it to seem that his activities will require too much time if they would cause the project to be delayed.

(d) If efficiency factors are assumed, they should be made explicit. For example, if a skilled craftsman or experienced worker is to perform a task, rather than a newcomer, this should be indicated.

(e) If sub-contractors are involved, it may be best to get a written estimate. Otherwise criteria to judge their efficiency in meeting deadlines will be more difficult to obtain.

(f) Do not consider known calendar termination dates, or this will bias the outcome.

1/ 382 and 383 are drawn on for these helpful guidelines.

(g) Be sure not to leave out certain activities which are frequently omitted from time estimates, including (383):

- -- review and clearances (especially at headquarters)
- -- material procurement
- -- revision of plans
- -- preparing reports; getting ready for meetings.

The planner should insure that these possibilities are considered by the people from whom he gets time estimates.

Because development projects are often plagued by time uncertainties, there are times when it would be a good idea to get more than one time estimate for activities. The PERT method provides for this by using three time estimates: the optimistic time, the pessimistic time and the most likely time. For beginners in the use of PERT, however, it is more advisable to use a single good estimate. When sufficient experience in networking has been gained, more sophisticated measures with three estimates can be applied.

In some cases, a good way to get realistic time estimates is to hold a planning meeting with representatives of the organizations who will be involved in the project. This can have the advantage of each of them feeling they are part of a team, and it also facilitates direct communication if differing time estimates are made for specific activities. Further, the organizations will be able to see how their activities are interrelated. Before the final draft of the network is completed, it may be necessary to call several planning meetings, because when the planner begins to compile the network with the information he has assembled from many sources, alternative ways of achieving project objectives will come to light. This may mean more work for the planner, but it can save months of wasted effort in implementation. A final network cannot be drawn during a meeting; rather, agreement on principles of operation and preliminary time estimates should be sought. The planner will make the necessary fine adjustments over a period of time, on consultation with the implementers as necessary.

It is worth repeating that the project illustrated in Figure 7 is greatly simplified. Most agricultural and rural development projects last much longer than 28.5 weeks, and involve dozens, hundreds, even thousands, of separate activities.1/ Because of this, there are many activities which can be scheduled concurrently, and many more opportunities for the application of time-saving techniques through PERT analysis.

1/ A point is reached beyond which manual application of networking is not feasible, however. For an extremely complex, long-range undertaking, a computer application of PERT would be required to schedule all the details of project tasks. For review purposes, major milestones could still be manually charted.

ANNEX F

THE ASIP RESEARCH METHOD

The research method used in this study is based on four principles.1/ One principle is to use an inductive rather than a deductive method. A second principle is to compare theory and practice to see what light theory throws on practice and to see what light practice throws on theory.2/ A third principle is to learn from success.3/ A fourth principle is that it is not enough to tell people what has to be done; they must also be told how to do it. These principles will be outlined here and then individually discussed in detail below.

Induction is a method of knowing that is distinguished from deduction. Induction involves examining and describing what was done in practice, evaluating and analyzing practice to identify the conditions and activities that were significant in each case and then finding the common themes or ideas that run through some or all of the conditions or activities. These themes are then formulated as generalizations. In the process, the conditions to which these generalizations can be applied are defined.

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1. Principles in this research are generalizations which refer to actions or norms that people can take or follow in order to improve their performance and achieve their goals. They are distinguished from other types of generalization which may be true but are not applicable as guides to conduct.

2. Theory as used in this research is any prescriptive or normative statement suggesting what ought to be done. It is distinguished from practice--what is done. This definition of theory includes a great deal more, e.g., recommendations of advisors, critics and international assistance agencies, than what is here called formal theory, e.g., economic, growth, psychological or management theory or models.

3. Success in this research means anything that in practice resulted in movement towards a significant developing country objective. Success does not imply an ideal state nor does it necessarily imply doing as well as or better than others such as those from whom an idea was borrowed. It simply means getting people where they want to go.

The comparison of theory and practice is one way to begin the process of induction since theory offers a large body of ideas as to what is significant in particular circumstances. The comparison of theory and practice helps to confirm, reject or determine the limitations of theoretical statements. The comparison of theory and practice helps the researcher to understand the generalizations he has developed and their application. Thus, the comparison of theory and practice is a central theme of this research rather than a formality confined to a separate section on empirical results.

Learning from success means that prescriptions will be based on what has worked in practice. Experience will be examined and the successes picked out. Since there are no 100 per cent successes, this means separating the successful elements of projects and programs from what must always be partial failure. It also means separating out those elements of success that are transferable, i.e., usable by people in other situations to improve their own performance. These transferable elements of success must be compared to cases of failure also in order to show that they are causes of success and not just common features of many situations, successful and failed. Once these elements of success are identified, they must be transformed into principles that can be applied elsewhere. This research will be concerned only with principles, i.e., those generalizations that can be acted on by people to improve their ability to achieve their goals.

It is not enough, however, to simply draw conclusions about what works and tell someone to keep these conclusions in mind. Induction means more than just summarizing; it means generalizing, going to a higher level of abstraction. The reader needs guidance on how to get back down again to concrete situations. Thus, the fourth principle of this research is to provide guidance on how to implement the conclusions reached.

These are not separate steps that are taken in one, two, three order. All four principles are continuously used to support each other. By going through a series of successive approximations, one principle after another is applied and reapplied. Gradually, the data are organized so that distinctions become sharper, common elements clearer, and why things work as they do becomes plainer.1/

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1. This is inherently a process of qualitative improvement. The original data are qualitative, the final results are qualitative, and each of the results achieved between these two end points is qualitative. Hence, nothing is gained by trying to use statistical techniques in this process. Such efforts would involve translating qualitative into quantitative data and retranslating at each

This method was not developed from scratch for this research or by our project. On the contrary, its basic components come from two main sources.

Two of the principles of this research, induction and the comparison of theory and practice, are methodological principles developed by John Dewey and others and applied by John Commons, Welsey Claire Mitchell, Thorstein Veblen and other institutional economists as well as by others. A recent application of this method was in Albert Waterston's Development Planning: Lessons of Experience.

Experience with Development Planning showed, however, that many people seemed unable to learn from it. They missed the most obvious lessons and were at a loss to apply what they did learn. Out of an analysis of these problems and of what made training and learning successful came the other two principles that underlie this research method: learning from success and discovering how as well as what to do.

Although the four principles underlying this research can be justified separately, the true justification of the method is that the four principles work together as a method. An article based on these principles, "A Viable Model for Rural Development," by Albert Waterston (Finance and Development, Vol. 11, December 1974, pp. 22-25), was not only favorably commented on by people concerned with rural development in many countries, but it resulted as well in an invitation to come to one country and help with rural development. Presentations of findings based on this type of research have been highlights, according to both staff and students, of courses for professionals at both the USDA and USAID. An early collection of findings was the basis for a successful training course for agricultural managers, including chief planners and other senior officials, from developing countries. A group of participants from one country presented a request to their government to bring this training to their country.

The following is a discussion of each of the four principles in detail.

1. Induction

Two ways of knowing or understanding have traditionally been associated with the idea of scientific method: induction

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approximation. This would be not only costly; the process of quantification results in a loss of information as well, often the very information needed to make the next step.

and deduction. Of the two, deduction gives the more certain answers if one agrees with the major premises, e.g., as in geometry. The advantage of deduction is that it is a matter of logic and can be set out for public review. Flaws in the logic then become relatively easy to catch. Hence the certainty of the answers deduction provides. The ultimate step in deductive logic is translation into purely symbolic forms such as the mathematical translations of economic theory developed by Paul Samuelson or the symbolic logic translation of Kenneth Arrow. Thus, deduction includes more than formal derivations using Aristotelian Logic. It includes the use of modern systems of logic and mathematical equivalence and logical analysis as well. The weakness of deduction is that it provides no way of verifying the major premises, either their truth or their limitations.

The advantage of induction is that it provides a means of establishing major premises. By looking at what happens in reality, themes that apply to a range of situations can be identified and generalizations made. The weakness of induction is that it can never be certain. No matter how many cases are found to fit the generalization, until all cases have been examined, it is possible for an exception to occur. Generally, it is impractical to examine all cases. Thus, in induction one looks for generalizations in which the preponderance of the evidence agrees with the generalization, and exceptions limit the generalization but do not disconfirm it. In this research, the preponderance of the evidence confirms a hypothesis when the exceptions can be shown to be governed by a different principle or to be operating under different conditions.

Thus, induction has two parts. One part is the establishment of the generalization. The second part is the definition of the conditions to which the generalization applies. These two parts are developed simultaneously since the establishing of a generalization means testing it under or for defined conditions. The defined conditions become part of the generalization whenever a test confirms the hypothesis. When a test disconfirms the hypothesis, the defined conditions of the test serve to limit the generalization, or, if the test covers all conditions, disconfirms the hypothesis.

The process of working inductively has four steps.1/ The first step is to collect and examine--to prepare--the data in order to determine what is relevant and usable. In this research, preparing the data will mean writing a narrative, often pieced together from many sources, describing

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1/ These four steps were isolated by Albert Waterston.

what happened. The criteria for what is included in this narrative are: (1) what theory, including the hypotheses of the researcher, suggests will be important; (2) elements that are common to a number of cases; and (3) what the participants felt was important, to the extent that this can be determined.

The second step is to evaluate the material to determine whether, or in what senses, the material is relevant to the purposes of the study. Here "relevant" means relevant to successful agricultural and rural development. Different observers may disagree. Success in the short run may be failure in the long run and vice versa. The activity may have succeeded but the costs were so high that the lessons are irrelevant. And since nothing is ever 100 percent successful, it is necessary to separate successful aspects from failed aspects of an activity. It is also necessary to determine, to the extent possible at the time, which successful aspects are transferable, i.e., could be applied by others in other situations.

A third step is to analyze the material to find the components that were crucial to achieving whatever successes the description and evaluation determined were present. Again, the comparison of theory and practice is important since theory offers many suggestions as to what should be important in these situations. Comparison of cases is also important because it may not be obvious how important a particular step is until it is found to have occurred in many situations. Finally, analysis asks why; why did this component make a difference? It is by digging into why things happened that causes are identified. Analysis is a matter of emphasis, of trying to find out what was most important in particular cases.

The final step is synthesis or generalization. This is a putting together of what was learned about what made particular successes work to get a principle that applies to a large number of cases. Formally this is done by further comparison of cases and of theory with practice. In practice, ideas for principles arise during the preceding steps. If adequate ideas don't come, then the preceding steps are continued and refined and more cases added. When ideas arise, they are treated as more theory and are compared with more cases in order to determine whether the idea is correct and, if so, to determine to what situations it applies. It is the process of synthesis that takes ideas beyond the confines of specific situations, models, and conditions. At a higher level of abstraction, many conditions or specifics of individual cases become irrelevant. What is left is the critical idea and the smaller number of conditions that are essential in all cases.

Thus, combining induction with learning from success, principles are identified by examining a large number of

examples of agricultural and rural development activities in developing countries. The elements of each example that represent something done successfully are identified. For each success, the conditions responsible for success are identified. On the basis of the conditions for success that are common to several situations, principles are drawn. These principles are then compared with theory and with less successful practice to insure that they do, in fact, correctly include the variables crucial to the successes.

The conditions under which these principles hold are established by examining the conditions under which the component successes took place. The wider the range of conditions where the relevant type of success took place, the more sure the principle is. Thus the research emphasis is on identifying successes from as wide a range of circumstances as possible. Where some successes do not come within the scope of the principle, other principles are developed and the nature of the difference between the two (or more) types of cases is defined.

All this may seem complicated but, in practice, is both fairly simple and natural. Induction is, after all, the way we all learned to speak our first language. We imitated sounds, selected certain sounds as significant, analyzed the conditions where those sounds got a desired result, and then generalized our use of these sounds by applying them in situations we had not previously observed. We frequently tested our ideas. In the process, we learned words and structure and also the conditions where particular words and structures were appropriate. All this was done without any instruction on methodology.

What makes this method seem strange and complex is the ten to eighteen years of school and longer period in the home where the emphasis was on either deduction (e.g., mathematics, grammar, and later economics) or authority--doing as we were told. To return to induction is difficult at first. It takes quite a bit of practice before one can stop thinking about the steps--applying them mechanically--and begin applying the method authomatically and as a unified whole. It also takes time to weed out the vestiges of reliance on deduction and authority that creep in when one isn't careful.

2. Theory and Practice

The use of theory or the comparison of theory and practice that has been discussed above is quite different from the usual use of theory in academic environments. Academic studies usually rely on deduction and logical analysis based on formal theory as a way of developing hypotheses. Since formal theory is itself a deductive and logical analysis of other premises, academic research is more technique-oriented than practice-oriented.

Theory confronts reality once, at the time of the regression or other comparison with experience. In the method used in this study, theory is used less formally but more completely.

In several places above, the use of theory as a starting point for analyzing and comparing data was mentioned. Since the point of this research is to find principles that correspond to experience, theory is the obvious source of ideas. Unfortunately, perhaps, there is far more theory than is useful for promoting successful practice. Ideas about what can be done are easy to generate by simply suggesting the avoidance of whatever error one finds. Formal theory is also a fertile source of ideas. In practice, however, few of these ideas identify aspects of a situation that are critical to success.

Since not all theory is useful, it is necessary to compare theory and practice to find out what theory is useful. This is the traditional use of comparison. In this research, however, instead of developing separate hypotheses and testing them, literally hundreds of ideas are tried. The objective is not to test a particular idea but to use tests to screen ideas in order to identify the useful ideas. Testing goes on until useful ideas are found.

The key to successful testing of an idea is to test it against as wide a range of practice as possible. This is important because most ideas are developed in a particular environment. They seem sensible in that environment. It is only by testing against more dispersed cases that limitations are found. For instance, many observers see low morale, high turnover of staff, poor performance, low salaries, and little practical knowledge among extension agents. The observers put all this together and conclude that extension services should pay salaries adequate to retain good people and maintain morale and should provide more training. Who can argue with that? In practice, virtually no one does argue against it. But some of the most successful extension programs have used unpaid or low-paid farmers as extension agents. These farmers may have had little or no formal education and little training and yet are more effective field agents than the professionals. The most that can be said for the observers' conclusion above is that it is a <u>hypothesis</u> about formal organizations. It says nothing about extension success. This, however, is only detectable if more than "regular" extension services are considered when theory is compared to practice.

Among the ideas that are subject to testing in this way are those of the researcher. It is by entering one's own ideas into a method in the same way that others' ideas are entered that one can hedge against the possibility that bias will play a significant role in the outcome. Again, this is a significant difference from deductive methods that require

a considerable intellectual investment in a single hypothesis before a test is even attempted.

A third use of theory is to understand and guide the use of the principles that are developed. Often people are reluctant to accept even a good empirical result if they are doubtful about why the fit is good. For instance, the economics professional has generally preferred the Keynesian rationale for policy to the monetarist empirical results. This is not entirely unreasonable. Relying on empirical connections alone can leave one in the position of the plumber who found from experience that hydrochloric acid would clear stopped drains but who didn't know that it also dissolved pipes.

3. Learning from Success

There are two types of experience that people can learn from: success and failure. The advantage of learning from failure is that it is relatively automatic. If you burn your hand, you don't usually put it on the stove again. The disadvantages of learning from failure are: (1) the pain of the lessons; (2) knowing what not to do does not tell you what to do--e.g., learning not to touch a hot stove doesn't teach you how to cook; (3) studying failure tends to produce bad mental habits and attitudes such as fear of failure, fault-finding, blaming others, and low self-esteem. None of these is conducive to successful action or learning.

The advantage of learning from success is that it offers clues as to what to do as well as what to avoid. Further, it produces a healthier, more positive frame of mind that is itself an aid to successful activity and learning. One problem in studying success is that the causes of success are rarely obvious. Simple imitation or making a model out of the success, as in the term "Chinese Model," often does not work due to differences in the conditions where the model is applied from the conditions under which the model was developed. For successes to be transferred and applied to new situations, they must be transformed into principles that extract the key lessons of success from the specific examples. How this is done was described in the section on Induction.

In practice, there are no pure successes. Thus, the task of identifying successes means separating from the partial successes those elements that worked. This is often difficult, since there is a tendency for the failure to conceal the success. It is entirely possible that the leadership on the Titanic was generally excellent. If so, the failure of someone to miss an iceberg has concealed this from us.

But finding successes is not enough to establish principles. It must not only be shown that successes occur when the

principles are applied, but also that failures occur when the principle is not applied. Thus, failures cannot be ignored. They are an important part of determining the conditions to which principles apply as well as determining the validity of principles. But failures are not a source of principles, because avoiding failures does not assure a successful outcome.

If people are to build on success, the conditions for success must be under their control. For example, a key condition for the success of some countries is the possession of a benign climate that does not suffer from droughts. But no matter how critical it may be in particular cases, lack of droughts cannot be a principle of successful development, since the presence or absence of snow or rain is not yet subject to human control. This does not mean that such conditions can be ignored; they may determine when principles of success can be applied. Further, principles can be developed about the identification of key resources and the use of the water available to a country. The ASIP concentrates on finding principles that can be applied to create new successes elsewhere and on defining the conditions under which those principles apply.

4. Explaining How

As discussed above, the generalization of principles raises the level of abstraction. This allows the drawing of common lessons from many cases. Because the lesson is common to many cases in various circumstances, there is increased confidence that the lesson is important. At the same time, abstraction allows the neglect of many of the conditions that were a part of the original cases. Thus, only essential conditions remain.

When principles are to be applied, however, it will mean returning to a world where the number of conditions relevant to a situation are greater than those that apply to the principle. Thus, the reader may need help to recognize the fit between a principle and a situation because of all the extraneous activities going on. The wide range of examples cited in the text in support of the principle should help here by showing the variety of circumstances to which the principle applies.

Even if the correct principle is identified as appropriate to the situation, however, that situation will include many conditions not covered by the principle. Thus, the principle cannot simply be applied; it must be adapted to the particular set of circumstances. For instance, it does no good to make provision of adequate salaries and training for extention agents a principle if, as is frequently the case, there simply isn't enough money to pay an adequate salary or enough

trained personnel to train everyone who needs training. For principles such as this to even be considered, there must be some guidance on where resources are to come from--what activities take priority in use of resources and in method. For example, there must be guidance on what activities are to be cut back or on how training can be made less expensive or simpler. These are the types of questions that will be considered in discussing how to implement principles.

In practice, every successful case used to establish a principle solved these how-to-do-it problems in some way. The same inductive process used to establish the principles will also be used to establish how to carry out the principles. Further, certain methods of implementation may apply to more than one principle. From these common solutions to problems of implementation, it may be possible to extract principles of implementation. In summary, three types of guidance will be offered on implementing principles: (1) the specific examples of how it was done that are used to justify the principle; (2) any conclusions or generalizations reached about how to implement a particular principle; and (3) principles of implementation in general.

5. <u>The Method in Practice</u>

In practice, this method of doing research begins by developing a classification list of the subjects to be researched. For instance, major heading 22 used in the ASIP is:

22. Policy Instruments and Measures
    - a. Direct Public Investment
        1. Public production enterprises
        2. Irrigation, land settlement, etc.
        3. Infrastructure
    - b. Incentives
        1. Price policies
        2. Tax policies
        3. Marketing measures (storage)
        4. Credit measures
        5. Measures regarding agrarian structure
        6. Other
        7. Disincentives
    - c. Regulations
    - d. Provision of services
        1. Research
        2. Education and training
        3. Extension and information services
        4. Other

Other major headings with subheads are for subjects like Strategy, Objectives, Rural Development, Organization, and Politics.

Once a preliminary classification list has been developed, research begins. Sources are read, passages marked, and the marked passages are photo-copied and put on five by eight cards. Two examples of such cards are on the next page.

In the top left corner is the file classification number for this card. The number corresponds to the heading typed at the top center of the card. Both number and heading are included, since the former facilitates filing while the latter facilitates the use of the card. Under the classification number comes either the word "theory" or "practice." Practice indicates that this card is about what has been done; theory indicates that the card is about what someone recommends doing or describes as a desirable norm or method. On the practice cards, there is also a designation of the country, project or region where the practice took place.

In the top right corner, there is an AG (for agriculture) and a number followed by a page number. The AG number is an identification number for the source from which the material was taken. These numbers are recorded on two bibliographic entry cards, one of which is filed by AG number and the other filed alphabetically by the name of the author. These numbers are used to keep track of sources while a paper is being drafted. Later they can be replaced by footnotes or other methods of citation.

There is naturally some overlap of topics in the file classification list and of theory and practice in the sources. Two or more cards may be made up to file in two or more classification categories. Passages can be divided to get separate theory and practice cards or the material can be assigned to the predominant category. In any case, it is more important to be sure the material gets included than that the classification be exactly correct. In practice, interactions among topics force the researcher to examine cards from multiple topics on most subjects.

The original classification is revised as necessary. Topics that are rarely used may be consolidated. New topics or subheads are added as research and writing determine that the topics are important. Excessive duplication of topics is eliminated. Generally, however, changing the classification list is kept to a minimum. The topics that provide the most obvious breakdown of the material rarely turn out to be the ones that are significant in determining what works. Thus, "improving" the classification has limited utility; the cards have to be sorted and resorted in use in any case.

22d(1)
Practice
Japan

Policy Instruments and Measures
Provision of services
Research

AG 209, p. 295

There is a parallel history of innovation and technical advance in Japanese agriculture. Western accounts of Japanese agricultural development after the Meiji restoration place much emphasis on the active role of government and landlords (Lockwood, 1954, 554; Fei and Ranis, 1964, 165). Japanese scholars do not deny this, but some have stressed that many important technical innovations came from the farmers themselves. Sawada (1964, 90) points out:

A successful land amelioration had been accomplished in several places, for instance, Ishikawa and Shizuoka prefectures, by owner-farmers in the early years of the Meiji era before they passed the baton to the government officials. The "regular planting" of rice seedlings took place in some districts as early as 1880's, long before it was embodied in some compulsory measures by the government. *Ensuisen*, a seed-selecting method using brine, had been contrived by farmers in a district in Kyushu before it was taken up by T. Yokoi, then the chief of a local experimental station. The improved plows which played the important role mentioned above, were invented by veteran farmers in Kyushu too, and propagated throughout the country around the middle of the Meiji era. The rotary weeder, and the treadle threshing machine, which saved much toilsome labour and raised production, were also invented among local people, and propagated rapidly.

22d(3)
Theory

Policy Instruments and Measures
Provision of services
Extension and information services

AG 877, p. 425

The U.S. extension model that American technicians attempted to transplant in Latin America perhaps could have succeeded under conditions similar to those obtaining in the U.S. in the 1940s and 1950s. The land grant structure was firmly rooted in the U.S. by then, there was a backlog of new technology to disseminate, the systems of rural credit and farm supplies had extended to all countries, most farm families had one literate member, and extension agents could count on a wide radio audience. I overheard one of the older, better known, Latin American administrators of agricultural institutions declare that the transplant would have done better if the technicians who brought it had been persuaded by an earlier American school of thought, and worried less about methods and more about improvising production programs for farmers who had no credit, no markets, no neighborhood fertilizer dealers, and who were visited rarely if at all by professional agricultural people other than the agent himself.

A relatively small part of the material reviewed is put on cards. Most of the material, in some cases all of it, is argument, opinion, criticism, introduction, summary, general description, or data of a background nature. The proportion of prescriptive material and examples of what was done is small. Even in case studies it is rare that fifty percent of the material if useful for this type of research. Ten to twenty cards per hundred pages reviewed is probably closer to normal. The value of a source is often determined by the detail of the illustrative examples rather than the substance of the material in the sources.

Once a significant number of data cards has been collected, writing begins. The classification information on the cards allows easy comparison of theory and practice and case with case. It also permits putting country and project cards together so that descriptions based on a number of sources can be built up. The views of various writers can be contrasted and compared. It is from these descriptions, comparisons and contrasts that successes are found and evaluated and the inductive process begins.

Another important aspect of the research in practice is the importance of personal contact with those with experience in particular countries or fields. There is no substitute for sources that can talk back, sources that can correct, amplify or provide alternative interpretations as an experienced professional can. Full use must be made of the range of expertise available. Fortunately, in Washington this range is great.

A specific example of a set of successful research findings was the discovery that there were two distinct types of agricultural extension. What made this finding difficult was the theory that defined extension as the effort to convince farmers to adopt a particular technique (technical extension). This theory is so predominant that even the people who were doing problem-solving extension described their activities as if they had just found a new way to carry out technical extension. In a sense, they were correct, but in practice the two methods were not only distinct but opposed.

The attempt to deal with this issue developed through several stages. First, a comparison of theory and practice led to a draft based on the conventional theory. As this was developed, especially on implementation issues, more and more anomalies and contradictions arose. As a result, a second draft was written which presented a distinction between cash crop and small farmer extension. However, this distinction did not yet permeate all the issues, and the result was confusion. This was compounded by exceptions, e.g., cases where cash crop extension worked for small farmers.

In preparing a presentation for a training course, the chapter was re-outlined to reflect the need for a special type of extension for small farmers and to specify some of the characteristics of such extension. Finally, the chapter was completely rewritten to reflect the distinction between technical extension and problem-solving. The advantage of this division was that it provided the basis for a clear distinction in theory and in practice between two different types of extension. The conditions to which each applied were defined and the particular problems of implementation of each method were set out. How to solve these implementation problems was discussed. Some of the principles of implementation were common to both cases; some were unique to one or the other. The results of this work will be found in the completed text.

ANNEX G

THE ASIP REFERENCE BOOK AND ASIP TRAINING 1/

In Phase I of the Agricultural Sector Implementation Project (ASIP), the ASIP staff prepared a Reference Book which embodies substantive information (gleaned from some 1,700 published and unpublished sources, as well as personal interviews) about the lessons of experience with agricultural and rural development planning and management. The Reference Book was compiled by comparing theory and practice in countries all over the world which have tried to plan their agricultural and rural development. (See Annex F, the ASIP Research Method.)

With the Reference Book as the main source, and as part of Phase II of the Project, the ASIP staff designed teaching materials and a course of instruction for transferring the information in the Reference Book to managers concerned with agricultural and rural development in developing countries. To test the ASIP approach and the teaching materials, the ASIP conducted a Pilot Training Course (PTC) in "Managing Planned Agricultural Development" in Washington, D.C., for a six-week period between July 21 and August 29, 1975. Twenty-one participants from six countries in Africa, Asia and Latin America attended the PTC. What follows briefly describes the ASIP training approach and how it was applied in the PTC, and explains the relationship between the Reference Book and the training approach.

1. The ASIP Approach

a. Introduction

The ASIP approach to training agricultural managers is a meld of a specific training process and a specific body of substantive materials. The training process, devised by Coverdale Organization of London, England, involves learning from experience by using a systematic way of getting things done to achieve objectives. The substantive materials are contained in the Reference Book compiled in Phase I of the Project.

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1. This note is in part excerpted from the ASIP Review of the Pilot Training Course. For the details on the course, consult the Review on the article, "Helping Bridge the Gap Between Planners and Farmers," by Albert Waterston, John L. Wilson and Wayne Weiss, Focus: Technical Cooperation, Supplement to International Development Review, No. 2, 1976, pp. 25-27.

b. The Coverdale Training

Coverdale training courses cover principles and practices for improving management capabilities. These may be grouped under seven themes: (1) setting group objectives; (2) using a systematic way of getting things done; (3) improving observation; (4) recognizing strengths and skills of those involved in joint activities; (5) planning cooperation for mutual benefit, (6) learning to listen actively; and (7) recognizing how to apply management authority effectively. These themes are included in tasks which are carried out by a method of learning from planned experiences.

In a Coverdale Course, tasks are used as the main medium of instruction. Whereas lectures are a good way to impart information, and case studies are useful for analyzing and discussing what has been done, tasks are considered best for imparting skills, since tasks involve learning-by-doing. One can gain knowledge from lectures and case studies about what should work, what went well or wrong, or what one ought to do. But to become skilled in anything, one must actually gain experience in tackling difficulties, getting things done, and bringing about improvements. If the skills acquired are to be practical, they must fit the participant's actual situation. Consequently, each participant in a Coverdale course is expected to bring his own knowledge and experience to a task and is never required to engage in "role-playing," i.e., to pretend that he is someone he is not. There is no right answer; on the contrary, there are usually a variety of acceptable answers.

One way to think of the task is by a skiing analogy. In teaching skiing today, one of the methods used is to start people out on short skis only a couple feet long. On these, the skier learns to ski on short, flat slopes. Gradually, he progresses to longer skis and longer, steeper slopes. The ASIP task is a short-ski, short-slope version of a real management job. Tasks differ from case studies which might be analogous to studying and discussing films of skiers in action. Tasks also differ from role playing, which would be like standing in a classroom and pretending to ski, going through the motions of skiing. Case studies and role playing are useful training devices, but they are not really skiing, nor are they really managing. Short skis may not be the same as full-size ones, but they really are skis. They really do provide experience at skiing. Similarly, the task is a real management job to do. The participant is not asked to study what others have done, nor to pretend he is something he is not. He is given a job where he can get real experience.

Unfortunately, people do not automatically learn from experience or use opportunities to get experience. Instead,

people working on jobs, especially new ones, bog down, get off the track, become confused, miss the point, or run out of time. Some individuals don't take part; some or all may fail to complete the task. But without taking part or completing the task, there is no experience of doing something. It does no good to be wearing short skis if you just stand watching other skiers. This is why coaching is important.

The job of the coach is not to help the participants do the job nor to supply answers or hints. The coach is there to see that everyone takes part and that the job gets done.

To carry out tasks, participants usually are divided into three or four groups, each with six or seven persons. Each group has its own coach. At any given time, all groups may be assigned the same tasks or different ones. The small groups and the task-centered learning method provide participants with opportunities to try new things and to practice those things that are found to be successful.

c. The ASIP Approach

In the PTC, most attributes found in the Coverdale courses were adopted, including the system of task-centered learning and the use of small groups and coaches. However, the tasks used for five of the six weeks of the PTC were either based on the substantive materials in the Reference Book or on similar substantive materials. The first week of the Course was largely alloted to the carrying out of fairly simple tasks based mainly on the lessons of experience contained in the Reference Book. In the second week of the Course, two members of the Coverdale Organization staff and two ASIP staff members gave a specially-tailored Coverdale-type course which emphasized management principles and practices. Beginning with the third week and continuing to the last day of the PTC, participants used the management principles they had learned in the second week of the Course to carry out more complex assigned tasks largely based on the substantive materials in the Reference Book. Thus, process and substance were combined and practiced in interaction with each other.

It is at this point that the research method used to create the Reference Book becomes important. Training does not usually last long. Tasks take time--anywhere from about an hour up to several days. Thus, relatively few tasks can be used.

The question is, What experience should the tasks provide? Text books are full of hundreds of things that the authors say managers should learn. The typical training course could at best cover only a small percentage of these. At the same time, experience is a powerful teacher; what people learn from experience makes a deep impression. For both these reasons, it is

crucial that the tasks be centered around the jobs that are both typical and important. The experience the participant gets should be experience at solving his biggest and most frequent problems.

To follow theory, however, leaves one with many choices with no way of telling what is important, or it leads one astray. The things that worked in practice frequently turn out to be other than what theory suggests is correct. It is by the research that is embodied in the Reference Book that the ASIP identified which management problems were important. This research also identified the successful solutions to these problems. This research was time consuming and expensive, but essential.

Thus, the essence of the ASIP approach is learning from experience. It is experience that is embodied in the Reference Book. This same experience then appears in the tasks. This same experience, along with that of the participants, then comes together in new experience as people carry out the tasks.

The combination of the Coverdale learning process and the ASIP substantive materials constitute the salient feature of the ASIP approach to the training of agricultural managers in developing countries. The approach, firstly, emphasizes the linkages between the substantive and management aspects of agricultural and rural development projects, programs and plans, and the necessity of dealing with both aspects. And, secondly, it concentrates on developing skill in managing planned agricultural and rural development (by a "learning-by-doing" methodology), rather than only on imparting knowledge (about what managers ought to do).

d. PTC Tasks

For the PTC, the ASIP devised agricultural and rural development tasks of various kinds and complexities which could achieve the PTC's objectives of providing participants with opportunities to (1) apply the systematic approach to getting things done, and (2) acquire knowledge, techniques and skills which they could use in managing planned agricultural development in their countries.

The PTC made as much use as possible of tasks, with lectures and field trips interspersed as comparatively light relief and as a source of ideas to be applied in subsequent tasks. At the start of a training session where a task was to be undertaken, each participant received a typewritten statement of the task which indicated the purpose of the task; gave instructions for carrying it out which included the constraints, limits or other conditions which participants were

to consider and be guided by; and indicated the product which was to result (e.g., a report for a General Session of all PTC participants, and whether the report was to be presented formally or informally). Finally, the statement indicated the sources to be tapped for information in carrying out the task.

After participants had read the task and their questions has been answered, time was alloted for reading source materials. Therafter, the resource person on the ASIP staff who was most concerned with the task briefed the participants, calling attention to salient features in the Reference Book or elsewhere which participants might wish to bear in mind in carrying out the task. After participants' questions on the briefing were answered, the participants formed groups of 2 to 8 persons, as instructed by the ASIP staff. Frequently, participants were instructed to form groups by country; sometimes, they were told to form multi-country groups. Each group had a member of the ASIP staff as a coach. While the coach sought to help his group carry out the assigned task, he did not participate in the substantive discussions, unless he was also the resource person for the task. The ASIP resource person provided a group with information only upon request and only to the extent required to help the group reach its own conclusions. The steps to be taken in carrying out each problem were assigned definite time limits which were posted at the start of each task asssignment. At a pre-assigned time, the groups usually met together in General Session, to present and discuss their findings.

The 36 tasks drafted for the PTC were known to exceed what could be carried out during the Course, but they were prepared, nevertheless, to allow the greatest possible flexibility in meeting the needs of PTC participants as they would be revealed during the Course. Only 20 tasks were used in the Course.

In designing tasks, substantive issues had priority over procedural ones. Most of the tasks were structured to minimize constraints on the way results were presented. Some tasks were relatively simple; others, relatively complex. Some tasks were specialized and intended for a specific kind of agricultural managers, e.g., extension workers. Other tasks--e.g., a task on devising a rural development model--were broader and intended for all kinds of agricultural managers.

Every task was designed to simulate the realities in developing countries to the greatest extent possible, and some were based on actual projects and programs in these countries. Tasks which were based on real projects or programs, or which approximated them, were considered essential, not only to achieve the PTC's announced objectives, but also to permit

participants to carry out tasks in a way which would provide them with results they could apply in their countries.

2. Lessons from the PTC Experience

a. The Task as a Learning Device

The ASIP task approach turned out to be a very flexible learning method which allowed participants to apply their widely varied experience to the same task to learn lessons and acquire skills from it. Groups found little difficulty in adapting each task to the country or local conditions familiar to the participants of the group.

While the task approach proved to be very successful for teaching purposes, what participants learned largely depended on how they viewed the opportunities presented by the tasks. At one extreme, a group would deal with a task as though it related to problems which might be encountered in the country of the group's participants. At the other extreme, another group used the same task to describe and justify the way the country of the group's participants dealt with problems raised in the task, without going beyond this to suggest improvements in the way problems were actually handled.

One indication of the efficacy of the task as a learning device was the incidence of participant activity. There was an unusually low absence rate from PTC sessions. Failure to participate was rare.

Experience with some tasks revealed that the task approach is a poor method for imparting definitions, whether or not they are generally accepted definitions. Where generally accepted definitions exist, participants' experience, a major input in the ASIP task approach, is of little value. Where there are differing definitions, participants get into a needless wrangle. In either case, reading assignments or lectures can provide the definitions more efficiently than tasks.

b. The Reference Book

Except for a couple of tasks, the PTC relied on the draft Reference Book prepared by the ASIP staff as the prime source of information for the tasks. The use of virtually a single source of information prepared by the ASIP staff had advantages. One advantage was the close relationship between assigned readings and the tasks, since the tasks had been drawn primarily from, and were largely based on, information in the Reference Book. This made it possible to pinpoint the parts of the Reference Book which were relevant to the tasks and to exclude those parts which (although perhaps useful for other purposes) were extraneous. This, in turn, permitted assigned readings

to be short, rarely more than 20 pages of triple-spaced typescript. Short, relevant readings, almost always from a single source, made it easy for participants (even those whose native language was not English) to prepare themselves adequately for each task--so much so that time which had been set aside during sessions for participants to read the Reference Book was used increasingly, as the Course proceeded, for carrying out tasks.

Moreover, since the Reference Book and the tasks had been written by the staff, the staff was generally well-informed about the content and thrust of the Reference Book and the tasks. This made it possible for the staff to provide knowledgeable coaching and briefing assistance during group and general sessions. Experience during group discussions clearly demonstrated that coaches had to be familiar with the section in the Reference Book relating to a task in order to coach effectively. This need to know what was in the Reference Book was particularly noteworthy when unforeseen events sometimes made it apparent while the task was being carried out that instructions for a task or its time schedule were unsuitable. On these occasions, coaches' knowledge of the Reference Book and the task made appropriate adjustments possible with minimum disruption.

The Reference Book was frequently used during group discussions of tasks and was cited by groups as a source during the discussion of more than half of the PTC tasks. In the case of some tasks for which participants did not refer to the Reference Book, the Reference Book nevertheless constituted an important source of information; but in other cases, the Reference Book did not seem to be particularly important, perhaps because participants had experience in the subject covered by a task which they considered more significant than the information in the Reference Book.

As a result of this experience, it was clear that the tasks needed to be reworded to put more emphasis on use of the Reference Book. However, it was equally clear that the training approach based on tasks, small groups and coaching, and the Reference Book did make for a unified experience that could not have been achieved in any other way.

ANNEX H

SELECTED ANNOTATED BIBLIOGRAPHY

1. General

351 Asian Studies Center. Seven Articles on Land Reform. Asian Studies Papers, Reprint Series No. 2, 1964-65. East Lansing: Michigan State University, June 1965.

Examines the relation of land reform to agricultural development in Japan, Taiwan, and Vietnam.

82 Aziz, Sartaj. "The Chinese Approach to Rural Development." International Development Review, Vol. 13, No. 4, 1973.

Reviews the Chinese model and investigates its possible application to other developing countries. The author concludes that at least some of the principles are transferable.

420 Bolivia. Ministry of Agriculture. Bolivia: National Community Development Program: Report for Years 1965-1966-1967. La Paz, 1967.

Describes the philosophy and operations of the program and reports on activities from 1964-1967. This is regarded as one of the most effective community development programs, with components of interest to rural development project and program planners and managers.

63 Development Alternatives, Inc. Strategies for Small Farmer Development: An Empirical Study of Rural Development Projects, Vol. 2, Case Studies. Report prepared for the U.S. Agency for International Development. Washington, D.C., 1975

A 3-volume study of 36 rural development projects in 11 countries of Africa and Latin America. Executive summary; Vol. I, Methodology; Vol.II, Case Studies.

404 Freire, Paulo. Pedagogy of the Oppressed. New York: The Seabury Press, 1970.

Discusses the development of a method of adult education for illiterates which, deriving from self-awareness, had led first to literacy, then to increased participation in development by dispossessed groups. A seminal work, often imitated.

405 Freire, Paulo. Education for Critical Consciousness. New York: The Seabury Press, 1973.

A further development of the themes expressed in Pedagogy of the Oppressed. Freire states the need for critical reflec-

tion by the poor and powerless before they can be involved in real development.

42 India. National Council of Applied Economic Research. Market Towns and Spatial Development in India. New Delhi, 1965.

An increasingly popular approach to regional (rural) development is the use of market towns as a development nucleus. This case study of the Indian experience offers suggestions on the development of market towns for agro-urban integration.

231 Lele, Uma. The Design of Rural Development: Lessons from Africa. A World Bank Research Publication. Baltimore: Johns Hopkins University Press, 1975.

A report of the World Bank's African Rural Development Study which analyzed the experience of 17 projects in 7 countries. The study has an operational focus, and is intended to improve the planning and implementation of future projects to which the Bank contributes.

469 Mann, Amy G. and Jan Miracle, eds. Rural Development: The Interplay of Analysis and Action. PASITAM Design Studies. Bloomington, Ind.: International Development Research Center, 1975.

A summary of discussions with several academicians and practitioners of development which explores relations between project and program design and institutional and organizational factors affecting implementation. Models for sector analysis, project analysis methodology, and institution-building are discussed.

107 Mosher, A.T. To Create a Modern Agriculture: Organization and Planning. New York: Agricultural Development Council, Inc., 1971.

Suggests that the development objective for agriculture is to create a modern agriculture, defined as one in which technology and efficiency are continually improved, the kinds of commodities produced change in relation to market demand, steady improvement in factors of production, and public and private service agencies are continually changing to meet new needs.

102 Mosher, A.T. Getting Agriculture Moving. New York: Agricultural Development Council, Inc., 1966.

Designed "to serve as a framework for systematic discussion of the development process in agriculture in in-service

training programs." Covers the essentials of agriculture: markets, technology, locally available supplies and equipment, production incentives, and transportation; and support elements or accelerators of agricultural development.

2. Planning and Policy

32 Bloch, G. "Statistical Problems Involved in Delimiting the Agricultural Sector." OECD Agricultural Review, Vol. 20, 1973, pp. 51-53.

Presents classifications of the agricultural sector by: agricultural products, agricultural labor force, and agricultural holdings; notes errors that may arise when incomparable bases for definitions are used.

64 Bomani, Paul, interviewed by Douglas Ensminger, "Tanzania's Road to Development: Bringing Development to the People." International Development Review, Vol. 16, No. 2, 1974, pp. 2-9.

Paul Bomani, Ambassador from Tanzania to the United States, was interviewed on Tanzania's development strategies and programs by Dr. Ensminger. The Ujamaa Villages were among the subjects discussed and reviewed herein.

40 Darin-Drabkin, H. "Cooperation as a Coordinating Factor of National Planning and Local Initiative." Socio-Economic Planning Sciences, Vol. 1, August 1968.

States that the crucial problem of agricultural planning is to find a way of coordinating the general needs of the national economy with the needs and possibilities of individual farms. Recommends that cooperation be built into structural and policy elements.

321 Dorner, Peter. Land Reform and Economic Development. Middlesex, England: Penguin Books Ltd., 1972.

A brief analysis of diverse approaches to land reform in historical perspective. Recommended as an introduction to the problem.

4 Food and Agriculture Organization of the United Nations. Programming for Agricultural Development. Reprint edition from The State of Food and Agriculture. Rome, 1960, pp. 99-148.

This chapter reviews procedures and methods of agricultural programming. Covers objectives of agricultural plans, organization for planning, target setting, and development of implementation strategies.

20 Food and Agriculture Organization of the United Nations. Report of the FAO/ECAFE Expert Group on Selected Aspects of Agricultural Planning in Asia and the Far East. Bangkok, 24 October to 4 November 1960. 62/A/16262-p., n.p., n.d.

Analyzes approaches to agricultural planning and some technical problems faced, including estimating demand for agricultural products, and the type of data needed for formulating plans.

73 Gadgil, D.R., "Planning for Agricultural Development in India." In Readings in Agricultural Development, edited by A.M. Khusro, pp. 562-584. Bombay: Allied Publishers, 1968.

A review of Indian planning through 1968, emphasizing the need for more detailed information from regions in establishing aggregate national targets.

30 Gittinger, J. Price. Planning for Agricultural Development: The Iranian Experience. Washington, D.C.: National Planning Association, 1965.

A case study which indicates that relatively favorable economic resources and expertise are not sufficient for success in the agricultural sector when national leadership sets its priorities elsewhere.

323 Horton, Douglas, E. Land Reform and Reform Enterprises in Peru. Report submitted to the Land Tenure Center and the International Bank for Reconstruction and Development. Madison, Wis.: Land Tenure Center, 1974.

A detailed report on Peru's pre-reform setting, the land reform process, and the performance of reform enterprises. Case studies of each agrarian zone comprise the appendices.

43 Hunter, Guy. Modernizing Peasant Societies: A Comparative Study in Asia and Africa. Published for the Institute of Race Relations. London: Oxford University Press, 1969.

A "study of agricultural society regarded as a living whole." Examines both economic and non-economic aspects of peasant life in an attempt to understand the needs precedent to effective change. Argues that there is much to be learned from developing countries, and that many worthwhile traditions of these countries can be maintained, rather than supplanted, while development occurs.

182 Hunter, Guy. The Administration of Agricultural Development: Lessons from India. London: Oxford University Press, 1970.

An analysis of the administrative methods and organization of agriculture in India, designed to draw from the Indian system conclusions which might be more widely applied in the developing world. Stresses the need for continuing adaptation of policy and structures to the changing societal milieu, and the urgent need to keep administrative systems as simple and responsive as possible.

505 Iglesias, Gabriel U. The National Rice Self-Sufficiency Program of the Philippines: A Case Study in the Implementation of a Development Program. Quezon City, Philippines: University of the Philippines, NSDB-UP Integrated Research Program, 1976.

This analysis of the Masagana 99 rice self-sufficiency program of the Philippines by a noted Filipino scholar looks at the background assumptions, and operations, of the Masagana 99 program in light of structural factors, leadership, technology, political and administrative support, and resources allocated to the program.

206 International Bank for Reconstruction and Development. Agriculture Sector Working Paper. June 1972.

Discusses the part agriculture plays in meeting national production and export goals. Reviews policy issues of broad significance to a number of developing countries. Discusses future Bank role in agriculture.

589 Kearl, Bryant, et al, eds. Field Data Collection in the Social Sciences: Experiences in Africa and the Middle East. New York: Agricultural Development Council, 1976.

Based on extracts from papers presented at a seminar workshop, this short book compares findings of field researchers in Africa and the Middle East. Good field data is difficult to secure, and defective data mislead planners and practioners, often at high cost. The findings presented herein will aid those who gather, analyze, and utilize such data.

593 Kuklinski, Antoni R., ed. Growth Poles and Growth Centres in Regional Planning. United Nations Research Institute for Social Development - Geneva. The Hague: Mouton and Co., 1972.

Thirteen papers on the theory and practice of regional development and planning based on growth poles and growth centers.

373 Lewis, Stephen R., Jr. "Agricultural Taxation in a Developing Economy." In Agricultural Development and Economic Growth, edited by Herman M. Southworth and Bruce F. Johnston, pp. 453-492. Ithaca, N.Y.: Cornell University Press, 1967.

One of fourteen articles by noted scholars and practioners which review problems and issues of agricultural development; traditional barriers to change, taxation, price policy, and a number of other important factors.

201 Montgomery, John D. "Allocation of Authority in Land Reform Programs: A Comparative Study of Administrative Processes and Outputs." Research and Training Network Reprint from the Administration Science Quarterly, March 1974.

Summarizes a study indicating that devolving administrative functions for land reform to local non-career officials produced better results for peasants than arrangements using professional officials in a centralized or decentralized bureaucratic system.

112 Ojala, E.M. "Research Requirements and Types of Information Needed for Agricultural Development Planning." In United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas. E/CONF.39/H/20. October 12, 1962.

Deals with data needed and practical means of analysis for planning agricultural development for both the public and private sectors. Advocates successive approximation.

39 Schickele, Rainer. "Farm Management Research for Planning Agricultural Development." Reprint. New York: The Agricultural Development Council, December 1966. Reprinted from Indian Journal of Agricultural Economics, Vol. 21, April-June 1966, pp. 1-15; Appendices I and II are published in Reprint for the first time.

Argues that planning for the agricultural production process at the farm level should become an essential part of national planning for economic development. National plans and local implementation should be complementary prongs of an overall approach.

79 Sigurdson, Jon. "The Role of Small Scale and Rural Industry and Its Interaction with Agriculture and Large Scale Industry in China." Draft. Stockholm: Stockholm School of Economics, Economic Research Institute, July 1974.

Analyzes industrial policy, characteristics of rural industry, and examples of small-scale chemical fertilizer, cement,

iron and steel, and other plants, with a brief comment on the relevance of the Chinese approach for other developing countries.

175 Taiwan. Ministry of Economic Affairs, Agricultural Planning and Coordination Committee. The Agricultural Program Under Taiwan's Third Four-Year Plan 1961-1964. Taipei, 1961.

This official report of Taiwan's Ministry of Economic Affairs describes policies and programs for utilizing agricultural resources, the investment plan, and crop production programs for the period 1961-1964.

392 U.S. Agency for International Development. Economic Growth in Bangladesh: The Case for Broad-Based Agricultural Development. Discussion Draft for Development Assistance Program FY 1975: Bangladesh. Dacca, December 1974.

An overview of a proposed development strategy for Bangladesh, with concentration on agriculture. Pages 70-78 deal with the Comilla Projects and the Thana Training and Development Programs which draw on the Comilla approach.

585 U.S. Agency for International Development, Office of Program Evaluation. Evaluation Handbook, 2d ed. Washington, D.C., 1972.

Describes and gives directions in the use of the evaluation system developed and used by A.I.D. in evaluating technical assistance (non-capital) projects.

586 U.S. Agency for International Development, Office of Program Methods and Evaluation. Project Evaluation Guidelines, 2d ed. M.O.1026.1, Supplement 1. Washington, D.C., 1973.

An updated companion piece to the A.I.D. Evaluation Handbook. Analyzes the evaluation process and presents an approach to clarifying project design through the Logical Framework.

587 U.S. Agency for International Development, Program Methods and Evaluation Office. A.I.D. Use of Development Indicators: A Progress Report. Washington, D.C., 1973.

An analysis of the indicators used in A.I.D. project design and evaluation, with suggestions for the more effective setting of project objectives and success criteria for improved implementation and evaluation.

70 Waterston, Albert. Development Planning: Lessons of Experience. Baltimore, Md.: The Johns Hopkins Press, 1966.

A comparative study of development planning based on materials from 55 countries which analyzes the strengths and weaknesses of virtually every major approach to planning process and organization.

6 Weitz, Raanan. "Agricultural and Rural Planning: Its Organization and Implementation." In United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas. E/CONF.39/H/8. October 9, 1962.

Discusses the nature and scope of comprehensive rural planning, based primarily on Israel's experience. The author was Director General of the (then) Agricultural Settlement Department of Israel.

97 Weitz, Raanan. "Toward a New Approach: Introduction and Conclusions." In Rural Development in a Changing World, edited by Raanan Weitz with assistance of Yehuda H. Landau, pp. 1-22. Cambridge, Mass. and London: MIT Press, 1971.

A compendium of papers by individual experts which discuss rural development in both more advanced and developing economies. Part One deals with concepts and approaches; Part Two comprises case studies from eight countries.

155 Zusman, Dr. P. "Principle Methods and Techniques of National Agricultural Planning." In Rehovoth Conference on Comprehensive Planning of Agriculture in Developing Countries. Rohovoth, Israel, 19-29 August 1963.

A precis of the principles of national economic planning as practiced in Israel. The aim of this paper is "to emphasize the identity of planning with a far-sighted and systematics agricultural policy, and to appraise some planning techniques presently available."

3. Projects and Implementation.

403 Ahmed, Manzoor and Philip H. Coombs, eds. Education for Rural Development: Case Studies for Planners, prepared for the International Council for Educational Development for the World Bank and the United Nations Children's Fund. New York: Praeger Publishers, 1975.

Seventeen case studies designed to present empirical evidence about nonformal education. Recommends practical steps

which developing countries and external assistance agencies can take to exploit more fully the potentialities of nonformal education.

91 Aynor, H.S. Notes from Africa. New York: Frederick A. Praeger, 1969.

These notes of an Israeli ambassador, in fictionalized format, examine the problems confronting agricultural development in Africa. Political and social problems are particularly effectively handled.

271 Centro Internacional de Mejoramiento de Maiz y Trigo. The Puebla Project: Seven Years of Experience, 1967-1973. El Batan, Mexico, 1974.

An overview of the research and project operations to develop, field test, and refine a strategy for rapidly increasing yields of maize on small land holdings in Mexico. Analyzes the factors leading to success at Puebla.

462 Chambers, Robert. Managing Rural Development: Ideas and Experience from East Africa. Uppsala: Scandinavian Institute of African Studies, 1974.

A study of the design and operation of an innovative Programming and Implementation Management System (PIM) oriented to devloving responsibility and authority for planning and managing rural development activities within Kenya's Special Rural Development Program.

494 Choldin, Harvey M. "The Development Project as Natural Experiment: The Comilla, Pakistan, Projects." Economic Development and Cultural Change , Vol. 17, July 1969, pp. 483-500.

A generally sympathetic analysis of the Comilla Projects which nonetheless suggests that the use of selected analytic techniques, such as cost-benefit analysis, might have improved project operations. Of special interest to those engaged in social science field applications.

545 Cohen, John M. "Effects of Green Revolution Strategies on Tenants and Small-Scale Landowners in the Chilalo Region of Ethiopia." The Journal of Developing Areas, Vol. 9, April 1975, pp. 335-358.

The CADU Project's objective of helping small farmers was circumvented by land tenure, local government, and other problems, including productivity gains by larger farmers who "nosed out" the smaller farmers. This issue is investigated herein.

399 Coombs, Philip H. with Manzoor Ahmed. Attacking Rural Poverty: How Nonformal Education Can Help. A Research Report for the World Bank prepared by the International Council for Educational Development, edited by Barbara Baird Israel. Baltimore: The Johns Hopkins University Press, 1974.

An analysis of the role of nonformal education in bringing about change in the rural sector. Investigates unconventional programs for extension, farmer training, training for non-farm rural work, and other salient areas.

459 Diaz-Cisneros, Heliodoro. "An Institutional Analysis of a Rural Development Project: The Case of the Puebla Project in Mexico." Ph.D. dissertation, University of Wisconsin, 1974.

A doctoral dissertation which examines in detail the problems of developing a strategy and plan for the institutional change which was necessary to enable the Puebla Project to succeed. The author was a key project official who participated in most of the major aspects of the project.

493 Fairchild, Henry W., and M.Z. Hussain. A New Rural Cooperative System for Comilla Thana. Second Annual Report, Rural Co-Operative Pilot Experiment, July 1962. Comilla, East Pakistan: Pakistan Academy for Village Development, 1962.

The Second Annual Report on the Comilla Cooperative Pilot Project. This was the first rural modernization element introduced at Comilla, and should be studied by those involved in problem-solving projects.

529 Gaitskell, Arthur. Gezira: A Story of Development in the Sudan. London: Faber and Faber, 1959.

A case study of one of the earliest regional rural development projects. Based in the Sudan, the Gezira Scheme operated for nearly a half century. Its lessons are still relevant for today's planners and practitioners.

546 Gebregziabher, Betru. Integrated Development in Rural Ethiopia: An Evaluative Study of the Chilalo Agricultural Development Unit. Bloomington, Ind.: Indiana University, International Development Research Center, 1975.

An evaluation of the Chilalo Agriculture Development Unit (CADU) by a CADU project staff member with four years' experience on the Project. Documents the major problems confronted by CADU and presents an analysis using the "linkages" concept developed by Esman.

591 Hayes, Samuel P., Jr. Measuring the Results of Development Projects: A Manual for the Use of Field Workers. Bern, Switzerland: United Nations Educational, Scientific and Cultural Organization, 1959.

This concise monograph, prepared for UNESCO in 1959, remains one of the better practical guides for project evaluation. It deals with stating objectives, selecting data to measure project results, collecting data, and interpreting findings.

383 Horowitz, Joseph. Critical Path Scheduling, Management Control Through CPM and PERT. New York: The Ronald Press Company, 1967.

A preferred text for those who want to understand and apply PERT and CPM. Intermediate level.

367 Hough, Richard Lee. "AID Administration to the Rural Sector: The JCRR Experience in Taiwan and Its Application in Other Countries." Washington, D.C.: U.S. Agency for International Development, September 1967.

Analyzes the experience of the Joint Commission on Rural Reconstruction (JCRR), with comments on those elements of JCRR work having possible applicability to other countries.

391 Hoxeng, James. Let Jorge Do It: An Approach to Rural Nonformal Education. Amherst, Mass.: University of Massachusetts, Center for International Education, 1973.

Reviews an innovative Ecuadorean project designed to transmit skills through a "learning by doing" approach in nonformal education.

234 Hunter, Guy. The Implementation of Agricultural Development Policies: Organization, Management and Institutions. Summary and Comment on the Second International Seminar on Change in Agriculture, at the University of Reading, 9-19 September 1974. London: Overseas Development Institute, 1974.

Summary of a seminar investigating problems in stimulating small-scale agricultural production.

46 Kulp, Earl M. Rural Development Planning. New York: Praeger Publishers, 1970.

Proposes a working method for analyzing and dealing with rural development problems based on systems analysis concepts.

37 Khan, Shoaib Sultan. Daudzai Project: A Case Study. Peshawar, Pakistan: Pakistan Academy for Rural Development, 1975.

A short overview of the Daudzai Project being implemented by the Pakistan Academy for Rural Development. This pilot project follows the pattern established at Comilla, and offers a test of some of the precepts governing the Comilla Projects in a different cultural context.

387 Lynton, Rolf P., and Udai Pareek. Training for Development. Illinois: Richard D. Irwin, Inc., and the Dorsey Press, 1967.

Expert commentary on training process and strategy. Deals with pre-training, training, and post-training needs of both the individual participants and the organizations where they work.

388 Macarov, D. and G. Fradkin. The Short Course in Development Training. Ramat-Gan, Israel: Massada Ltd., 1973.

Describes and analyzes the short-term training program developed by the Foreign Training Department of the Israeli Ministry of Agriculture over a ten-year period.

534 Myren, Delbert, ed. Strategies for Increasing Agricultural Production on Small Holdings. Proceedings of an International Conference, Puebla, Mexico, 6 - 7 August 1970. Mexico City, Mexico: International Maize and Wheat Improvement Center, n.d.

Summarizes proceedings of an international conference on "Strategies for increasing agricultural production on small holdings." Based on the Puebla Project in Mexico, and to a lesser extent on other projects in Latin America.

533 Myren, Delbert T. "The Rockefeller Foundation Program in Corn and Wheat in Mexico." In Subsistence Agriculture and Economic Development, edited by Clifton R. Wharton, Jr., pp. 438-452. Chicago: Aldine Publishing, 1969.

Case studies of the Cornell Project in Vicos, Peru (the Vicos Project); the Comilla Projects in East Pakistan (now Bangladesh); the ACAR Project in Minas Gerais, Brazil, a credit and rural assistance project; and the Rockefeller-sponsored program in corn and wheat in Mexico. These four case studies examine the use of physical inputs, and economic, organizational, socio-cultural, and knowledge factors in implementing projects from differing perspectives under varied conditions. (Chapter 13)

531 Raper, Arthur F., et al. Rural Development in Action: The Comprehensive Experiment at Comilla, East Pakistan. Ithaca, N.Y.: Cornell University Press, 1970.

Describes the first ten years of the Comilla Project (1959-1968). The authors believe that the Comilla prototype offers a workable model for other parts of the world, and through this detailed examination they attempt to show why.

498 Smith, Kenneth F. The Masagana 99 Management Information System. Manila: U.S. Agency for International Development, 1975.

A detailed description of the information system developed cooperatively by the Philippines' National Food and Agriculture Council, the Bureau of Agricultural Economics, and USAID to establish targets, forecast resource requirements, and monitor and support the Masagana 99 "Wondrous Rice" production program.

59 Streeter, Carroll P. Reaching the Developing World's Small Farmers. A Special Report from the Rockefeller Foundation, New York, n.d.

Case studies of programs and projects in Mexico, El Salvador, Brazil, Colombia, Kenya, India, and Taiwan. These are short general descriptions of the problems faced and the main aspects of the solutions attempted.

542 Turkey. Ministry of Food, Agriculture and Livestock. General Directorate of Planning, Research and Coordination. Manual for Preparation and Analysis of Agricultural Projects. Publication No. 59. Prepared by John C. Day as part of a U.S. Agency for International Development contract. Ankara, 1974.

One of the most comprehensive and detailed treatments available for the microanalytic aspects of project preparation, with concentration on economic and financial analysis. Heavily mathematically oriented, with numerous examples of worksheets for planning, analysis, and budgeting.

544 Turkey. Ministry of Food, Agricultre and Livestock. General Directorate of Planning, Research and Coordination. Guidelines for Review and Evaluation, Agricultural Development Projects. Publication No. 58. Prepared by John C. Day as part of a U.S. Agency for International Development Contract. Ankara, 1974.

A more general narrative treatment of the subjects dealt with in 542.

454 U.S. Department of Agriculture, Farmer Cooperative Service. Cooperative Cotia: A Force for Development in Brazil. FCS Information 84. Washington, D.C., 1972.

An analysis of a Brazilian cooperative which has been called one of the most proficient in the world. COTIA cooperative is a large and diverse federation which markets more than 100 commodities and provides services to more than 10,000 producer members.

464 Virone, L.E. A Practical Approach to Rural Development. Studies in Rural Extension - 10. Borgo a Mozzano: The Shell Agricultural Studies Centre, 1969.

Outlines the prerequisites for a rural development pilot project and discusses successful practices developed by Shell Oil Company in implementing successful rural development projects in Portugal, Thailand, and Italy.