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THE ROLE OF AGRICULTURE IN ECONOMIC DEVELOPMENT

By BRUCE F. JOHNSTON AND JOHN W. MELLOR*

The present article deals with issues that have too often been discussed in terms of the false dichotomy of agricultural vs. industrial development. The approach adopted here is to examine the interrelationships between agricultural and industrial development and to analyze the nature of agriculture's role in the process of economic growth.

Diversity among nations in their physical endowment, cultural heritage, and historical context precludes any universally applicable definition of the role that agriculture should play in the process of economic growth. Nevertheless, certain aspects of agriculture's role appear to have a high degree of generality because of special features that characterize the agricultural sector during the course of development. The nature of agriculture's role is, of course, highly relevant to determining the appropriate "balance" between agriculture and other sectors with respect to (1) direct government investment or aids to investment, (2) budget allocations for publicly supported research and education-extension programs, and (3) the burden of taxation levied on different sectors.

I. Special Characteristics of the Agricultural Sector in the Process of Economic Development

Two important and related features distinguish the agricultural sector in an underdeveloped country and its role in the process of economic growth. First, in virtually all underdeveloped economies agriculture is an existing industry of major proportions, frequently the only existing industry of any consequence. Typically, some 40 to 60 per cent of the national income is produced in agriculture and from 50 to 80 per cent of the labor force is engaged in agricultural production. Although large quantities of resources—chiefly land and labor—are committed to agriculture, they are being used at very low levels of productivity.

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The other significant characteristic is the secular decline which occurs in the relative size of the agricultural sector [6] [39] [45] [27] [26]. The importance of this process of structural transformation and the size of the related capital demands place a great burden on agriculture to provide capital for expansion of other sectors. The economic transformation also has important implications with respect to the changing role of labor and capital and the choice of methods for developing agriculture.

Secular decline of the agricultural sector: the "general transformation model." The two basic factors generally recognized as responsible for the structural transformation of an economy are: (1) an income elasticity of demand for food that is less than 1 and declining, and (2) the possibility of a substantial expansion of agricultural production with a constant or declining farm labor force.

A third factor that has received less attention is probably of considerable importance: by and large modern technology permits the most drastic reduction of costs in manufacturing industry, in power generation, and in long-distance transport. It is within these fields that investments in modern, power-driven machinery and the application of advanced technology lead to early and revolutionary reductions in costs so that price-elasticity and substitution effects reinforce differential income elasticities in changing the pattern of output and consumption.

The relative decline of the agricultural sector will not proceed as rapidly or as far in countries that have a marked comparative advantage in exporting agricultural products. But even countries particularly well suited by their resource endowment to emerge as major agricultural exporters can be expected to witness a substantial reduction in the share of agriculture if they achieve a sizable increase in per capita incomes. Denmark and New Zealand stand out as countries that have benefited greatly from their position as leading agricultural exporters; even so, less than 20 per cent of their labor is presently engaged in agriculture.¹

The reasons for the secular decline of agriculture and substantial expansion of manufacturing and other components of the nonagricultural sector have not been fully elucidated; but this type of structural transformation of an economy seems to be a necessary condition for cumulative and self-sustaining growth. A mere change in the product-mix

¹The Danish example is particularly striking. The country is conspicuously lacking in resources other than its excellent agricultural potential. More than 65 per cent of total agricultural output is sold abroad, and despite considerable expansion of nonagricultural exports since the second world war, agriculture still accounts for some 60 per cent of total foreign exchange earnings [18, p. 7] [22, p. 114].

available for consumption, obtainable up to a point entirely by means of international trade, is apparently *not* a sufficient condition.²

The two-sector classical growth model. The implications of the dynamic nature of the growth process have been elaborated most clearly in W. Arthur Lewis' two-sector model, which represents a special case of the "general transformation model" characterized above. Since, in densely populated countries, a considerable proportion of the rural labor force may provide an increment to production less than the requirements for its own subsistence, Lewis assumes in his model that there is a surplus of manpower in agriculture (subsistence sector);³ and that the nonagricultural (capitalist) sector is the dynamic element which absorbs this surplus of manpower.⁴

Since the supply of labor available in the traditional sector is assumed to be in effect "unlimited," the transfer of manpower to the capitalist sector is determined by the demand for labor in that sector, which in turn is limited by the rate of capital accumulation. In the capitalist sector it will normally be necessary to pay a wage determined by the average product per man in the traditional sector, plus some margin dictated by transfer frictions, social views of minimum subsistence, trade union pressure, and other institutional forces.

This is, of course, a transitional phase. "When capital catches up with labour supply," as Lewis phrases it, the two-sector model is no longer relevant. However, in the short run, nonfarm job opportunities cannot be created sufficiently rapidly to move ahead of population growth in the countryside. Doving has called attention to the fact

² Even Viner, who has been critical of using income from the agricultural sector to "subsidize uneconomic urban industry," does not really take issue with this proposition [48, p. 124]. His (reluctant?) concession is phrased in a double negative: "It is not my position that the path to economic progress is not, for many countries and even for most countries, by way of industrialization and urbanization." "The real problem," he continues, "is not agriculture as such or the absence of manufactures as such, but poverty and backwardness, poor agriculture, or poor agriculture and poor manufacturing. The remedy is to remove the basic causes of the poverty and backwardness" [48, p. 71]. Viner later suggests that if the masses of the population in underdeveloped countries were "literate, healthy, and sufficiently well fed . . . all else necessary for rapid economic development would come readily and easily of itself" [48, p. 131]. These factors are obviously important, but it seems highly questionable that shortcomings in literacy, health, and nutrition have been the sole obstacles, or even the major obstacles, to achieving rapid economic growth. Moreover, a static view of comparative advantage is an inadequate basis for determining what is or is not "uneconomic urban industry."

³ For discussion concerning the physical conditions in which such a labor surplus will or will not arise and for empirical support, see [33]. Georgescu-Roegen [12] emphasizes that special institutional arrangements are required to make it possible for certain workers to "receive more than they earn." The most common of these institutional arrangements is the family farm in which the unit of production is also the unit of consumption.

⁴ Strictly speaking, the subsistence and capitalist sectors of the Lewis model do not correspond exactly to agriculture and nonagriculture. The distinguishing feature of the capitalist sector is that labor is employed for wages for profit-making purposes and that substantial quantities of reproducible capital are used [30, p. 8] [29, p. 146].

that the farm labor force frequently does not decline in absolute numbers until fairly late in the process of development; the absorption of surplus labor from agriculture depends not only on the rate of increase of nonagricultural employment but also on the "weight" of the nonagricultural sector in the economy [8].

Lewis' treatment emphasizes the implications of the two-sector model for industrial development, but it also has important implications for agricultural development policy. So long as the conditions of this classical growth-model are relevant, factor proportions and productivities will and should be different in the two sectors and a different calculus is applicable to allocation decisions.

Resource allocation in agriculture. Since there may be discrepancies between private and social benefit or between private and social cost, the relevant concept in agriculture as elsewhere is the social marginal productivity of alternative investment projects [4, pp. 76-96] [9, pp. 56-85]. This concept, or the less sophisticated but often more operational technique of estimating cost-benefit ratios, is reasonably serviceable in appraising large-scale investment projects in the agricultural sector.

There are compelling considerations, however, which suggest that the most practical and economical approach to achieving sizable increases in agricultural productivity and output lies in enhancing the efficiency of the existing agricultural economy through the introduction of modern technology on a broad front. Of particular importance are expenditures for "developmental services" or "unconventional inputs" such as agricultural research, education, and extension that broaden the range of alternative production possibilities available to farm operators and strengthen their capacity to make and execute decisions on the basis of more adequate knowledge of agricultural technology.

Three considerations emphasize the need for a special approach in determining the level of resource allocation to agriculture and for establishing priorities within an agricultural development program. First, it is virtually impossible to quantify the schedule of increase in output or reduction in costs that can be expected as a result of expenditures for developmental services such as agricultural research or extension [1]. Even an *ex post* estimate is difficult, a fact brought out clearly in Griliches' interesting attempt to estimate the returns that can be attributed to the investment of resources in the development of hybrid corn [14].

The second factor is the importance of complementarities among agricultural inputs. It is necessary in designing a rational program of agricultural development to define a "package" of inputs—conventional and unconventional—that will be most efficient in increasing agricultural output.

The third difficulty concerns the need to discriminate between the use of scarce and relatively abundant resources. Investible funds, foreign exchange, and certain forms of entrepreneurial talent are in particularly short supply and are critical for industrial development. In contrast, many of the inputs for agricultural development are relatively abundant. In particular, agricultural labor will continue to have low opportunity cost for some time owing to the slow growth of demand for industrial labor. Use of shadow or accounting prices represents one technique for taking account of the abundance of these resources. However, explicit recognition of the special characteristics of the process of agricultural development is essential for designing a strategy for increasing agricultural output and productivity which will minimize requirements for the scarce resources indispensable for expansion of the capitalist sector.

Historical experience. The proposition that a substantial rate of increase in agricultural production can be achieved largely through the more effective use of resources already committed to the agricultural sector and with only modest requirements for the critical resources of high opportunity cost is essentially an empirical generalization. Considerable support for the proposition is provided by the experience of countries in North America and Western Europe that have been successful in increasing agricultural productivity.⁵ More pertinent, however, is the historical experience of Japan and Taiwan.

Labor productivity in Japanese agriculture approximately doubled over a span of 30 years, comparing farm output and labor inputs during the years 1881-90 with the decade 1911-20. The comparable increase in Taiwan appears to have been even larger—something like 130 to 160 per cent over the 30-year span between 1901-10 and 1931-40 [23, pp. 499-500] [22, pp. 23, 41, 78, 91]. A threefold expansion of sugar yields and a nearly twelvefold increase of output was a conspicuous element in the increase registered in Taiwan. This particularly rapid progress in sugar was favored by the spectacular world progress in breeding higher yielding varieties of cane during the first three decades of the present century and the fact that exportation to Japan provided an outlet for the rapidly expanding production. Similarly, the fivefold increase in cocoon production and sevenfold increase in output of raw silk in Japan was considerably more rapid than the over-all

⁵ Studies of the growth of agricultural productivity in the United States have underscored the importance of unconventional inputs and suggest that technological change has been about as important as the quantitative increase in conventional inputs in bringing about increased production [43]. Technical innovations were probably even more important in the impressive growth of agricultural productivity in Denmark; the average annual (compound) rate of increase between the 1880's and the decade of the 1930's was about 2 per cent [22, pp. 102-4].

growth of agricultural output. Technological progress resulting from research aimed at heavier yields of mulberry leaves, selection and breeding of superior races of silkworms, and improvements in practices ranging from the methods of feeding silkworms to the reeling of silk from the cocoons was the decisive factor in the rapid growth in the sericulture industry. Here again, however, the availability of an expanding export market was a necessary condition for the rapid growth of output that was attained.

It is also clear that technological progress was the decisive factor responsible for the increase in productivity and output of rice and other basic food crops that accounted for the bulk of agricultural production in Japan and Taiwan. The three key elements were: (1) agricultural research leading to the development and selection of higher-yielding varieties; (2) increased application of fertilizers; and (3) activities that facilitated wide use of the most productive plant varieties and of improved farm practices. The high degree of complementarity among various agricultural inputs is clearly evident in the agricultural advance achieved in these two countries. The work of the plant-breeders was largely directed at developing varieties characterized by a strong response to increased applications of fertilizer; the gains achieved were the result of the joint advance in improving plant varieties and in raising the level of soil fertility by heavier application of chemical fertilizers. Changes in cultural practices also played a necessary part in realizing the full potential of new varieties combined with heavier fertilization.

Increase of crop area, largely through extending the area of double-cropping, and expansion of irrigation were more important in Taiwan than in Japan during the periods considered; development in those directions was already fairly advanced in Japan by the 1880's. Thus it appears that agricultural investment was a somewhat more important factor in Taiwan than in Japan, but to a large extent it was direct, non-monetary investment [22, pp. 77-81].

The expenditures in Japan and Taiwan for agricultural research, extension-type activities, and other developmental services were very modest in relation to the large increments in output obtained.

II. *Agriculture's Contributions to Economic Development*

The most important ways in which increased agricultural output and productivity contribute to over-all economic growth can be summarized in five propositions: (1) Economic development is characterized by a substantial increase in the demand for agricultural products, and failure to expand food supplies in pace with the growth of demand can seriously impede economic growth. (2) Expansion of exports of

agricultural products may be one of the most promising means of increasing income and foreign exchange earnings, particularly in the earlier stages of development. (3) The labor force for manufacturing and other expanding sectors of the economy must be drawn mainly from agriculture. (4) Agriculture, as the dominant sector of an underdeveloped economy, can and should make a net contribution to the capital required for overhead investment and expansion of secondary industry. (5) Rising net cash incomes of the farm population may be important as a stimulus to industrial expansion.

1. *Providing increased food supplies.* Apart from autonomous changes in demand, presumably of limited importance, the annual rate of increase in demand for food is given by $D = p + \eta g$, where p and g are the rate of growth of population and per capita income and η is the income elasticity of demand for agricultural products [37].

Growth of demand for food is of major economic significance in an underdeveloped country for several reasons. First, high rates of population growth of $1\frac{1}{2}$ to 3 per cent now characterize most of the world's underdeveloped nations, so that growth of demand from this factor alone is substantial. As a result of international borrowing of knowledge and techniques in the public health field and the availability of such powerful weapons as DDT, the sulphur drugs, and penicillin, the decline in death rates is frequently sharp. This, in combination with the slow decline in birth rates, has resulted in rates of natural increase substantially higher than those that characterized the presently developed countries during their "population explosion."⁶ Moreover, there is now only a weak relationship between the factors mainly responsible for the rise in the rate of natural increase and the factors determining the growth of a nation's income.

Secondly, the income elasticity of demand for food in underdeveloped countries is considerably higher than in high-income nations—probably on the order of .6 or higher in the low-income countries vs. .2 or .3 in Western Europe, the United States, and Canada.⁷ Hence, a given rate of increase in per capita income has a considerably stronger

⁶The rapid population growth now characteristic of underdeveloped countries reinforces the view stated earlier that structural transformation of an economy is a necessary condition for cumulative economic growth and substantial increase of per capita incomes. Such a transformation, with the accompanying urbanization, increase of incomes, spread of education, and changes in attitudes and incentives, is a precondition for reduction of birth rates to levels compatible with a sharply lowered death rate. It may be desirable in some countries to reinforce the indirect influence of economic and social transformation by direct measures to encourage reduction of birth rates; but there is no evidence to suggest that direct measures alone would be sufficient.

⁷These approximations relate to income elasticity with respect to food expenditure measured at the farm level, the concept most relevant to assessing the growth of demand for agricultural products. We have reviewed some of the evidence bearing on income elasticities in developed and underdeveloped countries in [21, p. 339].

impact on the demand for agricultural products than in economically advanced countries.

The increase in farm output in Japan between the 1880's and 1911-20, which seems to have been of about the same magnitude as the growth of demand during that period, corresponded to an annual rate of increase in demand of approximately 2 per cent. With current rates of population growth and a modest rise in per capita incomes, the annual rate of increase of demand for food in a developing economy can easily exceed 3 per cent, a formidable challenge for the agriculture of an underdeveloped country. Moreover, as a result of the expansion of population in cities and in mining and industrial centers dependent upon purchased food, the growth of demand for marketed supplies is a good deal more rapid than the over-all rate of increase. Thus there are additional problems in developing transportation links and marketing facilities in order to satisfy the requirements of the nonagricultural population.

If food supplies fail to expand in pace with the growth of demand the result is likely to be a substantial rise in food prices leading to political discontent and pressure on wage rates with consequent adverse effects on industrial profits, investment, and economic growth. There is scant evidence concerning the price elasticity of demand for food in underdeveloped countries. At least in the case of an increase in prices as a result of demand outstripping supply, there is a strong presumption that the price elasticity for "all food" is extremely low, probably lower than in economically advanced countries. Cheap starchy staple foods—cereals and root crops—provide something like 60 to 85 per cent of the total calorie intake in low-income countries, so there is relatively limited scope for offsetting a rise in food prices by shifting from expensive to less costly foods; and the pressure to resist a reduction in calorie intake is strong.

The inflationary impact of a given percentage increase in food prices is much more severe in an underdeveloped country than in a high-income economy. This is a simple consequence of the dominant position of food as a wage good in lower-income countries where 50 to 60 per cent of total consumption expenditure is devoted to food compared with 20 to 30 per cent in developed economies.

Owing to the severe economic and political repercussions of a substantial rise in food prices, domestic shortages are likely to be offset by expanded food imports, provided that foreign exchange or credits are available.⁸ For some countries that are in a favorable position

⁸ Some underdeveloped countries have reacted to the social and economic problems resulting from food shortages and their inflationary consequences by instituting compulsory food collection, price controls, and rationing. It is easy to appreciate that considerations of social equity would lead to such measures in a low-income country; but from the

with respect to foreign exchange earnings this may be a satisfactory solution. But foreign exchange is usually in short supply and urgently required for imports of machinery and other requisites for industrial development that cannot be produced domestically. There is no simple or general answer to this question of import substitution that Chenery has described as "the most important and most difficult aspect of development programming . . ." [5, p. 67]. In view of the potential that exists for increasing agricultural productivity it is likely to be advantageous to obtain the additional food supplies by increased domestic output rather than by relying on expansion of exports to finance enlarged food imports.⁹ In any event, a static view of comparative costs may be misleading. The demand for imports of machinery and other items can be expected to increase as development proceeds, so the existing exchange rate is not likely to reflect the future demand for and supply of foreign exchange [5, p. 67].

The foregoing discussion has stressed the severe penalties attached to failure to achieve the "required" increase in output. This notion of a "required" increase in output should not be pushed too far; the price elasticity of demand for food is low but not zero and there is normally the possibility of adjusting supplies via imports. Nevertheless, it is noteworthy that the demand for food is a derived demand determined essentially by the growth of population and of per capita incomes; and this characteristic of the demand for food cuts in both directions. Not only does it mean severe penalties for failure to expand food supplies in pace with the growth of demand, but it also implies that the returns on investment in expansion of food crops for domestic consumption fall off sharply if food supplies increase more rapidly than demand. There is thus a significant difference between the domestic demand for food products and the more expansible demand for agricultural exports

standpoint of economic development the effects of an attempt to maintain such food distribution controls on a continuing basis are almost entirely unfavorable. Such programs tie up scarce administrative talent in a program of uncertain value that is usually ineffective as well; and they impede the growth of a market-oriented agriculture. Much higher returns are obtainable from a well-conceived program of agricultural development to expand total output rather than controlling its distribution. For an interesting discussion of experience in Pakistan see [46, pp. 121-26]. If short-run instability of food prices resulting from fluctuations in farm output is a real problem, there may be justification for establishing a food reserve, especially if U.S. surplus stocks can be drawn upon to provide the initial stock.

⁹This is, of course, merely a presumption, and it does not alter the fact that it is important to maintain price competition between domestic and imported foodstuffs, nor the fact that it is advantageous to import foodstuffs that cannot be produced efficiently at home, wheat imports in tropical regions being an important example. The availability of large quantities of U.S. agricultural surpluses on favorable terms has the effect of somewhat reducing the importance of measures to increase agricultural productivity and output in a developing country; but there remains the question whether such windfall supplies will be available on a continuing basis in quantities sufficient to satisfy a rapidly growing demand.

(of a particular country) and for the miscellany of goods and services produced by "nonagriculture."

2. *Enlarged agricultural exports.* Expansion of agricultural exports is likely to be one of the most promising means of increasing incomes and augmenting foreign exchange earnings in a country stepping up its development efforts. A profitable export crop can frequently be added to an existing cropping system; the capital requirements for such innovations are often moderate and largely dependent on direct, non-monetary investment by farmers.

Development of production of export crops has a further advantage in catering to an existing market; and an individual country that accounts for only a small fraction of world exports faces a fairly elastic demand schedule. In view of the urgent need for enlarged foreign exchange earnings and the lack of alternative opportunities, substantial expansion of agricultural export production is frequently a rational policy even though the world supply-demand situation for a commodity is unfavorable.

There are, of course, disadvantages to heavy reliance on agricultural exports. And simultaneous efforts to expand exports of certain agricultural commodities in a number of underdeveloped countries involve the risk of substantial price declines, especially if the relevant price and income elasticities are low.

A longer-run goal is diversification which will lessen the vulnerability of an economy that depends heavily on export proceeds from one or a few crops. One of the rewards of the structural transformation associated with economic growth is the greater flexibility of a diversified economy. Of much greater immediate importance, however, is the fact that for most of the underdeveloped countries the introduction or expanded production of agricultural export crops can and should play a strategic role in providing enlarged supplies of foreign exchange.¹⁰

3. *Transfer of manpower from agriculture to nonagricultural sectors.* To the extent that the Lewis two-sector model with its assumption of a perfectly elastic supply of labor is applicable, it follows that manpower for manufacturing and other rapidly expanding sectors can be drawn easily from agriculture. On the other hand, if the rural population is sparse and there is a good potential for expanding output of

¹⁰ As with so many of the policy issues that face a developing country there is no simple answer because intelligent decisions require a balancing of contradictory considerations. Agricultural exports are vulnerable to sizable price fluctuations, and there is a possibility of deterioration in a country's terms of trade if it is dependent on crops which experience a secular decline in price. It has been elegantly demonstrated that under certain assumptions expansion of exports can lead to "immiserizing growth," but we share Nurkse's skepticism concerning the concept of "output elasticity of supply" on which the demonstrations rest and agree with his conclusion that the pessimistic appraisals of the effects of trade really amount to demonstrating that an economy incapable of adapting to changed circumstances is at a disadvantage [36, pp. 58-59]. Much more important than a

profitable cash crops, it may be difficult to obtain labor for a rapidly expanding capitalist sector. In any event, the bulk of the labor for the expanding sectors must be drawn from agriculture in the earlier stages of development simply because there is almost no other source. The experience of Japan, where the conditions of the two-sector model were approximated, seems to indicate that the rate of investment was the limiting factor and that transfer of labor to industry was not a major problem [22, pp. 51-73]. In view of the potential that exists for increasing agricultural output per man, it is to be expected that labor-supply problems in manufacturing and other growing industries will not be serious provided that intelligent and vigorous efforts are made to enhance farm productivity.¹¹

4. *Agriculture's contributions to capital formation.* The secular decline of the agricultural sector and the structural transformation of an economy that characterize the dynamics of growth underscore the importance and difficulty of the problem of capital accumulation in an underdeveloped country. This is probably the most significant implication of Lewis' two-sector model in which the rate of capital formation determines the rate at which employment can be expanded in the capitalist, high-wage sector of the economy; and the rate of expansion of employment in the capitalist sector relative to the growth of the total labor force determines how soon the surplus of rural labor will be reduced to a point where wage levels are no longer depressed by the low level of productivity and earnings in the subsistence sector.¹²

An underdeveloped country that is making determined efforts to achieve economic progress faces formidable requirements for capital to finance the creation and expansion of manufacturing and mining enterprises, for overhead investment in transportation and utilities, and in the revenue needed for recurrent expenditure for expansion of education and developmental services. These requirements are certain to outstrip the supply of funds available except in those countries which have large earnings from petroleum or mineral exports or particularly favorable access to foreign capital. The sheer size of the agricultural sector

theoretical possibility of immiserizing growth is the fact that for the predominantly agricultural economy of an underdeveloped country, expansion of export crops is likely to offer a practical and economic means by which incomes and foreign exchange earnings can be increased. The gains are likely to be especially significant in relation to development in those instances in which the enlarged production of export crops depends primarily on the use of relatively abundant resources of low opportunity cost.

¹¹ Fleming has asserted that the ease with which labor can be transferred from agriculture to nonagricultural industry "has frequently been exaggerated" [10, p. 254]; but he largely ignores the significant potential that exists for raising labor productivity in agriculture.

¹² The difference between the rate of growth of total and nonagricultural employment, which Doving has termed the "coefficient of differential growth," is a useful measure for comparing the speed of sector changes [8].

as the only major existing industry points to its importance as a source of capital for over-all economic growth. This presumption is particularly strong during the early stages of economic growth inasmuch as reinvestment of profits, historically the major source of capital accumulation, cannot be significant so long as the capitalist sector remains a small segment of the economy.

Since there is scope for raising productivity in agriculture by means that require only moderate capital outlays, it is possible for the agricultural sector to make a net contribution to the capital requirements for infrastructure and for industrial expansion without reducing the low levels of consumption characteristic of the farm population in an underdeveloped country. An increase in agricultural productivity implies some combination of reduced inputs, reduced agricultural prices, or increased farm receipts. Labor, being the abundant input in agriculture, is the principal input that will be reduced, and attention has already been given to agriculture's role as a source of manpower. Implicit in the earlier discussion of the need to expand agricultural production in pace with the growth of demand for food was the important proposition that stable or reduced agricultural prices can facilitate capital accumulation by preventing deterioration or even improving the terms of trade on which the industrial sector obtains food and other agricultural products.

Before considering the possibilities of securing a flow of capital out of agriculture, mention should be made of the ways in which the resource requirements of the agricultural sector can be minimized. The approach to agricultural development considered in Section III is one which minimizes requirements for scarce resources of high opportunity cost and which emphasizes the possibility of enhancing the productivity of the resources already committed to agriculture. It is also desirable for the capital requirements for agricultural expansion, including the increased outlays for fertilizers that are likely to be so important in this phase of agricultural development, to be financed as much as possible out of increased farm receipts that may accrue with the increase of productivity and output. Possibilities also exist for levying school fees, charges for land registration, and other fees that cover all or part of the cost of services provided for the farm population. But for many of the developmental services important to agriculture, it is *not* desirable to link services rendered with a charge to defray the cost. This is partly because individual farmers may not be able or willing to pay for such services, but more important is the fact that social returns to expenditures for research and extension to raise agricultural productivity may be much larger than the private benefits that can be appropriated by individual producers.

Japan is probably the clearest example of a country where agricul-

ture contributed significantly to the financing of development. It was noted earlier that the impressive increase in farm output and productivity in Japan between 1881-90 and 1911-20 required only small capital outlays and but moderate increases in other inputs. Consumption levels of the farm population increased much less than the rise in productivity in agriculture, so that a substantial fraction of the increment in product in agriculture could be used to finance capital formation in the capitalist sector of the economy.

Since heavy taxes on agriculture were the principal device used to siphon off a part of this increase in productivity, it is possible to obtain some notion of the magnitude of this contribution in relation to total investment. Estimates of the division of the tax burden between agriculture and nonagriculture by Seiji Tsunematsu indicate that agriculture's share was some 80 per cent as late as 1893-97 and was still about 50 per cent during the years 1913-17 [22, pp. 53-57] [40, pp. 446-48].

Tax revenues from agriculture thus provided a large part of the funds that the Japanese government used in fostering development by constructing "model factories," by subsidizing the creation of a merchant marine and shipbuilding industry, and by strategic investments in overhead capital such as railroads, education, and research.

Rosovsky's estimates of investment in Japan throw light on the importance of government's role in investment. Even with allowance for the fact that his figures understate private investment, the data indicate that government investment, excluding military investment, exceeded 50 per cent of total investment throughout the period 1895-1910 [42, pp. 354-57].

This heavy reliance on agricultural taxation appears to have been a conscious policy. The eminent economic historian Takao Tsuchiya has interpreted the policy in these terms; "The urgent necessity for protecting and fostering other industries compelled the government to impose a heavy land tax on the agricultural population to obtain the wherewithal to carry out industrial development programs" [35, p. 4].

Political and institutional problems frequently make it difficult to translate the increased potential for saving and capital accumulation, made possible by increased agricultural productivity, into an actual increase in investment. Recent experience in India and Pakistan, for example, gives rise to doubts as to whether capital accumulation and economic growth will proceed at a "satisfactory" pace. Despite the stress that has been placed on promoting economic development, agriculture's contribution to investment and revenue requirements for government expenditure for current services seems to have declined; or at least there is evidence that agriculture's relative contribution to tax revenues has declined appreciably. Wald reports that whereas land

revenues in India provided over 20 per cent of total tax revenue in 1939 they accounted for only 9 per cent of the tax receipts of India's central and state and provincial government in 1954 and only 5 per cent of total tax receipts in Pakistan in 1952 [49, pp. 44n, 61-63].

The political difficulties in taxing the agricultural sector are often formidable, but it seems likely that insufficient recognition of the strategic role that agriculture can and should play in contributing to the capital requirements of economic development has been a factor in the failure to realize the potential for a higher rate of capital formation. Frequently, simple inertia and weaknesses in the tax system have been major factors: government revenues from land in the seven Part A states in India increased only 50 per cent between 1938/39 and 1951/52 whereas the index of wholesale prices of major agricultural commodities increased 550 per cent. On the other hand, inertia has contributed to high tax yields in instances in which tax revenues have been geared to rising world prices. The yield from the land tax in Burma declined from 40 per cent of total government revenue prewar to 5 per cent in 1952, but this was offset by the profits of the state agricultural marketing board which provided some 40 per cent of total government revenue [49, pp. 54, 63]. The influence of the postwar rise in commodity prices was a particularly significant element in the large take of export taxes and marketing board surpluses in Ghana, Uganda, and other African countries.¹³

The conclusion suggested so strongly by both theoretical considerations and historical experience is that in underdeveloped countries, where agriculture accounts for some 40 to 60 per cent of the total national income, the transition from a level of saving and investment that spells stagnation to one permitting a tolerable rate of economic growth cannot be achieved unless agriculture makes a significant net contribution to capital formation in the expanding sectors. If communist countries have an advantage in securing rapid economic growth, it would seem to lie chiefly in their ability to ride roughshod over political opposition and divert a maximum amount of current output into capital accumulation. And agriculture has been a prime target in squeezing out a maximum amount of surplus for investment. In the Soviet Union compulsory collection of grain at artificially low prices

¹³ This is not intended as a blanket indorsement of export taxes and marketing board surpluses as devices for mobilizing funds for development. Nurkse and others have rightly emphasized that excessively heavy taxation can "kill the goose that lays the golden eggs," which seems to be an accurate description of Argentina's policies during the decade following the second world war. It is also true that arguments for mobilizing funds by taxing the agricultural sector have a hollow ring if they encourage spendthrift government policies and expenditure on "public consumption goods," which Walker and Ehrlich believe to have been true in Uganda [50].

was used to siphon off the increment in output originating in agriculture and to facilitate the forced-march development of industry.¹⁴ The rural communes in Communist China appear to be a device aimed not only at extracting the maximum possible surplus of capital from the countryside but a maximum labor effort as well.¹⁵

Societies which value individual freedom and which limit the arbitrary power of government are unable and unwilling to apply the sort of coercion and drastic reorganization of rural communities involved in the collectivization drive in the Soviet Union and in the creation of the Chinese communes. But this should not blind us to the hard fact that an essential element of economic growth is, in Lewis' phrase, "the process by which a community is converted from being a 5 per cent to a 12 per cent saver . . ." [31, p. 226]. In the earlier phases of development it is well-nigh certain that agriculture must play a major role in the process.

5. *Increased rural net cash income as a stimulus to industrialization.*

One of the simplifying assumptions of the two-sector model is that expansion of the capitalist sector is limited only by shortage of capital. Given this assumption, an increase in rural net cash income is not a stimulus to industrialization but an obstacle to expansion of the capitalist sector.¹⁶

It is true, of course, that investment decisions may in fact be influenced not only by the availability of capital but also by demand conditions and estimates of the future profitability of additions to capacity. Nurkse has been especially emphatic in stressing the importance of *opportunities* for profitable investment as a strategic factor influencing the rate of capital formation, and Lewis himself emphasized in his report on industrialization in the Gold Coast that increased rural purchasing power is a valuable stimulus to industrial development [32]. Nurkse has given this concise statement of the problem:

The trouble is this: there is not a sufficient market for manufactured goods in a country where peasants, farm laborers and their families, comprising typically two-thirds to four-fifths of the population, are too

¹⁴ For a brief description of Soviet experience and references to fuller treatments see [23, pp. 508-10].

¹⁵ Recent reports indicate that the rural communes have encountered considerable difficulty in maintaining production efficiency because of some of the special problems of large-scale management in agriculture that are noted in Section III. See the summary of recent discussion of agricultural policy in the *People's Daily* and *Red Flag* by Jacques Jacquet-Francillon in *Le Figaro*, March 15, 1961, p. 5.

¹⁶ Lewis states that: "Anything which raises the productivity of the subsistence sector (average product per person) will raise real wages in the capitalist sector, and will therefore reduce the capitalist surplus and the rate of capital accumulation, unless it at the same time more than correspondingly moves the terms of trade against the subsistence sector [29, p. 172].

poor to buy any factory products, or anything in addition to the little they already buy. There is a lack of real purchasing power, reflecting the low productivity in agriculture [36, pp. 41-42].

There is clearly a conflict between emphasis on agriculture's essential contribution to the capital requirements for over-all development and emphasis on increased farm purchasing power as a stimulus to industrialization. Nor is there any easy reconciliation of the conflict. The size of the market is particularly pertinent to investment decisions in industries characterized by economies of scale so that a fairly high volume of demand is needed to justify construction of a modern factory. But substitution of domestic output for imported manufactured goods often provides a significant addition to demand that does not depend upon an increase in consumer purchasing power. Furthermore, if capital requirements for developing infrastructure and capital-goods or export industries are large relative to the amount of capital that can be mobilized, insufficient consumer demand is unlikely to limit the rate of investment.¹⁷ Political considerations, of course, also play an important role in this determination. Although this is another of the policy issues for which no general answer is possible, it will normally be appropriate to emphasize the capital contribution from agriculture in early stages of the structural transformation.

III. *Resource Requirements and Priorities for Agricultural Development*

It has been argued that a substantial rate of increase in agricultural production can be achieved largely through the more effective use of resources already in the agricultural sector and with only modest demands upon the scarce resources of high opportunity cost which are indispensable for industrial development.

The design and implementation of a rational program of agricultural development, however, is by no means a simple task. Although the experience of Japan, Taiwan, Denmark and other countries that have made notable progress in agriculture throws light on the type of ap-

¹⁷ It would appear that this was the situation that prevailed in Japan during the decades prior to about 1920. A provisional interpretation of developments in Japan during the years 1920-32 suggests that a low level of consumer purchasing power may have been more important than a lack of investible funds in limiting the rate of expansion of the capitalist sector. Even so, deflationary policies and an overvalued exchange rate appear to have been the principal factors responsible for the retardation in the expansion of the capitalist sector in Japan during this period [22, pp. 60-74]. It seems abundantly clear that Japan's remarkably rapid rate of economic growth since the second world war has been stimulated by social changes that led to increased purchasing power among the farm population and industrial workers; but it is also true that by that time the existence of a sizable industrial base and a high rate of profits provided the funds which permitted an extremely high rate of investment.

proach that is likely to yield high returns, their experience can only be suggestive. Variations in soil, climate, and in human resources are of such importance that many aspects of agricultural development are specific to a particular country, region, district, and, ultimately, to an individual farm. Changes over time in the availability and relative prices of productive factors are also of great importance in influencing decisions concerning the choice of techniques of production and the combination of farm enterprises.

Agricultural development policies. Emphasis is given here to a particular type of strategy for raising the productivity of an existing agricultural economy. The low productivity of farm labor, land and other resources in the agricultural sector is largely due to the lack of certain complementary inputs of a technical, educational, and institutional nature. Under these circumstances a crucial requirement for devising an appropriate agricultural development program is to identify these complementary inputs, determine in what proportions they should be combined, and establish priorities among programs designed to increase their availability.

Such a policy for agricultural development, emphasizing measures to increase the efficiency of an existing labor-intensive agriculture and with chief reliance on technological innovations rather than large capital investments, is obviously *not* applicable under all conditions. It is therefore convenient, even at the risk of considerable over-simplification, to emphasize the changing position by defining three specific phases of agricultural development: Phase I: Development of agricultural preconditions. Phase II: Expansion of agricultural production based on labor-intensive, capital-saving techniques, relying heavily on technological innovations. Phase III: Expansion of agricultural production based on capital-intensive, labor-saving techniques.

The labor-intensive, capital-saving approach to agricultural development, appropriate to Phase II, requires an environment in which the possibility of change is recognized and accepted, and in which individual farmers see the possibility of personal gain from technological improvement. Phase I is defined as the period in which these preconditions are met.

Improvements in land tenure are likely to be the most essential requirement in Phase I since an unfavorable tenure situation may stifle the incentive for change even though the potential exists for large increases in output.¹⁸ Rural attitudes toward change are also influenced by the attractiveness and availability of consumer goods, awareness of the possibility of technical improvements, availability of market out-

¹⁸ It is impossible to do more than call attention to this complex and important subject of land reform in this general treatment of agricultural development and its relation to over-all economic growth. Philip Raup has presented a persuasive statement of the economic importance of land tenure reform [41]. See also Doreen Warriner [51].

lets, and many other factors. If traditional group restraints and individual attitudes hostile to change seriously impede agricultural progress, considerable importance attaches to community development programs emphasizing adult literacy, self-help programs directed at the satisfaction of "felt needs," and similar activities that promote greater receptivity to change. There are probably relatively few underdeveloped areas where agricultural policies should be based on the assumption that the preconditions phase prevails.¹⁹ But certainly there are situations in which deficiencies in the institutional environment or attitudes unfavorable to change are critical limiting factors; and in any event, continuing improvement in institutions and incentives can be expected to facilitate agricultural progress.

At the other end of the spectrum, the capital-intensive, labor-saving technology of Phase III typically represents a fairly late stage of development, especially for countries with a high population density. Japan, for example, is apparently just entering this stage. In this phase, the opportunity costs of most inputs, including labor, are high by past standards and rising. Not only is the use of labor-saving farm machinery increasing but the use of many other urban-produced inputs is expanding as well. Hence the need for credit facilities becomes acute. Phase III is generally distinguished by the fact that a substantial amount of structural transformation has occurred so that agriculture no longer bulks so large in the economy.

Agricultural development policies in Phase II. The emphasis in Phase II on increasing the efficiency of an existing agriculture by heavy reliance on technical innovations associated with labor-intensive, capital-saving techniques, is related to certain distinguishing features of this stage of development: (1) agriculture represents a large proportion of the economy; (2) the demand for agricultural products is increasing substantially, but the "required" increase in output of food for domestic consumption is fixed within fairly narrow limits determined by the rate of increase of population and of per capita incomes; (3) capital for the expanding industrial sector is particularly scarce; and (4) the distinction between resources of high opportunity cost and those which are abundant in agriculture and characterized by low opportunity cost is of considerable importance.

¹⁹ With respect to the limitations on development that have been attributed to the allegedly irrational behavior of peasant agricultural producers, there seems to be a growing consensus that this view, espoused particularly by J. H. Boeke, is not borne out by the available evidence. Joosten, whose analysis of rubber exports in Indonesia refutes Boeke's notion of a perverse supply schedule, concludes that: ". . . a scrutiny of the facts shows that the peasant farms his land as rationally as possible under the social and economic conditions affecting him and within the limit of his opportunities as regard labour, land, markets, capital, knowledge and managerial skill" [25, p. 99]. Most of those who have given careful study to the problems of peasant agriculture would indorse that view (see for example [24]).

The design of an appropriate strategy for increasing agricultural productivity requires a high degree of judgment and intimate knowledge of the physical resources and agricultural characteristics of a particular region. Precise determination of an optimal production system, including optimal factor-factor and factor-product relations and operation of the various developmental services at optimal levels, is impossible. There is an inevitable and substantial margin of uncertainty in anticipating the returns likely to accrue from research programs and in forecasting the effectiveness with which knowledge of improved techniques will be disseminated and applied by individual farm operators. Moreover, the importance of innovations developed by individual farmers, an important feature of a progressive agriculture, is even more difficult to anticipate.

The essence of the problem is to identify those factors that are currently limiting increased production and to define a combination of inputs that will yield large returns in increased farm output and productivity. Although general presumptions may be of some value as a guide to research and analysis, there is no substitute for farm-level studies carried out in areas representative of the different types of farming situations that exist within a country or region. Such studies are needed to determine the nature of present input combinations and returns and ways in which efficient decisions and practices at the farm level are hindered by lack of essential inputs.

A number of attempts have been made to inventory the "nonconventional inputs" important for increasing agricultural productivity.²⁰ Four categories of complementary inputs or developmental services may be listed: (1) research to develop improved production possibilities; (2) extension-education programs; (3) facilities for supplying inputs of new and improved forms, particularly improved seed and fertilizers; (4) institutional facilities for servicing agricultural production, such as credit and marketing agencies, and rural governmental bodies for fostering collective action such as building feeder roads. These complementary inputs have a number of characteristics important to the agricultural development process:

First, they come from outside traditional agriculture. The individual farm operator makes the decision, for example, whether to use fertilizer or improved seed if those inputs are available. But whether the fertilizer or seed is available in a time, place, and form conducive to increased production is in large part determined by influences beyond the control of the individual farmer.

Secondly, all of these nonconventional inputs or developmental services include a large institutional component. Since agricultural research and extension-education programs offer tremendous external economies

²⁰ See for example [13] [34].

these functions are normally performed by governmental agencies. Under the conditions existing in low-income countries, it is also frequently desirable for government to encourage the creation of, or even to provide, the institutional facilities required to supply certain production inputs and credit and to process and market agricultural products.

Third, and most important, is the existence of important complementarities among the various conventional and nonconventional inputs. It is largely because of these complementarities that research and extension programs and making available fertilizers and other critical inputs can yield large returns in increasing productivity of the resources already committed to agriculture. Careful proportioning of the added inputs is also important. The interrelationship between the development of improved seed and increased use of fertilizer has already been stressed in reviewing the experience of Japan and Taiwan.

In addition to recognizing the desirability of economizing on resources of high opportunity cost, special attention needs to be given to concentrating resources on programs of the highest priority. Establishing a large number of objectives involves a twofold danger. An attack on items that are not currently of strategic importance obviously increases expenditure and lowers returns on investment. Perhaps even more serious, undue dispersion of effort reduces the effectiveness of critical programs because the shortage of competent administrative personnel imposes a severe limitation on the effectiveness of agricultural development programs.

This last consideration weighs heavily against price support and credit programs which require a considerable amount of high-level administrative talent.²¹ The need to concentrate limited resources on priority programs also makes it desirable to identify those geographical regions within a country that have high potential for large increases in production. Ability to supply the food requirements of expanding urban centers or a capacity for low-cost production of export crops with good market prospects are likely to be particularly pertinent considerations.²²

²¹ It is sometimes argued (e.g. [13, pp. 25-28]) that it is necessary to shift risk and uncertainty from the innovating farmer to other persons. But the members of the farm population in an underdeveloped country are not at a common level of poverty, and there is usually a group controlling a substantial proportion of the land, with asset and income positions well above the average, which is capable of bearing the risk and uncertainty of innovation and investment. Improved credit institutions become a high priority need as the use of capital equipment becomes more important.

²² The Swynnerton Plan for accelerated development of African agriculture in Kenya is an important example of a plan and program that have given special attention to "lands of high potential" [7, pp. 9-15]. B. van de Walle's sketch of a plan for agricultural development of the Congo advocates concentration of resources on areas of high potential for export crop production or which possess locational advantages in supplying urban centers; the limited investments in other areas would be justified by social rather than economic considerations [47, p. 48].

For many countries the most critical components of an agricultural development program in Phase II are (1) research, (2) programs to make knowledge of improved technology available to farmers, (3) arrangements for supplying certain strategic new types of inputs, and (4) enlarged educational opportunities. Introduction of new crops may offer a potential for large increases in the value of agricultural output and frequently enlarged foreign-exchange proceeds as well. But this is dependent, in part at least, upon research to establish the suitability of possible crops to local conditions, to provide planting material, and to determine appropriate cultural practices.

1. *Agricultural research.* The advances in scientific understanding, particularly during the past century, represent a possible windfall gain for a country launching a program of agricultural development today. It is largely because of the accumulated knowledge in such fields as soil science, plant nutrition, and genetics that there are the potential increments of productivity which provide the opportunity for taking up slack in a developing economy. Although an underdeveloped country can draw on the fundamental research and understanding that have been accumulated, the identification of promising avenues of progress and the testing and adapting of improved seed and cultural practices to local conditions are indispensable for realizing the gains that are attainable.

Mounting an effective agricultural research program is a long-term project that depends heavily on continuity of personnel. Shortage of qualified agricultural scientists is a critical problem which can be overcome only in part by employment of research workers from abroad.²³ So basic is an effective program of research to the other elements of an agricultural development program that it represents one of the few instances in which plans and budget allocations should err on the side of boldness, provided that this openhandedness applies only within the limits of carefully determined research priorities.

2. *Extension-education programs.* The effectiveness of agricultural research is dependent upon an extension-education program which carries research findings to farmers and carries knowledge of farmers' problems back to the research staff. The extension techniques that have been effective in the United States are not necessarily appropriate in other countries. Japan achieved notable results without an extension service per se; extension-type activities were performed by local experiment stations, village agricultural associations, and in other ways. In Jamaica and Denmark a network of agricultural societies has provided

²³ The cooperative program of the Rockefeller Foundation and the Ministry of Agriculture in Mexico owes much of its success to the continuity of service of the key scientists and the emphasis given to the training of young Mexican agricultural scientists [15].

an effective mechanism. Where farmer resistance to change is strong there may be a need for programs of supervised credit or subsidization of new inputs; and under some circumstances a government tractor-hire service might be justified in part as a technique for securing acceptance of improved practices or more productive farming systems. But the final success of a program to develop agriculture depends on training tradition-bound farmers to make economically sound decisions regarding new alternatives.²⁴

A commonly recommended alternative to the slow process of training the mass of farmers to make their own decisions is to institute some form of large-scale farming using specialized management, such as collective farms and various types of cooperative farming. But economies of scale in agriculture do not continue for nearly as far out the scale line as in the case of other forms of production. The high degree of variability in agriculture poses problems of management and decision-making which cannot be centralized without considerable duplication of effort. Brewster has stressed particularly the large number of "on-the-spot supervisory decisions" that must be made in agriculture [3]. There is a basic difference between agriculture and industry in this respect because the biological nature of the agricultural production process means that the operations to be performed are separated in time and space. This increases the importance of these on-the-spot supervisory decisions and reduces some of the advantages of mechanization.²⁵ A further significant economic advantage of decentralized management and decision-making arises from the more direct individual interest in the outcome of the farm enterprise with consequent favorable effects on incentives, initiative, and upon what Raup has termed the "accretionary process of capital formation" that are of such importance in agriculture.²⁶

²⁴ For discussion of the problems and feasibility of a program of management assistance to farmers in low-income countries, see [20].

²⁵ An interesting study by G. K. Boon of conditions under which mechanization is economical in the construction of field trenches emphasizes that "labour-intensive methods in construction are characterized by the absence of some of the disadvantages which they usually imply in industrial processes"; for example, "substituting labour for machinery for construction processes does not involve larger factory buildings and other extra capital outlays" [2, pp. 11-12]. This sort of contrast is, of course, even more evident in the differences between agricultural and industrial processes.

²⁶ Raup stresses the influence of a suitable tenure situation and of the time-consuming character of production processes upon capital accumulation in agriculture. Both elements are important, for example, in the growth of livestock numbers and quality as a result of slow improvements in feeding levels and better management and disease protection [41, p. 14]. Likewise, he emphasizes the importance of "periodic unemployment" in agriculture when the opportunity cost of labor is measured only in the reservation price of leisure time. "An incentive system that will maximize the investment of this labor in the firm is one of the basic requirements for agricultural growth. In terms of capital creation that structure is best which creates the maximum likelihood that the farm family will elect to 'exploit' its own labor" [41, p. 22].

Judging from the experience of collective farms and production co-operatives these considerations are of considerable importance; but they do not rule out the possibility of exceptions. It has been noted, for example, that plantations may facilitate the introduction of new export crops for which the capital and technical requirements are demanding, particularly if integration of production and processing is important for the control of quality [21, p. 342]. These advantages of large-scale production depend upon a high level of managerial skill; and they are likely to be temporary.²⁷ Similarly, some form of tractor-hire service or contract plowing provided either by the agricultural department, a co-operative, or private entrepreneurs, may be an economical arrangement, particularly if technical considerations such as deep or timely plowing are important.²⁸

3. *Supply of strategic new types of inputs.* Certain of the complementary inputs of critical importance to increasing agricultural production in Phase II are items such as chemical fertilizers that are new and must be supplied from outside the traditional village economy. Fertilizers and pesticides depend upon the establishment of new productive capacity or upon foreign exchange for imports; thus they compete directly for scarce resources of high opportunity cost. The returns on investment in those inputs, however, can be extremely high provided that the full range of complementary inputs is available—notably improved seed, knowledge of fertilizer response under various soil and cropping situations, and an extension organization capable of disseminating information to farmers.

The new inputs also require new institutional facilities to make them available at the farm level. In some countries fertilizer manufacturers have done this job effectively, but frequently in the earlier stages of development it is necessary for the government agricultural service or co-operatives to perform this function. To make available supplies of improved seed requires intricate institutional arrangements for seed multiplication and distribution so as to insure a pure supply; and here again governmental initiative is likely to be essential.

Improvement of transportation facilities may also be crucial to farmer utilization of purchased inputs. Improved transportation also

²⁷ In past years it was claimed that African smallholders could not produce high quality Arabica coffee in Kenya; but in the last ten years there has been a spectacular expansion of production by African producers. Problems of quality control have been difficult but by no means insoluble. This development has, of course, been supported by government research and extension programs and loans to facilitate the establishment of cooperative pulping stations.

²⁸ The highly successful Gezira Scheme in the Sudan exemplifies an interesting combination of labor-intensive and capital-intensive techniques [11, pp. 230-34].

increases production incentives through higher farm prices and speeds the spread of innovation through improved communication.

4. *Education and agricultural development.* Virtually all aspects of agricultural development hinge on developing a broad range of educational institutions. The critical problems concern the use of the small nucleus of trained personnel to staff training programs and the financial burden arising from enlarged expenditures for education.

Despite difficulties of finance and lack of trained teachers, many underdeveloped countries today are committed to large-scale expansion of educational facilities. This increased supply of trained people can be turned to good account in agriculture since trained manpower is needed to remove the bottleneck to efficient utilization of the labor and land resources that are already abundant in this sector. This is in marked contrast to the situation in industry where the large requirements for capital equipment to be combined with labor constitute a bottleneck to rapidly expanding the utilization of trained labor.

Efforts aimed at developing local government institutions, increasing literacy, and instituting rural social changes by community development or other techniques can be commenced by personnel with slight initial training supplemented by continuing in-service training. Even in the case of agricultural extension, programs at the early stages can emphasize relatively simple production innovations such as fertilizer-seed combinations, introduction of improved tools, and efforts to raise the general standard of husbandry nearer to that of the better farmers. The spread of education among the farm population broadens horizons, provides necessary skills for keeping records and accounts, and strengthens the capacity of farmers to make rational decisions.

Agricultural development in Phase II is potentially a dynamic process characterized by continuing increase in agricultural productivity.²⁹ This is so in part because of differential rates of adoption of new technology, but it is also a consequence of the continuing stream of innovations generated by an effective research program. This continuing growth of farm productivity depends on a large number of changes which individually give relatively small response but collectively add up to a large response. It requires continued improvement in incentives and in the institutions serving agriculture, including further re-

²⁹Higgins argues incorrectly that "with the labor-intensive techniques of small-scale peasant agriculture the opportunities for technological improvement are extremely limited" [16, p. 422]. His assertion seems to be based on the erroneous view that agricultural development at this stage is a one-shot proposition—shifting from "bad" seed and practices to "good" seed and practices—and that a dynamic process of agricultural development is impossible until "the discontinuous jump to more extensive and more mechanized agriculture" can be made [16, p. 422].

finement in the operation of the research and extension organizations, and the establishment or strengthening of institutions of higher education to provide the needed professional and administrative personnel.

IV. *Conclusions*

In this examination of agriculture's role in the process of economic development, an attempt has been made to emphasize features that have a high degree of generality. But diversity among nations and the variety that is so characteristic of agriculture inevitably limits the validity of a condensed, general treatment. The density of the rural population and the stage of economic development that has been reached stand out as having a particularly significant bearing on the importance of some of the factors examined in this paper.

Despite these qualifications, it is believed that the general thesis advanced has wide relevance: rural welfare as well as over-all economic growth demand a transformation of a country's economic structure, involving relative decline of the agricultural sector, and a net flow of capital and other resources from agriculture to the industrial sector of the economy. Agriculture's contribution to the requirements for development capital is especially significant in the earlier stages of the process of growth; it will not be so crucial in countries which have the possibility of securing a sizeable fraction of their capital requirements by export of mineral products or in the form of foreign loans or grants.

Policies that take account of this process of secular transformation and its implications are in the long-run interest of the farm population as well as the country as a whole. Reduction of the farm labor force is a necessary condition for establishing factor proportions that yield returns to labor in agriculture that are more or less in accord with returns to labor in other sectors. More concretely, insufficient movement out of agriculture will perpetuate, or lead to, excessively small farms and serious underemployment of labor as the proximate causes of substandard farm incomes.

Although this paper has stressed the importance of agriculture's role in development, we part company with those who draw the inference that agricultural development should precede or take priority over industrial expansion. Sayigh, who can be taken as representative of that view, asserts that "deep progress cannot be achieved on both these fronts simultaneously" [44, p. 448]. It is our contention that "balanced growth" is needed in the sense of simultaneous efforts to promote agricultural and industrial development. We recognize that there are severe limitations on the capacity of an underdeveloped country to do everything at once. But it is precisely this consideration which underscores the importance of developing agriculture in such a way as to

both minimize its demands upon resources most needed for industrial development and maximize its net contribution to the capital required for general economic growth.

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