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By

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ABSTRACT

This is a very condensed examination of the reciprocal interactions between agriculture and industry in the development process. It is argued that today's 'late developing countries' -- those characterised by an economic structure in which agriculture still accounts for some 60 to 80 per cent of the country's total labour force and by rapid rates of growth of both population and labour force -- confront special problems and opportunities. One consequence of those structural/demographic characteristics is that the nature and time sequence of farm innovations will determine the proportion of a country's farmers that is able to participate in the process of agricultural modernisation. And whether or not a country's agricultural strategy leads to wide participation of the rural population in technical and economic advance has major implications for the achievement of both the economic and social goals of national development.

To define the agriculture-industry continuum is not an easy task. For the high-income, developed countries the continuum is evident in a long, evolutionary process whereby countries that were overwhelmingly agricultural at some time in the nineteenth century were transformed into modern, industrial economies. This transformation took place even earlier in England. The transformation has been most apparent in the drastic change it brought about in the occupational composition of the labour force. However, a more fundamental feature of the economic transformation has been the growth of specialisation and increased economic interdependence - between agriculture and the other sectors and among producing units throughout the economy.

This specialisation has had effects that have gone far beyond those emphasised by Adam Smith. It has, of course, facilitated increased use of capital equipment and of new sources of power, beginning with the steam engine, and these changes have multiplied the productivity of human labour. Other changes associated with the pervasive growth of specialisation and of differentiation in the roles of institutions and individuals have been even more significant than the increases in a country's capital stock and the increased scale of economic units needed to make efficient use of specialised machinery and the new sources of power. Simon Kuznets is undoubtedly right in suggesting that the most distinctive feature that sets modern economic growth apart from earlier periods of economic change is the extent to which economic activity has come to be based on science and science-based technologies. Specialised institutions - universities, research institutes, the research and development departments of industrial firms - and individual specialists - scientists, inventors, innovating entrepreneurs - have created increasingly productive methods for transforming resources into economically useful goods and services. And a tremendous increase in exchange, especially pronounced in the expanded exchange of intermediate products - steel of many types and forms, machines, sulphuric acid, cement, caustic soda and a host of other products - has been necessary for this growth of productivity based on specialisation and the application of scientific knowledge to economic activity.

What bearing do these interlinked changes associated with movement along the agriculture-industry continuum have on the problems of agricultural development? Let me begin to answer that question by briefly contrasting the position of agriculture in two countries at opposite ends of the agriculture-industry spectrum - the U.S. and Ethiopia. It is well known that in the U.S. only about five per cent of the country's labour force is engaged in growing crops and raising livestock. Even if we add the workers engaged in indirect agricultural production -

i.e. in producing tractors, fertilisers and other inputs purchased by farmers - the percentage is still remarkably small. If we look back to the 1820's, however, we find that some 75 per cent of the U.S. work force was still engaged in agriculture. The proportion of the population engaged in nonfarm occupations at that time was obviously very small - although not quite as small as in Ethiopia today. Thus the U.S. farm economy of 150 years ago had many of the characteristics of an agricultural sector that is still heavily oriented toward subsistence production.

The fact that farming activities were directed in large measure to satisfying the subsistence requirements of the farm household was a necessity - but it was also regarded as a virtue. A good farmer of that day was esteemed for being self-sufficient, restricting his monetary purchases to a very limited range of commodities that could not be produced within the family unit. With the expansion of both domestic and foreign markets for farm products, however, farming came to be oriented increasingly toward production for the market. By 1961, commercial sales of farm products were high enough to permit annual cash expenditures by the average farm household in the U.S. of about $12,000, and 45 per cent of this total cash expenditure was devoted to production expenses, which do not include wages, rent and interest and tax payments as defined by the U.S. Department of Agriculture. A considerable fraction of those farm production expenses represented intrasectoral transactions such as purchases of seed or livestock feed from farms specialising in those lines of production. But the greater part represented purchases from the industrial sector, including outlays for the repair and operation of farm machinery. Although agricultural production continues to have some distinctive features because of its dependence on the soil and on the biological processes of plant and animal growth, the similarities between agriculture and other industries have become more important than the differences. As a result of the continuing advance in scientific knowledge and of research and development activity leading to the development of more efficient technologies, usually embodied in specialised capital equipment or other purchased inputs, increases in the productivity of agriculture and in other sectors have led to an enormous expansion in the productive capacity of the national economy. The growth of productivity in agriculture, for example, has been as dependent upon the development of more efficient techniques for the manufacture of chemical fertilisers and a wide range of increasingly sophisticated farm equipment as on the improvement of techniques employed within agriculture itself.

Turning to the opposite end of the spectrum, we have a country such as Ethiopia in which easily 85 per cent of the population is still dependent on agriculture for work and income. Agricultural productivity and per capita incomes are extremely low, and this is in large measure inevitable given the high degree of self-sufficiency and the technologies employed in the semi-isolated village communities

which are the dominating feature of the economy. Not only is a large fraction of farm output destined for the subsistence consumption of farm households, but most of the simple tools and other production inputs are provided within the farm household or perhaps by a village blacksmith or other local artisans, many of whom are also farmers. The specialisation that has evolved is thus confined for the most part to the village community, and, apart from some islands of modern agriculture, the knowledge that guides farm practices is based almost entirely on empirical insights that have been slowly and painfully acquired over many years. Very few of the farm households in these village communities are totally isolated from the rest of the Ethiopian economy and the outside world. Some cash income is earned by sale of farm products through domestic commercial channels, but the domestic market outlets are inevitably small in relation to the number of farm units when only some 15 to 20 per cent of the population is dependent on purchased food. Probably somewhat more important as a source of cash income for Ethiopia's farmers are the sales of coffee and other export products to consumers overseas. Nevertheless, according to a 1967 survey of farm expenditures which is probably an overestimate of the overall situation since it concentrated on provinces where coffee is grown, the total cash expenditures by the average farm household amounted to only $130, just slightly over 1 per cent of the cash outlays by the average U.S. farm household in 1961. Only a quarter of the total represented farm production expenses, and about two-thirds of the outlays in that category were for the purchase of animals, a figure that may well reflect a bias in the sample but which is probably also inflated by the tendency to invest in livestock as a store of wealth, a tendency which is reinforced by the lack of alternative forms of financial assets.

On the other hand, the Ethiopian farmers covered by this survey allocated over 60 per cent of their cash expenditures to various consumer goods and services as a means of augmenting the very low level of consumption derived from subsistence production. In the U.S., the average farm household has pushed specialisation to such a degree that remarkably little food is produced for home consumption so that even farm households rely predominantly on purchased food. Nevertheless, purchases of food, drink and tobacco represented only 25 per cent of consumer expenditures in 1961; and the total outlay for all consumer goods and services amounted to only a third of all cash expenditures by farm households.

These examples illustrate in a dramatic and somewhat extreme fashion the contrast between the high-income industrialised countries and late developing countries where the process of economic development has not yet brought about any very significant transformation of their predominantly agrarian structure. This subset of developing countries in which agriculture still accounts for some 60, 70 or 80 per cent of the total labour force and a large though smaller share of G.N.P.,

probably accounts for close to two-thirds of the world's population. Whatever the actual percentage may be, it is almost certainly an increasing fraction of the world total because of the rapid rates of population growth which are another distinctive feature of the late developing countries.

In our joint study of the reciprocal interactions between agricultural development and the expansion of manufacturing and other nonfarm sectors, Peter Kilby and I have attempted to explore the ramifications of three conditioning factors which, in our view, are fundamental to an understanding of economic development and structural transformation in these countries. (This study, Agricultural and Structural Transformation: Economic Strategies in Late Developing Countries, is due to be published in 1975 by Oxford University Press.) The first of these conditioning factors is the simple fact of being late, a fact that creates exceedingly difficult problems but which also offers special opportunities. The principal potential advantage derives from the existence of an enormous technological backlong that contemporary developing countries can draw upon. Because of being spared the necessity of investing the time and resources that are required to produce useful knowledge, these countries have an opportunity to achieve very rapid economic growth. But that is not only an opportunity; it is also an imperative if truly disastrous consequences are to be avoided.

The existence of a large body of accumulated scientific knowledge and advanced technologies is a double-edged sword, a fact that is illustrated most dramatically by the half-completed demographic revolution that has been experienced by today's developing countries. The widespread impact of modern public health measures and other interventions -- anti-malaria campaigns, mass innoculation programmes, local health centres or clinics able to dispense antibiotics and other drugs, improved transportation and the availability of free or concessional food imports to lessen the effects of drought or other calamities -- all of these have led to an unprecedented rapid reduction in mortality rates. Few would deny that this reduction in the number of premature deaths has been a great boon to the families affected. But, unlike the circumstances that characterised the demographic transition in the industrialised countries, this lowering of the death rate has not been accompanied by major changes in the structure or productive capacity of the economies. The fact that a rapid rate of growth of the total population is followed after a lag by even more rapid growth of the population of working age means that a high rate of expansion of employment opportunities outside agriculture is required in order for the nonfarm sectors to absorb more than a small fraction of the annual additions to the work force. But the experience of the past 25 years has demonstrated that even when non-agricultural production is expanding at rates of 5 or even 10

per cent per year, the rate of increase in nonfarm employment is only a little more rapid than the rate of growth of the total labour force. Hence, the farm population and work force in these countries is continuing to grow at a rapid rate, and even the decline in the share of agriculture in the total labour force is distressingly slow.

The relatively capital-intensive and import-intensive character of much of the investment that is taking place points to another dilemma. Because of being late-comers, these countries confront a large number of possibilities for increasing productivity in both industry and agriculture. But this is a mixed blessing because of the strong possibility that many of the technologies that are borrowed will be ill-suited to their needs. The contemporary industrialised countries evolved increasingly productive technologies as the frontiers of science and technical knowledge were expanded and as emerging scarcities of particular resources induced innovations to reduce demand for resources that were becoming more costly. Hence the technologies that are most readily available for transfer are by and large very capital-intensive because they were developed in response to a situation in which labour was becoming scarce and costly while capital was becoming a relatively abundant resource.

The likelihood of inappropriate technology transfer is, moreover, heightened by the distorted structure of relative prices which prevails in most developing countries as a consequence of the pursuit of a policy of import substitution based on high levels of tariff protection, typically buttressed by foreign exchange controls, import licensing and quantitative restrictions on imports. In addition, the tariff structure and related restrictions usually have a very different impact on capital goods as compared to final consumer goods. Because of a partial view of the development process and a strong preoccupation with the role of capital formation, governments have frequently allowed imports of machinery and other types of capital goods to enter duty free or at a very low tariff rate. At the same time, consumer goods are subject to tariff rates as high as 100 per cent or even more. It has been demonstrated that such a highly differentiated tariff structure is tantamount to subsidising the price of the capital goods that can be imported duty free or at rates well below the average level of protection. The effects of these foreign trade policies have generally been reinforced by certain other policies that have often been associated with them. Most pervasive in its effects is the practice of requiring institutional lenders, whether governmental or private, to charge interest rates that are well below the opportunity cost of capital in these countries where capital, like foreign exchange, is an extraordinarily scarce resource. Accelerated depreciation allowances and the operation of both import and investment licensing also

contribute to this underpricing of capital and foreign exchange, relative to labour, by influencing the decisions of the modern sector firms that have preferential access to supplies of those scarce resources. The result is an inappropriately capital-intensive pattern of investment within a modern or formal sector of the economy which remains extremely small in terms of employment even though it absorbs a large fraction of the available resources of capital and foreign exchange.

A major consequence of this mix of policies is that economic growth does not lead to progress along the agriculture-industry continuum. Instead we typically witness an enormous gap, a veritable chasm, that separates a large agricultural sector still dominated by small, semi-subsistence farmers from a modern industrial sector of capital- and import-intensive enterprises which has many of the characteristics of an alien enclave.

This generalised picture of dualism between a traditional agriculure and a modern industrial sector is, of course, an oversimplification. First of all we must note that a similar dualism often exists within agriculture itself. Most of the burden of financing the inefficient expansion of a highly protected domestic industry is borne by the agricultural sector. This de facto tax is collected in part by turning the terms of trade against agriculture. Protected firms in the domestic industrial sector are the beneficiaries of the high prices that farmers must pay for consumer goods and inputs. Farmers also receive relatively low prices for their export products because of the existence of an over-valued exchange rate defended by the various curbs on imports. In addition, farmers are often obliged to pay an explicit export tax or a de facto tax represented by the frequently large difference between a marketing board's purchase price and the world price. During the past decade there has been increased awareness of this burden on agriculture, but too often the measures taken to redress the situation have favoured a sub-sector of atypically large and capital-intensive farm units at the expense of the great mass of the rural population. This consequence is obvious in the case of duty free imports of tractors and tax rebates for fuel; but it also applies in large measure to subsidised distribution of inputs and to credit made available at artificially low interest rates so that the limited supplies available from institutional sources must be allocated by some form of non-price rationing. Although farm input subsidies and low interest rates are frequently justified as being needed to help the poor farmer, in practice the larger farmers with greater wealth and political influence usually receive the lion's share of those scarce resources. In the case of credit, the low-interest-rate policies also have adverse effects on the supply of savings and on the growth of financial intermediaries so that the typical farmer dependent on credit from non-institutional sources must pay a rate of interest even

higher than warranted by the high opportunity cost of capital in a capital-scarce economy.

It is also necessary to recognize the role of firms in an informal sector engaged in small-scale manufacturing and a variety of service activities. These small-scale, labour-intensive units have many of the characteristics of agriculture as a self-employment sector in which a part of the labour force, unable to find employment in the modern or formal sector, manages to find some work and a meagre income.

I will deal very briefly with the other two conditioning factors which Kilby and I regard as fundamental to an understanding of the structural transformation process in late developing countries. I have already alluded to one of them in suggesting that the growth of productivity and output in agriculture can only be understood within the context of the interdependence between agriculture and other sectors. Certain facets of this interdependence have received considerable attention in the literature on agricultural development: (i) the need to expand production and commercial sales rapidly enough to meet the food requirements of a growing nonfarm population; (ii) the importance of achieving a net transfer of resources from agriculture to the faster growing nonfarm sectors; (iii) the role of agricultural exports as a source of expanded foreign exchange earnings to finance a growing volume of imports; and (iv) the so-called contribution of agriculture in providing a major part of the additional labour required by the nonfarm sectors. Because of the structural-demographic characteristics noted earlier, however, it is more to the point to emphasise the reciprocal contribution represented by the expansion of employment opportunities in the nonfarm sectors which initially slows the growth of the farm labour force and eventually permits a reduction in the absolute size of the work force in agriculture.

Other facets of this interdependence between agriculture and nonagriculture also have highly significant effects on development. In particular, it is essential to consider the level and composition of intersectoral commodity flows. The extremely low level of farm cash receipts and expenditures epitomised by the Ethiopian situation illustrates the way in which the existing economic structure limits the volume of intersectoral commodity flows. This constraint on the level of intersectoral commodity flows arises because, as noted earlier, the urban population dependent on purchased food is extremely small relative to the number of

farm households. And because agricultural sales are thus limited, the farm sector's demand for manufactured consumer goods and purchased inputs such as fertiliser and farm equipment is subject to a severe purchasing power constraint. This is, of course, not a totally binding constraint. Expansion of agricultural exports can, especially in small countries, make it possible for farmers to expand their cash income at a rate considerably more rapid than would be possible with exclusive reliance on the domestic commercial market. Nevertheless, for the cash receipts accruing to the average farm household to reach a really high level requires a considerable transformation of the overwhelmingly agrarian structure of a late developing economy. This purchasing power constraint has some important implications. It means that the nature and time sequence of farm innovations and associated inputs will determine the proportion of a country's farm households that will be able to participate in the process of agricultural modernisation. And whether or not a country's agricultural strategy leads to wide participation of the rural population in technical and economic advance will, of course, exert a powerful influence on the composition of rural demand for consumer goods as well as farm inputs -- and thereby shape the pattern of industrial expansion to a considerable extent.

The final conditioning factor is closely related to the considerations that have just been mentioned. It concerns the interacting influence on the pattern of rural development of the size distribution of farm operational units and the type of technologies adopted. The average farm unit in a late developing country is inevitably small, but there can be great variation in the dispersion of farm size around the mean. For example, there is a strking difference between the relatively equal size distribution of farm operational units in Taiwan and the enormous contrast in Colombia between a very large number of small units cultivating but a small fraction of the agricultural land and a small number of very large farm holdings which account for the bulk of the cultivated area. Thus four-fifths of Taiwan's farms are within one acre of the mean farm size of three acres. In Colombia, however, only one-tenth of the farmsteads are within five acres of the mean farm size. The mean farm size of 56 acres is, in fact, a very misleading statistic. Most farm units are much smaller, while most of the farm land is in holdings many times larger than the mean farm size; the largest one per cent of holdings are on average nearly 50 times larger than the mean farm size. Colombia is an extreme example of the concentration of land in large operational units, but whenever the expansion of agricultural production is concentrated in a sub-sector of large farms the size distribution will be quite highly skewed. To the extent that the large farms which comprise

such a sub-sector dominate commercial sales of farm products, they will not be seriously constrained in rapidly expanding their use of purchased inputs of all kinds. The great bulk of the country's farm households will, however, be subject to a purchasing power constraint that will be even more binding than the structurally determined constraint discussed earlier. Hence, their ability to gradually modify their traditional farm technologies is bound to be severely restricted since most productivity-increasing innovations require some increase in purchased inputs.

What are the implications of those three conditioning factors for the choice of strategy for fostering agricultural development? I want to emphasise a few propositions suggested by these three factors which appear to deserve careful consideration in many if not all late developing countries.

Clearly, one of the most demanding tasks that a successful development strategy must fulfill is to draw maximum advantage from the technological backlog while avoiding the pitfalls of borrowing inappropriate technologies. 'Getting prices right' can clearly assist in this task because a distorted structure of relative prices, especially underpricing of capital and foreign exchange, increases the likelihood that the technologies borrowed will be ill-suited to developing a country's resource endowment. There are, however, many other policy variables that exert a critical influence on both the rate and pattern of economic development.

The basic proposition that I want to stress is that an agricultural strategy that leads to the progressive modernisation of a large and increasing fraction of a country's small farms is of central importance to achieving rapid economic growth and structural change which involves the whole population in the transition from a predominantly agrarian society to a productive and diversified industrial economy. It is fairly obvious that widespread involvement of the rural population in this process of technical and economic change will bring greater benefits to the large fraction of the population dependent on agriculture than a strategy that is concentrated on a sub-sector of large-scale farms using technologies that differ drastically from those employed by the great majority of farm units. It is less obvious, but I believe that it can be demonstrated by historical evidence as well as logic, that a progressive modernisation strategy has significant economic as well as social advantages.

First of all, by achieving fuller mobilisation of a country's indigenous resources such a strategy minimises the agricultural sector's requirements for the

particularly scarce resources of capital and foreign exchange - and thus facilitates more rapid structural transformation. A sequence of divisible innovations that can be used efficiently by small-scale farmers has the effect of complementing rather than displacing a country's relatively abundant labour resources. Moreover, by fostering widespread increases in the productivity of the land and labour already committed to the agricultural sector, it is possible to achieve large increases in total factor productivity, i.e. in output per unit of total inputs. The experience of Japan and Taiwan is especially impressive in the extent to which increases in factor productivity, based mainly on divisible, yield-increasing innovations affecting millions of small farm units, has contributed to the expansion of agricultural production.

A pattern of agricultural development that promotes widespread improvement in income-earning opportunities in agriculture also leads to a relatively equal distribution of income among the rural population. As noted earlier, the composition of rural demand for consumer goods and farm inputs associated with such a pattern of income distribution can be expected to provide a valuable stimulus to the growth of domestic manufacturing output. Moreover, much of this expansion will be in relatively small firms employing technologies that are much less capital- and import-intensive than plants in the large-scale 'modern' sector which use technologies that differ only marginally from those used in high-income countries with drastically different factor proportions.

Furthermore, the pattern of structural transformation that results from widespread advances in productivity among the bulk of a country's farm households can be expected to make some highly significant contributions to the broader process of social modernisation. We must not lose sight of the fact that the transition from a low-income agrarian society to a high-income industrial economy must involve a good deal more than changes in the economic sphere. Most obviously, if progress is not made in bringing birth rates into tolerable balance with sharply reduced death rates, disastrous consequences lie ahead. On the other hand, if the pattern of agricultural development and other factors influencing rural attitudes, motivation and behaviour facilitate a fairly rapid spread of family planning, a given rate of expansion of farm output will lead to more rapid growth of per capita income and thus a greater increase in purchasing power to be devoted to productive inputs as well as to raising consumption levels.

I will argue in a moment that a strategy of progressive modernisation is likely to accelerate the reduction of birth rates. In addition, such a strategy can be expected to generate considerable political and financial support for the

expansion of education in rural areas and also for programmes to improve the health and nutrition of the rural population which supplement the effects of rising per capita incomes. I am impressed by the arguments put forward by Carl Taylor, Asok Mitra and others concerning the potential contribution of maternal and child care programmes which provide a package of health, nutrition and family planning services. It has been argued, and with a good deal of supporting evidence, that reductions in infant and child mortality, which give parents greater assurance that the children they already have will survive, are of great importance in overcoming resistance to the practice of family planning. The argument has also been advanced that the changed attitude to the future that seems to follow better health and nutrition enhances receptivity to the novel idea of consciously restricting family size. Of equal importance, however, is the fact that widespread involvement in the process of technical and economic change and the strengthening of institutions and communications networks, which are both cause and consequence of progressively modernising the agricultural sector, will have similar effects on rural attitudes toward family planning. Eva Mueller's analysis of the interrelations between socio-economic factors and the degree of acceptance of family planning among farm households in Taiwan provides considerable support for that proposition. In particular, she found that the expansion of economic horizons and the rising aspirations which have affected such a large fraction of Taiwan's farm households, though of course in varying degree, appear to have contributed very importantly to the acceptance of family planning in Taiwan. She suggests, however, that where agricultural improvement is confined to a small minority of farmers, so that the great majority have no experience with progress and no reason to raise their sights, the changes in household preferences will be much less extensive than in Taiwan and the environment for the spread of family planning much less propitious.

Rather than elaborating further on the advantages of a strategy of progressive modernisation, I propose to consider a few of the formidable obstacles to designing and implementing such a strategy. Probably the most obv us obstacle is the opposition of politically powerful groups who see an advantage in a more dualistic pattern of development which favours a modern industrial sector and an enclave of modern, large-scale agriculture. A highly skewed distribution of the ownership of land may, of course, create a political and economic environment that is hostile to the widespread modernisation of small farm units. For that reason it is often claimed that land reform is a prerequisite for achieving such a pattern of agricultural development. I happen to be persuaded that redistributive land reform is likely to

yield significant economic as well as social advantages, but needless to say, the fact that a number of my academic colleagues and I hold such a view has precious little bearing on the political realities in a particular country which will determine whether land reform is feasible or not. What I can say as an economist who has studied the problems of agricultural development for a good many years, is that it is the size distribution of operational units, not ownership units, that is the crucial factor influencing the nature and sequence of technical innovations and thus the pattern of agricultural development. In addition, the weight of evidence seems to suggest that emphasis on rental ceilings or on the rhetoric of redistributive land reform without effective implementation is likely to be counter-productive.

Again I will make passing reference to experience in Japan and Taiwan. During the period prior to the land reforms carried out after the second World War, the widespread modernisation of small-scale farm units in those countries made a notable contribution to overall economic growth and structural change in spite of a highly skewed size distribution of ownership units. This was basically because the government's policies were effective in promoting the modernisation of the existing small-scale farming system, and the large landowners aimed at maximising their wealth by renting out their land to small-scale tenants or part-tenants rather than undertaking direct cultivation. I am mindful of the fact that the situation was one of great hardship for many tenant households. It is certainly to be hoped that with improved opportunities for rapid economic growth and the possibility of supplementing domestic resources with loans and grants from abroad small-scale farmers in developing countries today will have an easier passage to the position which has now been reached in Japan and Taiwan where the growth of employment opportunities throughout the economy has greatly improved the returns to labour in agriculture as well as in the nonfarm sectors. I would emphasise, however, following an observation made by Clifford Geertz in comparing Japan's experience with that of Indonesia, that in Japan, and also in Taiwan, the hardships borne by the farmers were not in vain because in both countries the pervasive modernisation of the existing small-scale farming systems made a notable contribution to the transformation of the agrarian economies. I would also argue, though without pursuing the matter here, the merits of a land tax which insures that a sizeable fraction of the differential rent accruing to farm land is mobilised by government units to finance investments in infrastructure and other development programmes.

It may well be that in some situations, especially in Latin America, land reform is a necessary condition for pursuing a strategy of progressive modernisation, but it would be overly pessimistic to argue that it is always a precondition. More generally, I would suggest that two other sets of problems are likely to be more

difficult than the political obstacles in implementing an agricultural strategy aimed at the progressive modernisation of the agricultural sector. First are the many challenging problems of organisation and implementation which are involved in fostering technical and economic progress among millions of small-scale farmers. These are issues which have already received considerable attention at the Seminar, and I merely reiterate that they are complex and of crucial importance.

The other problem area relates to the difficulty of reaching an effective consensus on the type of agricultural strategy to be pursued, a problem which compounds the difficulty of making the decisions needed to devise and implement a coherent set of policies and programmes. It appears to me that this is a problem which applies as much to donor agencies as to the governments of developing countries.

Let me illustrate this problem by briefly sketching two alternative reactions to the challenges faced by developing countries which differ from the ideas I have advanced in opposite ways. One response has been to argue that the problem of increasing agricultural output at a sufficiently rapid rate is so enormous and urgent that it must be regarded as an overriding concern. Thus David Hopper stated, on the basis of his considerable involvement with India's agricultural problems during the 1960's, that increased food production must be regarded as "the priority objective. In the same paper, he went on to assert "that if the pursuit of production is made subordinate to other aims, the dismal record of the past will not be altered"; and he specifically rejects the idea that tractor mechanisation should be discouraged because of what he describes as "its assumed impact on rural labour-force employment", the argument being that such policies would interfere with an increase in multiple cropping. Hopper and many others thus view the key policy issue as a choice between efficiency and equity. In emphatically opting for efficiency, they dismiss goals other than the maximisation of farm output and give short shrift to the view that the efficiency of an agricultural strategy should be assessed in relation to its contribution to the multiple goals which, in my opinion, should be furthered by the modernisation of the agricultural sector. Hopper also gives little attention to the influence of the size distribution of operational units on the choice of techniques. It will be clear from my earlier remarks that I would contend that labour shortages are not likely to be a serious constraint on multiple cropping except on a typically large operational units, especially if small farmers have access to simple and inexpensive equipment of good design to ease emerging labour bottlenecks.

According to the second of these alternative viewpoints, the problem of transforming a traditional economy and achieving widespread improvements in the wellbeing of the population is not really very formidable if only the country's

political leaders have the 'will' to plan the country's development appropriately. In this view, it is the cupidity and corruption of powerful vested interests that are the important obstacles to progress. Given a strong commitment to economic planning for the benefit of the whole population, the problems of low productivity and poverty could be readily overcome. My doubts about that view stem from a conviction that the most effective governmental strategy for promoting rapid and efficient agricultural development is one that emphasises changing the production possibilities available to individual farmers. Such a strategy requires a combination of (1) agricultural research that generates technical innovations adapted to the needs of small-scale farm units with limited cash income and purchasing power; (2) farmer training programmes to assist in diffusing knowledge of more productive, scientifically based technologies; (3) investments in irrigation, rural roads and other types of infrastructure; (4) programme to improve the marketing of farm products and the distribution of inputs; and (5) appropriate and consistent policies related to prices, taxation and land tenure. Such a strategy is based on a recognition of the significant advantages of decentralised decision-making by individual farmers and the fact that the price mechanism fulfills a critical and inherently difficult communications function by harmonising decentralised decisions and by harnessing the powerful motive of profit. On my reading of the evidence available, which I confess is based more on the well-documented experience of the Soviet Union than the approach pursued in Chin about which we know much less, detailed planning for the agricultural sector is less effective than a strategy which concentrates on improving the technical and economic environment in which individual farmers operate.

According to another point of view, the shortcomings of the economic policies and programmes of the past two decades, with their focus on the goal of increasing G.N.P. to the neglect of concerns about employment and income distribution, are deplored, but the emphasis is on direct measures to expand employment opportunities through massive rural works programmes and similarly large-scale programmes of nutrition intervention and other direct measures to improve the health and wellbeing of the population groups which have been by-passed as a result of development policies mainly benefiting the 'modern' sub-sectors in industry and agriculture. As I mentioned earlier, I am persuaded that maternal and child care programmes which deliver a package of health, nutritional and family planning services to rural as well as urban areas merit high priority because the benefits of such programmes promise to be large relative to the costs. Yet, except for a few very selective activities, I am skeptical about the prospects for undertaking direct welfare

programmes on a sufficient scale to have a substantial impact. In countries where poverty is a huge and pervasive problem, it seems unrealistic to expect programmes based on the redistribution of income financed by taxation of the wealthier groups to be more than a mere palliative. Hence, it is essential to promote widespread increases in employment and in income-earning opportunities as an integral part of a country's strategy for agricultural development.

I would like to conclude my treatment of this large topic by mentioning two issues which appear to be of critical importance to the success of efforts to achieve the progressive modernisation of agriculture. It has often been emphasised that improved seed-fertiliser combinations have a key role to play because they represent a divisible innovation that can be used efficiently by small farmers, and the potential for achieving substantial yield increases is usually very great. The rapid rise in fertiser prices during the past three or four years has, however, raised doubts about the viability of this approach in the years ahead. This issue involves a host of complex questions about fertiliser manufacturing technologies, the cost and availability of raw materials and the location of fertiliser plants. The conclusion that I draw from recent studies by the World Bank Fertiliser Study Group and other organisations is that there are sound reasons to expect fertilisers to again become an abundant and relatively low-cost input within the next four or five years. Although it seems probable that the OPEC countries will be able to continue to maintain petroleum prices at recent high levels, it seems unlikely that monopoly pricing of fertiliser exports will be possible. Especially in the case of nitrogen fertilisers, the rather wide availability of supplies of natural gas, supplies that are large relative to the amounts required for fertiliser production, and the low opportunity cost of this input in many countries make it profitable to expand production capacity even on the assumption that prices will decline considerably from current levels. There is, however, a large question whether the necessary investment decisions to expand capacity will be made rapidly enough to eliminate the present excess demand situation in a reasonably short time. There is also a danger that the current high prices will encourage governments in a number of importing countries to build small-scale, high-cost plants with the result that their farmers will be obliged to rely on expensive fertiliser from domestic sources rather than having access to low-cost imports.

The manufacture of nitrogen fertiliser, being an extraordinarily capital-intensive process that is characterised by substantial economies of scale up to a minimum capacity of at least 1,000 tons of ammonia per day, is a line of production that is particularly ill-suited to low-income countries with an abundance of labour

and a severe shortage of capital. On the other hand, a number of the petroleum-producing developing countries which have large supplies of investable funds and cheap natural gas, most of which is currently being flared, have a large comparative advantage compared to countries without natural gas and probably even in comparison with producers in Europe and North America who have access to natural gas but at higher opportunity cost.

In contrast to fertiliser production, where the end products and manufacturing techniques offer little scope for adaptation to differences in factor prices, the expanded manufacture of farm equipment in developing countries offers promise of making significant contributions to agricultural development and industrial growth. To realise this potential, however, certain conditions must be fulfilled. Increases in agricultural productivity and the growth of farm cash income must be spread widely so as to generate demand for relatively simple and inexpensive items of farm equipment that can be produced efficiently by relatively small-scale, labour-intensive and capital-saving firms which have not yet reached a high degree of technical sophistication. In some countries, notably in tropical Africa, the indigenous skills in foundry work and other metal working activities are still very limited. Some countries are making special efforts to stimulate rural industrialisation: for example, the Rural Industrial Development Centres, Village Polytechnics and Technical Institutes in Kenya. Those efforts are not likely to amount to much, however, unless the efforts to expand production capabilities by technical assistance and training are matched by an expanding demand for a widening range of products of modest but growing sophistication which can be produced by such firms.

The sharp increase in fuel prices and in the cost of tractors and spare parts seems to be having a dampening effect on the enthusiasm for the direct transfer of mechanical technologies from the high-income, developed countries. By the same token, these conditions are sharpening interest in the possibility of easing labour bottlenecks and increasing the timeliness and precision with which farm operations can be performed by improving the range of animal-powered equipment and by the gradual spread of many other types of inexpensive equipment that can make a very broad contribution to increasing the productivity of farm labour and at the same time stimulate progress along the agriculture-industry continuum, leading to economy-wide increases in productivity, output and employment opportunities.