GUY HUNTER*

THE FOOD RESEARCH INSTITUTE'S FIFTIETH ANNIVERSARY CONFERENCE, STRATEGIES FOR AGRICULTURAL DEVELOPMENT IN THE 1970s: A SUMMARY AND CRITIQUE

PREFACE

When the Food Research Institute initiated research on economic development a little over two decades ago, two principal roles were identified for agriculture: as *provisioner*, and as *generator* of overall economic growth. Developments in agricultural science since that time, particularly of high-yielding varieties of rice and wheat and the adaptation to local conditions of high-yielding maizes, promise solution of the provisioning problem for the decades just ahead. But, for a variety of reasons—many of them not well understood—the accelerated expansion of crop production made possible by the new cereals does not seem to be generating desired changes in nonagricultural output and employment.

It was the task of the Conference to assess the causes of this failure of agriculture as generator by examining the dimensions of the new agricultural technology that are shared by the other economic sectors, and to develop strategies for agriculture that might capitalize on the opportunities these interconnections afford for economic growth.

It was suggested by one participant that the Conference coincided with a "watershed" in thought about agricultural development, marking the passage from a time when the focus was almost exclusively on agriculture alone to a period when agriculture is always viewed within the framework of the national economy. It is to be hoped that the Conference did in fact mark the passing from an older parochial view to a more promising catholic one, and that agricultural planners of the future will shed the blinders that have prevented them from seeing the impact of their policies on other sectors. Time will tell.

The Conference was sponsored by the Food Research Institute, with supplementary sponsorship by the Agricultural Development Council, Inc. of New York and the Overseas Development Institute of London. Conferees from 20 countries convened on the evening of December 13, 1971, and continued their deliberations through December 16. A smaller group stayed on to constitute an informal seminar devoted to the topics of the Conference and adjourned on

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December 18. In all, 114 representatives of national and international development agencies, private industry and banking, philanthropic foundations, and university faculties took part. They included experts from all the continents, with years of service in agricultural development both in their own countries and abroad.

General planning and organization of the Conference was undertaken by Professor Bruce F. Johnston, assisted by Mr. Guy Hunter of the Overseas Development Institute and Professors Roger W. Gray, Clark W. Reynolds, Scott R. Pearson, and C. Peter Timmer of the Food Research Institute. Special thanks are due to Mr. John E. Lynch, Administrative Associate, and Mrs. Minnie Jurow, who served as Conference Secretary.

The Institute also wishes to acknowledge financial support provided by the Overseas Development Administration of the United Kingdom for the travel for six African members of the Conference, the Ford Foundation for travel for three British scholars, and the Agricultural Development Council and the United States Agency for International Development for travel support of participants from Latin America, Asia, and the United States.

Mr. Hunter's "Summary and Critique" is a masterful weaving-together of the issues and the positions presented and defended by the participants. The depth and richness of his own understanding of development issues help to provide a unity to the discourse that may not have been perceived at the time by those who were deeply engaged in the discussions. We are profoundly indebted to him for consenting to undertake this task that none could have done as well as he.

Had the full proceedings of the Conference been published as a book, it would have been dedicated to the memory of Merrill Kelly Bennett, who served as Executive Director of the Food Research Institute from 1942 to 1952 and as Director from 1952 until his retirement in 1962. Instead, this Conference issue of *Food Research Institute Studies* is, in itself, a tribute to his towering contribution to the work of the Institute.

William O. Jones,
Conference Chairman

FOREWORD

When a massive volume of "Conference Proceedings" thuds down on the desk, there are few among scholars or executives who do not give a little groan. What most of them would like, perhaps, is to get some idea of the kinds of argument which took place, the kind of movement in thinking which seemed to emerge, and some form of access to a few papers in full, whether because of their special respect for an author, or because of an intriguing title. It is to meet this natural wish that this special issue was designed. There are, of course, many dangers in such compression of the material; I have sought to minimize these by giving authors the chance at least to correct the more serious editorial shortcomings.

The papers summarized are arranged under a few broad headings, to bring together those with generally similar subject matter or type of approach. In some cases, where a formal comment on the paper was presented to the Conference, this comment has been added, in summarized form. In one major instance (agricultural technology), sections from several papers have been brought together, to relieve the reader from jumping backwards and forwards in the text to compare them.

Pure summarization can be very wearisome to read in large doses, because the freshness, illustrations, and varying styles of the original full paper are lost. As far as possible, I have therefore used quite extensive quotation in the author's own words, with linking passages where there is heavy compression. I have also allowed myself an occasional liberty of comment, as well as the concluding few pages, mainly to bring out agreements or differences between different authors, to point up the drift of argument or indicate alternative approaches, sometimes even to add a little salt to the dish by allowing my own prejudices to peep out. I think it will be reasonably clear what is summary and what is comment.

Any reader who wishes to see an original paper can normally do so: the Appendix gives the formal list of titles and authors and an indication of their availability. I have not, in general, included the author's references to other scholars, which are, of course, recorded in the original texts.

G.H.

CONTENTS

STRATEGIES FOR AGRICULTURAL DEVELOPMENT IN THE 1970s

PART I. POPULATION AND FOOD SUPPLY

Two of the Conference papers set an outer framework on a world scale for the proceedings—the paper on population by Dudley Kirk and that on the future supply of major foodgrains by Eric Ojala. Without these two the Conference would have been without any means of answering a valid question: Is there famine ahead, and, if so, how soon?

Dudley Kirk

Kirk's paper[1] was unusual in its sober optimism, though perhaps it would be less misleading to emphasize the sobriety rather than the hope. Since the Food Research Institute was established 50 years ago, the population of the world has doubled, from 1.8 to 3.6 billions; yet "the world is feeding its much larger population, if anything, better than it was fed in 1921." Moreover, "most countries have indeed made gains. The rhetoric about the population 'explosion, bomb, crisis' (what you will) has obscured the fact that the economies of most developing countries have indeed kept pace with population growth, and many have moved ahead."

So much for the past, with an explicit recognition that total gains have been badly distributed, mainly to the industrialized countries, and that "there are indeed many hundreds of millions of people who do not have the means to obtain an adequate diet."

The future is more doubtful. The present rates of population growth in less developed countries (LDCs) are far higher than ever they were in the now rich countries of the world.

> Even the present situation cannot be maintained indefinitely without a reduction in the rate of population growth. Many countries are still on the razor's edge. In some countries, like Bangladesh, a pathetically small margin separates the normal from the catastrophic. Nor can any amount of technological progress in the very long run keep up with the 2½ percent rate of population growth now occurring in the developing countries. In the long perspective, zero population growth is not just a cause or a goal; like the laws of motion, it is a law of nature. Any nonstop rate of growth, no matter how small, will ultimately lead to disaster.

What are the hopes of reduction in birth rates? Kirk lists five reasons for hope. First, the falling trend of birth rates in many developing countries. "Of 47

[1] "Prospects for Reducing Birth Rates in Developing Countries: The Interplay of Population and Agricultural Policies." Quotations from the various Conference papers may not agree with the final text as it appears in published version.

developing countries listed by the United Nations (UN) as having 'virtually complete' registration of births, 42 report a reduction of the birth rate between the early 1960s and the late 1960s." These reductions are occurring in the more advanced countries of widely divergent cultures—in East Asia, . . . Southeast Asia, . . . in the Islamic world, . . . among the blacks of the West Indies and in Latin America. It is true, as Kirk says, that these do not include the giants—China, India, Pakistan,[2] Indonesia, Brazil, Nigeria (a total of about 1,600 million). In fact, accurate evidence of what is happening there is hard to come by; a few straws in the wind (the 1971 census in India showed 15 million less than the predicted figure) may justify at least suspended judgment.

The second hopeful point lies in the tentative conclusion of a recent Stanford study that, once decline in birth rates sets in, it moves down faster—more than twice as fast—than did the rates in Europe or the United States; and the higher they are, the faster they fall.

Third, the climate of opinion is far more favorable to birth control; fourth, growing prosperity tends to be correlated with falling rates; fifth, a better technology of birth control is available.

Against these factors the author sets, with great force, the sheer immensity of the numbers involved.

> In the less developed areas, including mainland China, there are over 400 million couples in the reproductive ages. And this number grows by more and more each year, now by about 10 million a year. To persuade, induce, or coerce such an enormous mass to practice birth control and reduce their family size is a Herculean task, a job for Zeus himself. In fact it cannot be done from outside or by anyone playing God; it must be done by the people themselves.
>
> It follows that what we need is not so much a crisis mentality as a long-term campaign. With such an enormous problem it is fatuous nonsense to expect quick results. What we have is not so much an explosion or a bomb as a relatively slow-moving but vast, relentless force.

The remainder of the paper goes on to emphasize the long, slow haul that lies ahead, with no real view of possible success before the end of the century and a further huge increase in population; the delayed effects on the labor force—the entrants for 1987 are already born; and the contribution of an effective agricultural development strategy, particularly if it brings a modest prosperity to the lowest income groups, the vast mass of rural population. It is a vision of grave difficulties in the short term—say to the 1990s; but there are at least possibilities of much more hope later on. Such is the challenge: even with so balanced a presentation, it is sufficiently grim.

Eric Ojala

If we now turn to the prospects of output of basic cereals and of world cereal trade in Eric Ojala's paper,[3] the projects[4] show the possibilities of a con-

[2] Pakistan = Pakistan and Bangladesh; the papers were written before the division.

[3] "Impact of the New Production Possibilities on the Structure of Internal Trade in Agricultural Products."

[4] They *are* projections, not estmates; see page 13 below.

siderable excess of exportable surplus over effective trade demand. At the very outset of his paper, Ojala emphasizes the technological advances and increased outputs in the developed countries as a highly significant factor, quite apart from the Green Revolution in less developed countries. He adds an interesting comment:

> In the sphere of industry we have become familiar with the spread of manufacturing processes and investments from the original centers of innovation and concentration to the outlying regions of the world which formerly constituted the markets for manufactured goods. The application of industrial technology in new lands forced the adjustment of earlier production and trade patterns. Thus, as a conspicuous example, the structure of world trade in textiles was transformed during the first half of this century and is still experiencing the necessity for severe readjustments. The same principle holds true in world agriculture.

A whole book on the possible changes in the structure, content and geographical dispersal of the world food industry would be needed to forecast—or guess—the detailed implications of this statement.

There follows a brief section on the Green Revolution. The most striking statistics are for *wheat*, notably (apart from Mexico) in India and Pakistan for the years 1966–70. In the five-year period India increased acreage under the new wheats from 3,000 to 6.1 million acres; by 1970 they covered 37 percent of Indian acreage and 65 percent of output, with a rise in national average yield per acre of 50 percent. Corresponding figures for Pakistan show 45 percent of acreage, 59 percent of total output, and a yield rise of 50 percent. Other encouraging areas have been Turkey and North Africa, subject in the latter to control of septorial disease. In countries with winter frost, where the Mexican varieties are not suitable, encouraging results are coming from a Russian wheat (notably in parts of Turkey, Iran, Afghanistan, Argentina, and Chile).

The rice story is significant but perhaps less dramatic. Although the new varieties have been adopted as rapidly as the dwarf wheat varieties in terms of total acreage covered, the proportion of acreage benefiting is much less. This is because the new varieties are successful only under good water control, a condition which applies to two-thirds of the wheat land in Asia but only to one-fifth of the rice land. Moreover, the first International Rice Research Institute (IRRI) variety proved susceptible to important rice diseases and had lower milling and taste qualities, defects which are being corrected in subsequent breeding work. New varieties from Food and Agriculture Organization (FAO)–sponsored programs have been successful in both Malaysia and Ceylon, with three-quarters of the Ceylon paddy land planted to H4 and H8 in 1969, including a high proportion of smallholdings.

The maize and sorghum stories are again more mixed, mainly because of disease factors; but intensive new breeding programs may well alter this.

The paper then moves on to a key table of yields of wheat and paddy, from 1909–13 to 1968–70, with a projection to 1980, for the major producers of each crop (see Table 1). Ojala's most significant comment on this table is that, in developed countries, the rising curve starts fairly flat and steepens dramatically

TABLE 1.—AVERAGE YIELDS OF WHEAT AND RICE (PADDY) IN SELECTED COUNTRIES, 1909–13 TO 1968–70*

(Quintals per hectare)

	1909–13	1923–27	1928–32	1934–38	1948–52	1953–57	1958–62	1963–67	1968–70
					WHEAT				
United Kingdom	21.2	22.0	21.9	23.1	27.2	30.9	36.4	40.5	38.2
France	13.1	14.0	14.8	15.5	18.3	22.6	25.4	31.2	35.6
United States	9.9	9.7	9.7	8.7	11.2	12.9	16.7	17.4	20.2
Algeria	6.7	5.3	5.4	5.6	6.2	6.9	6.6	6.1	6.2
Argentina	6.6	8.6	8.8	8.7	11.5	13.2	13.2	14.6	11.2
Brazil	—	13.1	9.7	8.3	7.4	8.4	5.7	7.6	9.6
Mexico	3.8	4.6	6.3	6.7	8.8	12.1	15.8	23.1	28.0
India	8.1	7.5	7.0	7.1	6.6	7.4	8.0	8.3	11.6
Pakistan					8.5	7.5	8.0	8.1	11.0
Tunisia	3.2	4.2	4.6	5.1	4.9	4.5	3.7	4.7	4.6
Turkey	—	6.5	7.8	9.9	10.0	10.0	10.5	11.7	11.8
					RICE				
United States	16.7	20.1	23.3	24.7	25.6	31.5	38.5	47.6	49.4
Japan	30.8	32.5	35.0	36.3	42.5	44.1	50.0	51.8	56.4
Burma, India, and Pakistan	16.5	14.3	14.5	13.9	12.0	13.2	14.8	15.3	16.7
Ceylon	8.0	7.7	8.6	9.9	14.2	15.8	18.6	19.4	24.0
Egypt	36.0	30.0	29.9	35.0	37.9	47.7	51.8	50.8	52.0
Malaysia	10.2	12.3	13.2	17.3	19.3	20.9	23.5	24.6	23.2
Philippines	7.4	11.7	12.0	10.9	11.8	11.6	11.7	13.2	15.7
Taiwan	17.0	20.1	22.3	24.7	22.1	28.5	32.9	39.0	41.5
Thailand	15.0	18.6	16.3	12.9	13.1	13.6	14.2	17.0	18.1

* Data from FAO, *The State of Food and Agriculture, 1968* (Rome); Annex Table 16, revised and extended, from unpublished FAO reports.

in the later years. In developing countries many of the curves are still rising only moderately. However:

> The experience of Mexico and the promising beginnings made in Ceylon and Malaysia, India, Pakistan, and the Philippines suggest that in the developing countries where the curves of yields are still basically flat, cereal yields can potentially be doubled even more quickly than in the developed countries. This is because of the very low present levels of yields in the developing regions and the accumulation of improved planting material and technological advances available for local research and application. It is evident that enormous gains lie ahead not only for wheat and rice but also for maize, millet and sorghums—very important food and feed grains for which the yield trends are still generally flat. These gains will be realized only if there is a firm and continuing commitment by governments to ensure adequate investment in the essential supporting institutions and services.

The last sentence in this quotation is emphasized again by Ojala, indicating the formidable administrative and institutional effort needed to deliver the new

technology to the mass of small farmers. This is an observation which will recur many times in these papers.

The second half of the paper concentrates on potential exportable surpluses and potential demand on a world trade basis, relying on the very recently completed *FAO Agricultural Commodity Projections 1970–1980*, covering 132 countries and 60 commodities. The key assumptions are: (1) unchanged national policies as known in 1971; (2) constant 1970 prices; (3) continual improvement in technology; (4) continued growth of gross national product (GNP) at current trends; (5) continued population trends as for the 1960s, with a small acceleration in LDCs.

> The FAO results are thus essentially trend-oriented projections, not forecasts or targets. Although the assumptions are rather unrealistic in the real world, some such standard assumptions are necessary for methodological reasons. The projected imbalances that emerge from the calculations will not, of course, occur in practice. They reflect rather imprecisely the order of magnitude of the disequilibria between demand and supply which would arise if the observable trends continued unchanged until 1980, with the underlying assumptions.

Space will not permit a detailed account of these projections.[5] Their basic conconclusion is that world demand for cereals would increase at about 2.3 percent per annum (on the assumptions given) through the 1970s, while world production would increase at 2.8 percent per annum.

> The projected increase in export availabilities would amount to 68 million tons for all cereals, of which 51 million tons would be in coarse grains and 16 million tons in wheat. As against this, the overall increase in import requirements would be only 15 million tons, most of it coming from two developed countries—Japan and the United Kingdom.

Two significant comments by Ojala must be added. First, that "with high domestic prices the developed exporting countries will have to rely on increasingly high subsidies to exports," and that the pressure for adjustment in the developed countries will be further intensified. In fact, developed countries are putting a double pressure on the market, both by the technological advance toward self-sufficiency in importing countries, and by steep rises in output by exporting countries (United States, France, for example). The second comment is contained in the last sentences of the paper:

> The location of the adjustments that will inevitably take place, as between developing and developed country exporters, and therefore the impact on the structure of trade, will be determined as much by the balance of political forces as of economic ones.
>
> A much more broadly acceptable international framework for such adjustments, of which there is no sign at present, will have to be formulated and negotiated, if the benefits of agricultural science and technology are to be widely and equitably shared among the peoples of the world.

These two background papers, taken together, reveal a situation both as to population and food supply, which, within their assumptions, is certainly

[5] The paper is published in full in *Food Research Institute Studies*, XI, 2, 1972.

capable of human control, granted even a modicum of wisdom. There are, of course, other parameters, of which pollution or deterioration of the total environment is the most obvious. Production could certainly be matched to a reasonably decelerated population growth falling ultimately to zero: whether the environment could stand the strain, and whether world political behavior can avoid enormous follies, are other matters.

PART II. ECONOMIC ANALYSIS

The papers collected in Part II move from a wide general view of the economic process of agricultural development (Ruttan and Hayami, and in some degree Little), through more detailed analysis of the relation between agriculture and other sectors (Mellor and Lele, Kilby and Johnston, Cline), to a pair of papers on agricultural taxation (Lewis and Krishna), including some written comments on these papers by other Conference members. It may be convenient to take these three groups under subsections.

GENERAL

The paper prepared by Ruttan and Hayami was the first to be discussed at the Conference, and perhaps significantly stressed a recurrent theme—the significance of factor prices for the shape and type of development process.[6]

Vernon W. Ruttan and Yujiro Hayami

Before launching their main thesis, the authors run through four earlier approaches to the problems of agricultural development. These are loosely described as "models"—the conservation model, the urban-industrial impact model, the diffusion model, and the high payoff input model. These are not, of course, economic models in the strict sense: they might better be described as emphases—or even fashions—of thought about agricultural development, partly embedded in local-historical events (the conservation model is mainly about British eighteenth and nineteenth century agriculture), partly concerned with *special* parts of the subject (regional disparities of growth related to urban-industrial contact), partly reflections of technological change (the high payoff input model is obviously related to the plant-breeding and chemical revolution).

The conservation model was, in effect, partly economic theory and partly a technical concern with the energy cycle in the soil. It involved the optimal combination of cropping, animal husbandry, manure, and other inputs to increase output while maintaining fertility, with some general economic propositions in the background (scarcity of resources, law of diminishing returns). It says little about the relationship of agriculture to other economic sectors or about prices, or about the social structure in which agriculture is embedded. The urban-industrial model, in sharp contrast, consists chiefly of the *aperçu* that vigorous urban-industrial growth with its effect on demand, and on the circulation of new ideas and techniques, can stimulate, in its vicinity, a vigorous upsurge of agricultural output. The authors rightly observe that this favorable combina-

[6] "Strategies for Agricultural Development: the Evolution of Thought."

tion of circumstances is not reproduced in situations of chronic unemployment and "pathological" urban growth in some parts of the LDCs. They do not, however, mention the mounting interest in "growth centers," an idea which seeks to create, through planning, a dynamic rural-urban relationship at local levels.

The diffusion model equally owed its origin to an observation of the difference in performance between farmers in similar ecological circumstances. One rational aim would be to diffuse among the more backward the good management of the more progressive farmers. This particular emphasis gave a strong stimulus to farm management and production-economics research, linked to the theory of the firm, and to improvement in quantitative methods and data processing techniques. The authors add that "research of rural sociologists on the diffusion process . . . contributed to the effectiveness of the agricultural extension service and strengthened the confidence of agricultural administrators and policy-makers in the validity of the diffusion model." In the next paragraph, however, they record somewhat bleakly that "technical assistance and community development programs, based explicitly on the diffusion model, failed to generate either rapid modernization of traditional farms or rapid growth in agricultural output." These two quotations emphasize the dangers of describing these successive phases of emphasis as "models." Even if agricultural administrators knew much about diffusion theory, and even if it is a good and useful theory, and even if it was faithfully applied (three very large assumptions), the causes of failure in rapid modernization of traditional farms are far too complex to be laid at this door.

The high payoff input model is attributed by the authors partly to the double criticism by T. W. Schultz of the diffusion approach on the grounds: (a) that, within their constraints, peasants are rational and efficient resource allocators, and (b) that the inputs which required to be diffused, to suit the real conditions of peasant agriculture, did not exist ready-made and would have to be produced and tailored to "the biological and other conditions specific to the agriculture of poor communities." While the authors recognize the apparent success of this model, as exemplified in the plant-breeding research and package programs of the Green Revolution, they feel the model to be intellectually unsatisfactory since, while it recognizes the necessity for an input of public sector activities (especially research), "it does not explain how economic conditions induce the development and adaption of an efficient set of technologies for a particular society. Nor does it attempt to specify the processes by which factor and product price relationships induce investment in research in a particular direction."

It is this defect which the authors seek to remedy in the second half of their paper, in describing the induced development model, which is described as "an attempt to develop a model of agricultural development in which technical change is treated as endogenous to the development process, rather than as an exogenous factor that operates independently of other development processes."

The argument is based on the statement that "technology can be developed to facilitate the substitution of relatively abundant (hence, cheap) factors for relatively scarce (hence, expensive) factors in the economy." After pointing out that technological change in agriculture may take a labor-saving path largely through mechanical innovation (tractors) or a land-saving path through chemical-biological innovation, the authors support a theory of "induced innovation"

following a line of thought springing from Hicks's *Theory of Wages*. Its main thrust is to emphasize "the role of changing factor prices in inducing a continuous sequence of non-neutral biological and mechanical innovations along the iso-product surface of a meta-production function." This is illustrated both diagrammatically and with argument both as to mechanization and as to fertilizer use, tracing the effects of a changing price ratio on inducing the use of, say, a combine, or a changing land-fertilizer price ratio to induce the adoption of changing crop varieties, and, indeed, the development of such varieties at the research level.

This theory is extended to the public sector:

> Our view of the mechanism of "induced innovation" in the public sector agricultural research is similar to the Hicksian theory of induced innovation in the private sector. A major extension of the traditional argument is that we base the innovation inducement mechanism not only on the response to changes in the market prices of profit maximizing firms but also on the response by research scientists and administrators in public institutions to resource endowments and economic change. We hypothesize that technical change is guided along an efficient path by price signals in the market, provided that the prices efficiently reflect changes in the demand and supply of products and factors and that there exists effective interaction among farmers, public research institutions, and private agricultural supply firms.

Note the second half of the proviso.

Later, the authors emphasize again that "the response of research scientists and administrators represents the critical link in the inducement mechanism." And indeed, having somewhat boldly hypothesized that this link works, they extend the induced effects to "scientists working in more basic fields." Further, a change in factor prices and technology will affect not only research but major institutions, such as those governing land tenure; the authors quote in their support both Schultz and Kazushi Okhawa for the view that "institutional reform is appropriately viewed as a response to the new opportunities opened up by advances in technology," and quote the Second Enclosure Movement in England as an instance. They are, of course, aware of some social implications: "The process of transforming institutions in response to technical and economic opportunities generally involves time lags, social and political stress, and, in some cases, disruption of social and political order. Economic growth ultimately depends on the flexibility and efficiency of society in transforming itself in response to technical and economic opportunities."

It is clear that the authors are somewhat worried by the public sector research and institutions link, since they repeatedly emphasize that "socialization" of much biological research in agriculture is essential. The reason for socialization is clear. Private individuals and firms can rarely appropriate the returns to this type of research, which will therefore require some form of public support and financing. But insofar as this socialization implies the establishment of research institutions by government, with direct or indirect influence by government on research policy, more difficult issues are raised. For, a little later, the authors are recommending "the removal of the rigidities and distortions arising from govern-

ment policy itself—including . . . unfavorable factor and product prices for agriculture." Government is a political process, dominated by the most powerful elements in society; if it has power to distort factor prices, it has power to influence the direction of publicly financed research. The model does not seem to accommodate the possibility that the most powerful elements of society can manipulate the direction of research in their own interests or in favor of a variety of political goals. Indeed the authors appear to recognize this, in quoting for example the fact that, as a result of such manipulation, the real cost of tractors in West Pakistan was substantially below the cost in the United States. If we are left with a theory that factor prices *truly reflecting resource endowments and real costs* are the basic power-unit to induce agricultural development, we seem to have a theory of what would optimize growth, granted high economic rationality in government policy and exclusion of minority manipulation or conflicting political aims, rather than a theory explaining what has actually happened.

Comment by George L. Beckford

In his comments on the paper by Ruttan and Hayami, Beckford first observed that the model is one of agricultural *growth* (output) without an element of welfare or widespread improvement of mass conditions in the rural area. As the preceding paragraph shows, this could well be true; but perhaps it goes beyond the authors' terms of reference. His second point is of major importance, in suggesting that analogies from the record of Western nineteenth century development are not applicable to many developing countries today. In the West "the social order . . . was of a kind that permitted the emergence of economic institutions and behavioral patterns that fit the neoclassical marginalist framework of economic analysis." But the economies of LDCs "are for the most part characterized by imperfect market conditions and social institutional arrangements that create artificial rigidities and inflexibilities in the patterns of resource use." This vital comment is applicable to other Conference papers, and may well prove to be one of the most significant contributions. Beckford adds: "Furthermore, the openness of most underdeveloped economies exposes them to exogenous influences of a kind that serves to shatter the neat links between factor endowments and factor prices and between factor prices and technological change which are central to the induced development model."

The comment then continues with a list of objections. Profit maximization is not the consistent motive of small farmers; there is not a reliable association between resource-endowments and factor prices; factor-substitution is not always possible at the margin; resource endowments can be altered by technological change (e.g., desalination), rather than technological change springing from resource endowments; the dependence of LDCs on the capital, technology, and management resources of the economically advanced countries means that exogenous technical change (the possibility of which the Ruttan-Hayami paper admits) will be not occasional but dominant. Finally:

> Any model of induced institutional reform must explain how the existing institutional arrangements affect different groups in the society, how change will affect these groups, and the balance of power between the

> groups. This calls for a political, social, and psychological analysis that the simplistic Ruttan and Hayami model cannot possibly cope with. A further consideration is the obvious relationship between institutional structure and technological change. Certain patterns of social organization simply do not contribute to the kind of social inputs (education and research, for example) that are critical to the process of change envisaged in the induced development model.

This last comment fills out our own concern at the implications of "socialization," and of the power-structure generally, in relation to the paper.

Beckford concludes by stating a personal position, which brackets, in some degree, the two main sections of the Conference—that which deals with economic analysis and that which deals with implementation.

> To my mind, the induced development model of Ruttan and Hayami exposes the fundamental limitations of contemporary theorizing on the nature of the process of agricultural development. If we are concerned, as I am, with the material welfare of rural people, then the problem must be approached differently from the way the authors have attempted. Basically, Ruttan and Hayami have started from the body of economic theory that we have at our disposal. That body of theory is based on the observation of economists of real situations that existed in the past. I suggest that we need to analyze the process of agricultural development from the perspective of the present. In terms of agricultural development this means developing models appropriate to the contemporary situation in Third World countries.
>
> If we are to do this, it seems to me that we need, first, to develop a typology of underdeveloped agriculture reflecting different institutional arrangements in particular situations; and, secondly, to develop models appropriate to each type identified. For the most obvious lesson to be gained from the evolution of thought on this subject is that useful theories of agricultural development have been based on analyses of specific situations. It is the specific social order that determines the institutional arrangements that influence the interplay of the proximate economic variables that are central to the Ruttan-Hayami model. So if we are to understand the development process we need to probe far beyond the proximate economic variables. And I am afraid that, as economists, we are just not equipped for that!

Ian M. D. Little

The second general paper on economic policy is that by Ian Little dealing with capital intensity of investment and the growth of employment.[7] It is at once wide-ranging and laconic, as it would have to be to cover so much highly complex argument in a short space. If there is one general emphasis, it is again on the market and price system as a fundamental point of reference. Little adopts six subheadings: "Investment in Industry and Agriculture"; "Industry or Product Choice"; "Scale of Operations"; "Industrial Structure" (size dis-

[7] "The Influence of Economic Policy in Less Developed Countries on the Capital Intensity of Investment, and Growth of Employment."

tribution of plants); "Choice of Techniques"; and "Capacity Utilization"; followed by a brief assessment of their relative importance.

After a very brief statement that most LDC government policies have favored industry relatively to agriculture, the author moves to the choices of industry, which, at least *de facto*, appear to have been made by direct government choice, indirectly by import and investment licensing, directly or indirectly by the price mechanism (tax, subsidy, tariff controls), by encouragement to private external investment, or by keeping low interest rates and relatively high wages.

While direct government choice in search of independence, prestige, or import-substitution ("the poor man's guide to market research") has had some effects, Little puts greater weight on the many forms of protection, occasioned by balance of payments difficulties, and resulting in overvalued exchange rates, the discouragement of exports, and high costs of local inputs. This, combined with inducements to outside investors (tax holidays and remission of import duties on capital items that are more or less equivalent to low interest rates) encourages capital intensity. "Any policy which cheapens capital and promotes high wages obviously favors capital-intensive industries and products."

After a very brief note that economies of scale normally save both labor and capital, the saved capital being available to create jobs elsewhere, without any *a priori* presumption that the total result raises or lowers the capital-labor ratio, Little moves on to a more detailed discussion of the size distribution of plants.

The discussion concerning the effects of having many small plants is, in effect, a warning against generalization. Obviously, too many small plants, underutilized, waste capital and raise the capital-labor ratio. Although the small plant is usually labor-intensive, if it uses more capital as well as more labor per unit of output this advantage is lost. Little quotes P. N. Dhar and H. F. Lydell for evidence that small firms (20–50 employees) normally have a higher capital-output ratio than larger firms (5); but very small firms (below 20 employees) had a lower capital output ratio than those immediately above them in the scale. This appears to be a contrast between "traditional" manufacture and "small modern"; large modern, working two or three shifts, might have a better ratio than either. It is worth noting that capital in very small enterprises probably has a lower social cost (per unit of actual cost) than in large.

On choice of techniques, the author concentrates most on low interest rates as a cause of cheapening capital to industry—agriculture usually does not have this advantage, nor do traditional very small firms—tariffs, overinvoicing of capital equipment, and import licensing which encourages the holding of excessive stocks all work in the same direction. Simultaneously, labor laws and high wages for employees in government, public enterprises, and large modern firms all tend in the same direction of capital intensity.

The same influences lead to poor utilization of capital, since the underpricing of capital weakens the incentive to use it more intensively. Night-working, and perhaps six-hour shifts, would be more advantageous.

Little opens his concluding section: "It hardly needs to be said in 1971 that, for most less developed countries, the most important thing is to increase the demand for labor in agriculture. Also, the level of incomes in agriculture and

from other activities in rural areas needs to be raised relative to the towns to help reduce urban drift at the high rates which are now general." How is this to be done? The main answer given is in terms of the price-structure—the reduction of industrial protection, progressive agricultural income taxation (particularly where land distribution is extremely unequal), and the encouragement of rural industry from the proceeds. This recipe is repeated in later papers, notably by Cline and Lewis. As to inputs, those which are complementary to labor will be desirable on employment grounds. Other inputs require careful cost-benefit analysis, using shadow prices, before a clear answer can be given. But, says Little, "it is better still to try to get actual prices right and let them scan the otherwise unavailable factual screen, and produce the answers." And again:

> Leaving aside land reform and other major changes, the only way to influence the enormous number of decision makers in agriculture is via prices. Thus operating on prices is the only effective way of maintaining or increasing labor intensity of agriculture. Fortunately I do not think that many people believe in fixed coefficients in the field.
>
> But prices in agriculture cannot be got right independently of prices in the rest of the economy. Freer trade and exchange rate policies, and better methods of encouraging industry, will all tend to make prices for both agriculture and industry more favorable to employment. To the extent that the price structure is a "seamless web," there is little need to decide areas or priority.

The paper ends with a vigorous argument against the assumption that particular agricultural or industrial processes necessarily have fixed coefficients as between factor use, emphasizing the degree of freedom, and of elasticity of demand for labor, once the process is divided into its component parts and the various alternative methods for each part are considered.

It is interesting that both Ruttan and Hayami and Little come back to the price mechanism so strongly, although Little does not stretch its effects beyond the fairly narrowly defined limits of the economic process as such. There was, however, some comment from Conference members on the whole concept of the "right" or "true" price. How far does such a price exist objectively, independently of political decisions as to the objects of economic policy? Perhaps insofar as government influences internal prices, the "right" set of prices is that which, having regard to resources, is best designed to achieve a rational combination of economic and social aims as set by government itself.

Little occasionally implies that "capital" is really a fixed amount at any one time, so that more spent in one place means less in another. As Kilby and Johnston later observe, it sometimes seems that in some LDCs capital is hoarded (in the form of land or gold ornaments) until attractive investment opportunities appear. At least for small multiple investment opportunities it might be that idle capital would be invested if the returns were sufficiently attractive. Moreover, the amount of capital which is and can be generated by self-employed farmers or underutilized land is often underestimated. While this would support the emphasis on "right prices" as a sounder stimulant for development, it would modify slightly the strict limitation on capital availability which involves a total sacrifice

of one use to another. Little is of course right if *all* capital, including capital at present idle, is included.

INTRASECTORAL AND INTERSECTORAL EFFECTS OF INCREASED AGRICULTURAL PRODUCTION

From the wide view of economic development we now move to a far more concentrated analysis of the movement of goods, prices, and labor within the agricultural sector and between it and other sectors. The most elaborate paper on this subject is that by John Mellor and Uma Lele.[8]

John W. Mellor and Uma Jayant Lele

In the introduction to their paper, the authors emphasize that their argument analyses effects of technological change in foodgrains. It is concerned with the "growth of [domestically] marketable surplus of agricultural commodities and increased capacity to support a nonagricultural labor force on the one hand, and through growth in farm cash income and hence increased effective demand for output of other sectors on the other hand." This growth will only take place if there is substantial technological change in agriculture; and the nature and operation of technological change will greatly affect its impact on domestic factor and product markets.

The first section of the paper relates technological change in foodgrain production to the size of the market for agricultural commodities and the quantity of labor transferred to the nonagricultural sector. It largely recapitulates, although without the evidence and formal definitions, an earlier paper by the same authors (*15*), and the reader may have to pick his way carefully between the food sector, the foodgrain sector, the nonfoodgrain sector, the agriculture and nonagriculture sectors, and the "other agricultural" (as opposed to foodgrain) sector. It is also to be noted that farm cash income is related by the authors to the marketable surplus of *food*, a statement which would not hold good if export had been included, and also excludes a number of nonfood products which are, at least in part, domestically marketed (e.g., fibers, including silk, kenaf, cotton, hides). In fact, *cash* income in many parts of the world is found from a product other than the staple subsistence food crop, whether grain or tubers.

It is also to be noted that two categories of producer-consumer in the agricultural sector are used—"laborers" or "laboring classes" and "landowning classes"—and their consumption both of foodgrains and of other commodities are contrasted. Taken at face value, this classification would certainly work badly in Africa. However, it becomes clear that the dichotomy is only for simplification and that the analysis applies to any situation in which there is inequality of landholding.

Subject to these caveats, the argument moves in three main steps. First, the implications of withdrawal of labor from agriculture without any increase in per capita foodgrain production are investigated. If this occurs, the nonfoodgrain sector will get an increase of food, but less than proportionate to the amount of labor moved (because laborers remaining in foodgrains will have higher incomes and eat more grain). Prices of grain relative to nongrain will rise.

[8] "Domestic Markets and the Growth of Farm Cash Income."

Second, technological change and income distribution are introduced to the argument. Thus, given that wage rates in the nonagricultural sector are a function of the level of living in the agricultural sector,

> the more unequal the distribution of physical production in the traditional sector subsequent to a technological change in the agricultural sector, the greater the supply of foodgrains marketed to the nonfoodgrains sector, and the lower the wage rate at which the surplus labor in the foodgrains sector is willing to migrate to the nonfoodgrains sector. Consequently, our analysis showed that if there is technological change in the foodgrains sector which maintains the existing distribution of income or worsens it, this would reduce the proportion of population engaged in the foodgrains sector (i.e., increases employment in the nonfoodgrains sector), and move equilibrium terms of trade against the foodgrains sector.

What happens to the per capita incomes of laborers if distribution of income in the foodgrain sector alters either for better or for worse through technological change is indeterminate, depending upon the rate of increase in employment relative to the change in total incomes in the foodgrain sector. The analysis, however, showed that the greater the growth-rate of foodgrains output, the faster the growth of nonagricultural employment.

At this stage the argument is summarized as follows:

> To the extent that technological change in the agricultural sector is accompanied by increased labor's share in output, it would provide a dampening effect on the growth of nonagricultural employment. This would occur
>
> 1) through its unfavorable effect on marketed supply of food,
> 2) through its effect on the level of industrial wages required to withdraw labor from agriculture to the nonagricultural sector.
>
> [In fact, growth] in agricultural output may be completely compensated by increased share of agricultural laborers with no effect on the growth of nonagricultural employment. By the same token technological change that brings about a movement in the distribution of agricultural output against the laboring classes may enhance the growth of nonagricultural employment.

In the third stage, the overall capital-labor ratio (K/L) is brought in. It is concluded that the K/L ratio in the nonagricultural sector will increase with increases in per capita income in the agricultural sector, and that "the actual magnitude of the rate of growth of the capital-labor ratio is contingent upon the rate of growth of agricultural output and to changes in relative factor shares in the agricultural sector." The K/L ratio will increase less rapidly if agricultural output grows at a high rate, and "it may increase even less rapidly if an increase in agricultural output is accompanied by a decline in labor's share in agricultural output. This is because the opportunity cost of labor to the nonagricultural sector is dependent on per capita income in the agricultural sector."

It may be helpful to summarize this three-stage argument in two contrasting bundles of propositions which are all stated in its course:

a) Fast foodgrain growth with low share to labor
    i) accelerates nonagricultural employment growth;

ii) reduces rate of increase of the K/L ratio in nonagriculture.

b) Fast foodgrain growth with high share to labor

i) decelerates growth of nonagricultural employment;

ii) increases rate of growth of K/L ratio in nonagriculture.

These are depressing propositions for those who would hope for both a larger share of income to labor and an increase in nonagricultural employment. However, we may remark that higher foodgrain consumption when labor's share increases at least fills hungry bellies, even if it reduces the flow to nonagricultural employment; and (as will appear later) *agricultural* employment has also to be taken into account. A good deal of space has been devoted to this argument, since a clear understanding of the employment and income effects of increased agricultural output is absolutely essential to agricultural strategy.

The next section of the paper deals briefly with the share to labor of increased earnings from high-yielding varieties. Figures based on research in Aligarh District, Uttar Pradesh, show an increase of 57.5 percent per acre in the total income of all (family plus hired) labor, or 37 percent to hired labor. But the percentage of the total *increment* going to labor is only about 10 percent as against 68 percent to family land and capital. These figures of course emphasize that a percentage increase on a small magnitude is a far smaller amount than one on a large magnitude, and emphasize also the tendency for absolute income differentials to widen fast. The actual increase of 57.5 percent to labor is nevertheless significant. A survey of fourteen other studies of the impact of the new technology shows the incremental share to labor varying greatly, but with a central tendency toward about 10 percent.

The next section moves to analysis of the distribution of consumption expenditure of incremental farm cash income between foodgrains and other products by income groups. In India, agricultural laborers spend about 75 percent of increments on agricultural commodities, 55 percent on foodgrains alone; among those with higher incomes only 15 percent is allocated to foodgrains. For nonfoodgrain agricultural commodities the increment is a fairly steady 35 percent for all but the very lowest income group. But for nonagricultural commodities the lowest group spends only 22 percent, while the highest spends 66 percent, of which only 8 percent is spent on textiles and 58 percent on nontextiles.

The authors point out that "nonfoodgrain agricultural commodities" provide the most important opportunity for demand-led expansion in production, with milk in the lead. These are also highly labor-intensive in production.[9] A further table shows the effects on consumption of an increment in income either: (a) in which a 90 percent share goes to landowners, or (b) in which a 90 percent share goes to laborers. Obviously, in the second case far more goes to foodgrains, rather less to other agricultural products, and very much less to nonagricultural products. The authors comment: "The larger the share . . . paid to the landowning classes, the more likely that institutional rigidities, factor proportions and export leakages will provide too low a level of employment to absorb the foodgrains produced or to provide an acceptably broad distribution of income." There is need, as the authors point out, for analysis of more recent consumption expendi-

[9] Milk processing is, however, quite highly capital-intensive.

ture data to examine whether, with shifts in the consumption function over time, expenditure even in the lower income grades would swing more toward nongrain foods and then nonagricultural consumption.

The next section of the paper indicates clearly that the type of traditional consumer goods which low income groups purchase are, with some exceptions, relatively labor-intensive in production, a conclusion confirmed by the Kilby-Johnston paper. Thus when linkages arising from consumption of nonfoodgrain items are taken into account, the earlier indication that a high incremental share to labor decreases the growth of nonagricultural employment is modified.

The paper ends with a macrosimulation model of the relation between employment growth and increases in food production in the Indian economy.

> The purpose of these simulations has been to estimate how much additional employment will have to be generated to keep the prices between the foodgrains and the nonfoodgrains constant if the only constraint in the economy is the supply of foodgrains and if that constraint is released. The additional purpose is to examine the implications of the various distributional biases of the foodgrains technology for the increase in employment.

The model is based on assumptions that

a) foodgrain production increases at 3.9 percent per annum;

b) foodgrain production in the traditional sector grows at 2.5 percent per annum (with 80 percent incremental share to labor);

c) initially, 10 percent of acreage is in the high-yielding sector, of which 50 percent is double cropped—yields here at 1.95 times as high as in the traditional sector (10 percent incremental share to labor);

d) 1 percent of initial cropped area is transferred to high-yielding area per year; and

e) yields per acre in the modern sector increase at 3 percent per year. On these assumptions the following results, expressed as annual percentage increases, would appear:

Output		Employment			
Foodgrain	Traditional sector	Total	Foodgrain	Other agricultural	Non-agricultural
3.9	2.5	5.2 rising to 6.2	4.6 falling to 3.6	5.7 rising to 6.5	3.0 rising to 4.0

The rationale of these figures is fairly clear. At first, most of the increase is from increased labor use in the traditional sector, with a 4.6 percent increase in employment in the dominant foodgrain sector.[10] This increase falls as more output comes in later years from the high-yielding sector, where labor's share in monetary increment is lower, with a corresponding increase for the products of the nongrain agricultural sector and the nonagricultural sector, corresponding to increased incomes in the landowning and higher income classes. Change in the assumptions first to a lower total growth (2.9 percent per annum) of foodgrains, with a lower rate also in the traditional sector (1.25) reduces employment growth

[10] This explains part of the disappointing figures for employment increases in nonagriculture mentioned earlier.

to 3.2 percent rising to 4.5 percent. A second change (2.9 percent of total foodgrain growth but 2.5 percent in the traditional sector and a slower rate of transfer) shows a high required rate of employment growth in the traditional sector but a growth of only 1.4 percent in the nonagricultural sector.

Within the assumption of the model, it seems surprising that the traditional sector, without any high-yielding varieties, could achieve over 4 percent per annum employment growth on the same acreage; and the increase from 5.3 percent to 6.2 percent in total employment growth in the agricultural sector as a whole seems extremely high; it may be pointing to the present losses in employment potential due to institutional constraints. It might be expected that, after a few years of this process, considerable structural change toward nonagriculture would take place in response to such large increases in farm incomes and demand. But the model is interesting as a demonstration of changing relationships.

The final conclusions of the paper include one major statement which calls for comment. It is:

> Greater distribution of increased foodgrains output to the lower income laboring class is directly associated with greater employment.

This appears to contradict the earlier model, where greater shares to labor appeared to decelerate the growth of nonagricultural employment and to increase the K/L ratio in nonagriculture. However, the "greater employment" here includes employment in foodgrains; the demand so generated is directed toward relatively labor-intensive products; and a steady proportion of rising labor incomes is devoted to nongrain agricultural products, increasing both incomes and employment in that sector. If the sections of work contained in this paper had been fully fused with each other, perhaps a more decisive picture would have emerged.[11] At present, the "conclusion" may seem to have a sounder base than some of the results of the earlier model. For, looking beyond the first impact of change, we may see that, though there may be a lag in employment growth for two or three years while sheer hunger is satisfied, any sustained growth in small farm incomes, in their millions, must begin to stimulate a wide circle of the whole economy, in parallel with a diversification and specialization of farm output as the dominance of foodgrain consumption begins to diminish. Perhaps it is necessary to emphasize that much of the paper is in static terms, so that some of the implications may have a short validity in terms of time. The discussion of capital-labor ratios however brings in a key element of "second round" employment effects and points the way to a dynamic view which is important for medium-term policy.

William R. Cline

Highly relevant to the Mellor-Lele theses are parts of the broadly conceived paper by William Cline.[12] Cline starts with a firm statement:

> The political structure is the principal determinant of the effects of alternative agricultural policies on income distribution.... In the absence of a

[11] This has in fact been done in a later paper by the same authors.
[12] "Interrelationships between Agricultural Strategy and Rural Income Distribution."

> specific commitment to improving rural equality, the benefits of government policies tend to accrue to rich farmers in proportions equal to or greater than their share in agricultural production ... because the government favors its more important clients and the upper income farmers have greater access to credit and improved inputs because of their greater collateral.

He next points out that, granted the growth of the labor force and poor urban-industrial employment openings, "both urban and rural income distributions will grow more skewed unless ... recent trends toward skewed channeling of benefits of agricultural modernization are reversed through conscious selection of employment-generating and income-equalizing policies."

From these two strategic statements, which cover perhaps the central concern of the Conference, Cline moves to a critical difficulty—demand elasticity for agricultural goods. His approach is different from Mellor's. Using equations based on a price-elasticity of demand of unity or below, and holding incomes constant, it is easy to show that equilibrium output expands by a smaller proportion than yields; and employment expands by a smaller proportion than equilibrium output, since cultivated area must decline. For example, if yields double, with a price-elasticity of demand of 1.0, equilibrium output rises by only 41 percent and area cultivated must shrink by 29 percent. That element of labor which is tied to area cultivated will decline, while labor related to output (harvesting, threshing) may increase (if it is not mechanized).[13] The effect (as Mellor agrees) would be less if benefits of additional output are spread to low income groups whose income elasticity of demand for food is higher. Nevertheless, the bare equation looks discouraging. It will be less discouraging if one remembers that, as Cline points out, increased demand from increased farm income will indirectly increase labor demand; and secular increase in demand for agricultural goods combined with rural-urban migration can offset declines in labor requirements per unit of output. In addition (a) domestic demand may rise to the point of eliminating all agricultural imports (not only grain); (b) even if the price of one commodity falls, the range of possible production from land is enormously wide, and the potential demand for non-grain foods in poor countries is very large.

Finally, increased agricultural output will raise farm demand for goods from the rest of the economy, which in turn will expand employment and output. To the extent that urban resources are underutilized, there should follow a "multiplier" effect from the upward surge in farm incomes, though this interaction is still sadly uncharted. While the earlier Mellor-Lele model seems to be bolted down to somewhat gloomy conclusions by the strict use of opportunity cost of labor in migration to other sectors, and by a "first round" (but not, presumably, perpetual) preference for foodgrains among laborers, it may be that Cline only appears gloomy if the rise in agricultural incomes is omitted.

The author then, most valuably, moves to combat a notion that long-term growth must be traded off against short-term equity of distribution of income, because of a reduction of savings if the rewards go to small incomes. Using data from Mexico and Brazil, he concludes: "that the savings ratio was not especially sensitive to the distribution of the 20 percent of increment in rural income. The

[13] The net effect would be a decline in labor where the proportion of labor related to area cultivated is 59 percent or more, on the given assumptions.

savings rates were higher for the most skewed version, but not radically so, and certainly not to the degree implicit in a conventional dichotomy of 'the rich save, the poor do not.' "

The remainder of the paper discusses a number of possible policies designed to improve income distribution. Cline heads this list with land-redistribution—a section which will be discussed under Doreen Warriner's paper. His second candidate is the improved seed-*cum*-fertilizer solution. Here he points to the tendency to skew incomes through differential access to credit; to regional disparities (irrigated versus rainfed areas); to the far higher profit of landowners compared to laborers (as also stressed by Mellor), and finally to the original argument on price-elasticity of demand.

> These observations suggest that there is some degree of unequalizing income distributional impact inherent in the strategy of improved seeds *cum* fertilizer, and that this bias is greatly increased if credit and informational networks channel these improved inputs to the larger farms. Nevertheless, the output effects of these improvements are so dramatic that it would be highly inefficient (in a Pareto sense) to oppose them. The policy implication is that if perverse income redistribution effects of new seed varieties are to be minimized, not only must the inputs reach small farmers on an equal footing with large, but there may also be a case for skewing the channels toward small farms—so that the differential impact on profits versus wage bill will be lessened through the placement of improved inputs on farms employing primarily family labor (and thus profit-sharing labor) rather than hired labor.

The concluding sections of Doreen Warriner's paper reinforce this view.

The next discussion is on mechanization, which can await discussion with the Kilby-Johnston paper, and there are useful observations on irrigation, price-support programs for labor-intensive crops, taxation, extension, minimum wages, and rent control as possible tools for income redistribution. The last two policies are strongly disapproved.

In the concluding remarks of the paper, Cline reverts to his opening warning that "in the absence of specific policy measures to improve rural income distribution, it will tend to remain skewed or to grow more concentrated"; he repeats a warning on the dangers of the seed-fertilizer program, and concludes:

> The principal policy implications are that governments truly seeking rural equity should look to land redistribution as a principal means to this end; they should terminate current price distortions favoring mechanization; they should make farm machines available to small farmers on a custom service basis when and if mechanization is found economically desirable at social prices; they should increase levels and enforcement on land and rural income taxation, and channel credit toward the poorer farmers. The policy implications for external lending agencies are: (1) leverage should be exercised to induce income equalizing policies that would otherwise be rejected due to political structures in recipient countries; (2) past flirtations with loans for agricultural mechanization should be discontinued until strong evidence on its economic desirability is found; (3) sample surveys examining agricultural techniques, and surveys permitting the development of reliable data on income distribution, deserve special attention for financing.

It seems that Cline does in fact believe that considerable steps could be taken to improve income distribution, at least as far down as the small cultivator—the question of landless labor is another story. He does so apparently despite the grim demand equation with which he started, and which is reemphasized in a single sentence later: "The use of any input other than labor to increase output will tend to decrease labor's share in income." Some comfort may be drawn, despite this equation which, of course, applies across the board of his whole argument, from two reflections. The first is that small cultivators (freeholders, tenants, or customary holders) represent such a vast mass of humanity in Africa and Asia. The second is that, in the long term, and including a host of political, institutional, and other factors not discussed, "the addition of inputs other than labor" has, in developed countries, demonstrably not had the ill effects on labor which the paper forecasts. Short-term, much can be done; long-term, the process of structural transformation will bring its own problems, and also solutions.

Peter Kilby and Bruce F. Johnston

The third major paper dealing with general intersectoral relationships is that by Peter Kilby and Bruce Johnston;[14] and it is centered on the theme of structural transformation—"that process by which the proportionate share of agriculture in labor employed and national output diminishes and that in other sectors rises as per capita income grows."

After a mention of the higher elasticity of demand for manufactures than for food as one underlying cause of structural transformation (it lies, at least for the bulk of the agricultural population, at a rather later stage in the development process than some of the poorer and hungrier LDCs have reached), Kilby and Johnston go straight back to the fundamental law of division of labor and specialization:

> This process of division of labor induces a transfer of many activities from the household economy to specialized external producers: the making of clothing, utensils, furniture, weapons, jewelry, the processing of crops, the construction of houses, other buildings, and boats. Nor is the transfer of these tasks out of the farm household limited to the production of hard goods: "fetching water, gathering fuel, educating, litigating, adjudicating, healing, regulating individual conduct, propitiating the Deity, waging war and governing are increasingly turned over to public utilities and oil companies, and to teachers, lawyers, judges, doctors, policemen, priests, soldiers and congressmen" (9, p. 178). In this way the functions of agriculture are gradually pared down to the single activity of growing raw materials.

The critical factors bearing upon the pace of structural transformation in predominantly agrarian economies are defined as technological capabilities, investment funds, foreign exchange, and the level of farm purchasing power. "It is our argument," say the authors, "that a 'unimodal' agricultural strategy, aimed at the progressive modernization of the bulk of the nation's cultivators, as contrasted to a 'bimodal' crash modernization effort concentrated upon a small subsector of large-scale mechanized farms, minimizes the extent to which the above constraints impede the process of transformation." The authors emphasize cer-

[14] "The Choice of Agricultural Strategy and the Development of Manufacturing."

tain interconnections, echoing Mellor and Lele and (in relation to research) one of the main contentions of Ruttan and Hayami.

> A given size distribution of farms is associated with a particular range of distribution of farm purchasing power: the latter, in turn, is a principal determinant of who has access to new technology. The market allocation of investment resources is likewise connected with various magnitudes related to farm sales.... Finally, research and development activities are to a considerable extent molded by the kinds of problems that are being encountered by the bulk of the nation's commercial farmers.... In this paper we are concerned with the linkages between agriculture and industry and thus will be confining our attention to the disbursement pattern of farm cash receipts. We will attempt to show that, paralleling its effects in the farm sector, a unimodal agricultural strategy contributes to a more desirable pattern of industrial development in terms of employment, output and the diffusion of technical knowledge than is the case under a bimodal strategy.

After a note that agriculture's purchases from the manufacturing sector have their maximum effects in the early stages of transformation, when agriculture may account for 50 percent of net national product and industry only 10 percent, the authors proceed to analysis of the destination and effects of farm household expenditure.

Leaving aside taxes and acquired financial assets (agriculture's capital transfers to other sectors) and wages, rent, and interest, which are mainly intrasectoral in the first round (wages will have intersectoral effects when spent in the second round), the authors concentrate on the main intersectoral commodity flows of current inputs and capital goods employed in production, and final consumer goods and services, with a passing note on the value added to farm produce in processing, storage, transport, and distribution. Production and consumption expenditures are then compared for groups of households in Taiwan and among progressive farmers in Uttar Pradesh, India.

The most significant differences are: (1) the far greater production expenditure per acre in Taiwan (1,670 rupees) as against Uttar Pradesh (487 rupees); and (2) the fact that cash outlays per acre for *large* farms in Uttar Pradesh are almost twice as large as those for farms under 10 acres in Uttar Pradesh, whereas in Taiwan both output and expenditure per acre *diminish* with every increase in farm size. This is attributable to the use of highly divisible fertilizer and chemical inputs in Taiwan as against "lumpy" investment in mechanical equipment in Uttar Pradesh.

Turning to the pattern of demand for manufactured consumer goods, the authors suggest that a broad, fairly even income distribution will result in large markets for comparatively simple goods, entailing the use of labor, skills, and raw materials which are largely domestically supplied; a highly skewed income distribution leads to small markets for more differentiated goods which can seldom be efficiently produced locally with a low import content. They further note that an even distribution will evoke a larger demand for food, leading both to better nutrition and productive capacity and maintaining demand and employment in the agricultural sector. In both these conclusions they agree with the Mellor-Lele paper.

To analyze the type of industries which produce the ranges of goods that might be expected to correspond to a large low income demand and to a much skewed income demand, the authors use a ranking of industries in Pakistan (*8*). A "high" ranking implies intensive use of both physical capital and human skill; a "low" ranking implies greater use of relatively unskilled labor and less capital per worker. "With the exception of paint, all of the goods we have identified as being associated with the more equal distribution of income, implied by a 'unimodal' agricultural strategy fall in the lower half of rank orderings." Anticipating the discussion of farm inputs and equipment, the authors note that the light engineering branch of the capital goods industry is highly labor-intensive, whereas fertilizer represents an "exceedingly capital-intensive industry." There is a strong case, on many grounds, for importing fertilizer.

It is worth noting that the advantages of the highly divisible fertilizer and chemical inputs, which have been so important in Taiwan, contribute to a labor-intensive path of agricultural development, especially if fertilizer is available to farmers at prices which fully reflect the low production cost of the technologies now available.

The remainder of the Kilby and Johnston paper analyzes the use of farm equipment and can better be considered together with the complementary section in Cline's paper, as a separate topic.

FARM EQUIPMENT AND TRACTORS: INCOME AND EMPLOYMENT EFFECTS IN MANUFACTURE AND USE

It may be useful—partly because it is unusual—to consider together two different aspects of mechanization (and particularly tractor use), the one being the much-discussed effectors on farm employment of various types of mechanization; the other being the implications for industrial structure, skills, and employment of farm demand for a particular range of equipment. Kilby and Johnston deal particularly well with the latter aspect; Cline has an interesting section on tractor use; and Barker, Mangahas, and Meyers, in a case study of some aspects of the seed-fertilizer revolution on the Philippines, deal with mechanization and with some wider aspects of land use and employment, with a valuable comment from Falcon.

Peter Kilby and Bruce F. Johnston

Returning now to the analysis by Kilby and Johnston of the farm equipment industry, it is evident (as the authors say) that a very wide field of interest lies in equipment use, since "variations in the type of farm machinery are critically related to the choice of technology and factor proportions in the agricultural industry"—much more so than in the case of the large but invariant demand for standard fertilizers.

From the demand side, the first major movement takes place when structural transformation is well under way, cash receipts growing, and a demand to ease labor bottlenecks and upgrade energy sources arises. If this is a gradual process, the demand will be for cheap equipment, in view of the competition between farmers and their great caution in using cash resources. If, however, there is a sudden leap forward in output and potential profits associated with high prices that tend to persistency (India and Pakistan since 1967), there will be a shift in

demand toward more powerful and expensive items—tractors and combines—with a sharp rise in capital intensity and import content.

On the supply side the authors give a detailed description of the structure of the equipment industry in three tiers, with a note that many factors encourage widespread competitive manufacture of relatively cheap equipment with a very moderate skill element in the labor. The lowest layer is the village artisan, with simple equipment, uneven quality, producing to order. The second layer is the urban workshop, with a larger output, more specialized skills, some power tools, producing by batch for sale to a general market. The third layer is the tractor industry. This consists of relatively few large firms, distributing through dealers with after-sale service, and requiring much higher investment, managerial ability, and skill-intensity. The interconnections between the three layers is a vital element in efficiency, and the authors quote interesting examples of manufacture through numerous satellite small firms, and occasionally of firms producing complete knockdown component sets to sell at wholesale prices to local blacksmiths, who assemble, retail, and provide service (Taiwan and, increasingly, India).

Finally, the authors attempt a last task of measuring "the quantitative impact of different agricultural strategies upon the farm equipment industry with respect to value added, foreign exchange requirement, and employment." The magnitude calculated is an annual "equipment flow," consisting of depreciation and spare parts—i.e., farm demand for manufacturing output—for three different equipment "packages," or farming regimes. These are: (1) fully mechanized farming with tractor and combine; (2) a package centered around a power-tiller; and (3) improved bullock technology with stationary thresher. To obtain the impact on local manufacturing, import content, taxes and distributive margins are deducted. They derive the equipment flow per acre under various agricultural strategies for West Pakistan (rupees per acre):

Equipment package	Total equipment flow	Import content	Taxes	Distribution	Manufacture
Tractor	129.4	64.4	21.3	33.7	10.0
Tiller	135.1	59.8	19.7	28.2	27.4
Bullock	83.9	21.9	8.8	4.2	49.0

The authors make two comments. "Thus, not only does mechanized farming displace farm labor and make intensive use of scarce capital; it also contributes less to (local) manufacturing output.... The foreign exchange input of the bullock-implement package is some 40 percent less than that of the tractor alternative." This is an extremely interesting finding, and could be tested for various conditions of crop, size of operational unit, and farming system.

William R. Cline

Cline, in his section on farm mechanization, concentrates almost wholly on the use of tractors. There are, of course, many detailed studies of the comparative employment effects of various combinations of machinery (cultivating, harvesting and threshing, pumps) for various technical situations and cropping patterns (see especially *1*), and the Conference did not cover the full range of this subject. Cline devotes his main attention to three arguments in favor of tractor use: first, the argument from speed of operation; second, the argument that speed enables double-cropping; and third, that tractor-plowing increases yield.

As to speed by itself, Cline observes that more bullocks could probably do as well, especially when assisted by better implements and by stationary threshing machinery of simple design. Regarding double-cropping, he observes that, where land is relatively plentiful (as in much of Africa and Latin America), extension of acreage, with tractor-plowing, is more likely than double-cropping, thus using more land and less labor. On better yields, the evidence is extremely shaky. There may be dry land areas where a tractor is better able to break the hardpan (but this problem may yield to an occasional deep plowing by very heavy machinery, on contract, followed by normal cultivations). Evidence from Brazil obtained by the author from 117 rice farms there showed an almost negligible advantage (0.02 percent) in yield in tractored against nontractored acreages. As to costs, Cline quotes Bose and Clark (*3*), that social benefits of tractorization fall below social costs, though private benefits exceed private costs; and in reaching that conclusion the authors did not even allow for the effects of an overvalued exchange rate. Had they done so, the discrepancy between social benefits and costs would have been still greater. The author recommends that, when and if mechanization is found to be economically desirable at social prices, machinery should be made available to small farmers on a custom service basis.

Little's paper adds two more observations—that tractors used for double-cropping may also be used to displace labor at harvesting; and that, if used to smooth out peak demands for labor, they also displace off-peak labor. Would it not be better, he asks, "to let there be high wages at peak times and draw back people from the towns to help with the harvest"?

Randolph Barker, Mahar Mangahas, and William H. Meyers

The earlier part of the case study deals mainly with the effects of introducing high-yielding rice varieties in the Philippines in terms of the yield potential of the varieties in the wet and dry seasons, the rates of adoption by farmers, farm yields, and effects upon land utilization for paddy crops; the second half deals with more theoretically treated aggregate effects on employment. The earlier section is a valuable addition to the country evidence of adoption ratio and effects, and needs to be read in detail and in comparison with similar studies in India and elsewhere; it is not summarized here, but there are one or two significant comments by Falcon. The second section adds significantly to the presentations on labor and mechanization by Kilby and Johnston and by Cline.

Barker et al. point out that recent increases in paddy production have been mainly due to increases in yield per hectare, combined with an increase in percentage of area irrigated.

> Under these conditions, three major changes can affect total labor use in the rice sector: an increase in labor input per hectare due to the new rice technology, a decrease in labor input per hectare due to labor-saving mechanization, and an increase in average labor input per hectare as the irrigated and more labor-intensive portion of total crop area increases.
>
> Comparing labor input levels on all farms in 1966 and 1970 from the Central Luzon-Laguna Survey . . . , we find that land preparation labor declined while transplanting, weeding, and harvesting-threshing labor increased sufficiently to raise the total labor input. Also, on balance, the proportion of hired labor increased. Looking at the labor inputs for areas

planted to local and high-yielding varieties in 1970, it is clear that it was the more intensive labor use for high-yielding variety production which raised both the total and hired labor inputs for 1970 above their 1966 levels.

The two tasks which account for most of the increase in labor input are weeding and harvesting-threshing.

Although rotary weeders were increasingly used, these involved straight-row planting, which involved a higher labor input for transplanting. Total labor input increased, in the area studied, by 9.5 percent, but output increased by 26 percent—a sharp increase in labor productivity.

While tractor use has increased (both in areas using high-yielding varieties [HYV] and elsewhere), the use of mechanical threshers has decreased mainly because HYV-use drives the crop harvest into the rainy season, where the heavy machines cannot be moved easily across wet fields.

From this note on mechanization, the paper moves on to a more general analysis of labor absorption. After calculating an elasticity of employment with respect to own-sector value added of 0.7 for the agriculture, forestry, and fishing sector,[15] the paper suggests that a 4.5 percent per annum growth in value added for the five-year period 1969–74 would induce a 3.7 to 3.8 percent annual employment increase. At the rates for value added projected by the four-year plan (1971/72–1974/75), which are 5.3 percent per annum, the induced employment rise would be 4.4 to 4.5 percent.

While the authors note, tentatively, that increased output and incomes should have a positive influence on nonagricultural employment, the two major conclusions of the study can be summed up in two quotations:

> Farm level analysis of employment effects indicate that even in those regions where mechanization has progressed, per hectare labor requirements, especially for hired labor, have increased. A high level of mechanization is not a precondition for the successful introduction of the new seed-fertilizer technology. On the other hand, higher farm incomes generated by the new technology may tend to increase the rate of mechanization....
>
> Statistics to show the recent trend in national agricultural employment are not yet available. The employment-output (value-added) elasticity for Philippine agriculture is estimated to be 0.7. Assuming that the total labor requirements per hectare are not materially affected by the new technology in rice or by rising wage rates, maintaining the past level of labor absorption would require a growth in agricultural value-added of 4.5 percent or better.

Comment by Walter P. Falcon

Falcon, in a thoughtful comment to the Conference on the Barker-Mangahas-Meyers paper, noted particularly that the results showed a fairly widespread adoption of the new varieties by small farmers in Philippine conditions. This might be expected where technology is divisible and inputs fairly easily available at farm level; but, Falcon observes, generalization on this is dangerous without better information on the tenurial and institutional structure (e.g., strongly hier-

[15] Falcon warns that the time series is short (12 years) and that the figure of 0.7 depends very heavily on the specific assumptions made.

archical and unequal in size of holdings or the reverse), particularly with regard to second round and later effects on income distribution and farming technology. He notes also the wide gap between potential and achieved paddy yields, which may again point to defects in the institutional system (e.g., availability of credit).

Noting the apparent fall in the land base where the new varieties of paddy were adopted, Falcon makes a further observation of great importance. This is that single commodity studies may omit vital information about total farm management and use of both land and labor. If more labor is used on the reduced acreage of paddy, what happens both to labor and land use on the rest of the farm? Further, without analysis of farm size and of the effects of seasonality in labor use, figures of "labor hours" may be a misleading guide to estimates of employment.

These comments by Falcon have great significance, not only for the approach to analysis but for policy affecting institutions and implementation. In particular, the possible conflicts between the single-commodity and the farm-management approaches show up in policies which structure extension and marketing systems through numerous single-crop marketing boards and policies which stress farm-income maximization by extension advice with a strong farm-management bias. The comment on the effects of existing socio-political structure and institutions of course tie up with similar points in the papers of Warriner, Cline, and Mellor and Lele, dealing with inequality (skewing) of farm holdings and incomes.

The virtue of Kilby and Johnston's equipment analysis is that it has a far greater claim as a total socio-economic strategy than the work (useful in itself) which deals only with the implications of mechanization for *farm* employment. The growth of a light engineering industry is a highly significant event in any developing country—the lack of it in so many parts of Africa is an enormous handicap to economic progress. It has great implications for skills (from the humblest upward to the highest), for widespread distribution of activity in rural areas, for diversification (since the skills will serve industry as well as agriculture), and for giving a useful load to the wildly spinning wheels of education by widening the horizontal and vertical range of employment opportunity and needed qualifications. Such an approach forms part of a total approach to social and economic growth through the gradual, sequential processes of structural transformation, from which the authors started out.

THE TAXATION OF AGRICULTURE: INTERSECTORAL TRANSFERS

Stephen R. Lewis, Jr.

The paper by Stephen Lewis is far more than a technical treatise on agricultural taxation.[16] The general discussion of the transfer of resources between agriculture and other sectors traverses several issues which were of fundamental importance to the Conference. It is particularly difficult to do justice to such a closely knit and balanced argument in summary form; this account of the paper concentrates mainly on one vital issue—the ways in which the traditional basic theory of the instrumental role of agriculture in assisting the growth of higher produc-

[16] "Agricultural Taxation and Intersectoral Resource Transfers."

tivity activities throughout the economy has been applicable and applied in the actual policies and record of many developing countries.

Lewis opens his discussion of the role of agriculture from the W. Arthur Lewis two-sector model ("Economic Development with Unlimited Supplies of Labor"), and refers to the vital role of agriculture in economic growth, and to its instrumental role in "feeding a growing nonagricultural labor force, earning more foreign exchange, providing capital for development of the rest of the economy, serving as a growing market for domestic manufacture." He mentions two problems when the W. Arthur Lewis model is "badly behaved"—"when food supplies to the modern sector do not expand as rapidly as the modern sector's demand for labor"; or "if real wages (in terms of modern sector output) rise before unlimited labor had become exhausted." This would cut into the modern sector surplus, and Lewis notes that it may be met by capital-labor substitution, reducing employment "in higher productivity sectors." This is uncomfortable because "resources for development must be found somewhere and it is unlikely that they will be found in voluntary savings of wage laborers or of the salaried middle classes."

It appears that they must be found, at least in good part, from agriculture, and Lewis moves on at once to ask: "What is the optimal level and composition of net transfers from agriculture?" There are three possible ways in which such transfers can take place: (1) voluntary savings by individuals and firms in the agricultural sector at least partially invested outside it;[17] (2) government taxation; (3) government may turn the terms of trade against agriculture. Transfers could be too small—so that higher-productivity outlets for capital in the nonagricultural sector are unexploited; or too large, "in the sense that the agricultural sector is unable to finance higher-productivity activities, and instead lower-productivity activities are taken up in nonagricultural sectors." (One may note that this second case, in the form of marketing board surpluses, was taken up 15 years ago in Uganda and is violently in issue at present in Nigeria.) Lewis remains convinced that a net outflow of resources "will in general be in the direction of optimality," although allowing that, for a temporary period, "a confluence of circumstances (e.g., high-yielding agricultural varieties that substantially raise the productivity of capital in large-scale irrigation, drainage, storage and transport facilities for some period of time) might make a temporary resource transfer into agriculture sensible."

Lewis then moves to a more detailed examination of government policies which turn the terms of trade against agriculture, finds that the subsidization of industry by agriculture has in many cases been considerable and remarks that: "In the context of the two-sector model, depressing agriculture's terms of trade and improving them for the modern sector should have improved the saving rate and the rate of investment for the economy, the rate of growth in output and in employment in the modern sector, and the rate of growth of output of the economy as a whole."[18] He then observes: "Instead, however, the principal difficulty encountered by countries following the policy of turning the terms of

[17] There is some reason to suppose that savings from self-employment are more easily made than savings from wages and salaries.

[18] Quoting Little, Scitovsky, and Scott (*14*); T. H. Lee for Taiwan (*11*), and the author for Pakistan.

trade against agriculture is the inefficiency with which the nonagricultural sectors used the transferred resources."

Lewis is referring here to the type of price-distortion resulting from ill-conceived import substitution policies, mentioned earlier in relation to Little's paper. He goes on to observe:

> A substantial portion of the increase in gross returns to the firm made possible by the structure of the protection subsidized the inefficient use (from the point of view of the economy as a whole) of capital, labor and intermediate inputs.... And, therefore, the agricultural sector was being "taxed" not to increase overall saving in the economy but rather to give an ongoing subsidy to industries that would have been unable to compete in international markets even with a correction for the overvaluation of currencies that existed in countries following this pattern of "growth."

These are key sentences in the paper.

Further, rising urban wages have too often meant that "transfer from agriculture has resulted not in increased savings or increased government revenue, but in increased consumption by the urban labor force." This, combined with inefficient factor use, has further diminished the increase of private or government saving. Further, price-distortions as between agriculture and industry have resulted in unfortunate distortions within agriculture itself.

The paper then notes that attempts to maintain agricultural prices in face of Green Revolution increases in productivity result in undesirable subsidization of some producers by others and that the lack of progressive agricultural taxation, combined with price maintenance, results in loss of government revenue and undue profits by some farmers, increasing the inequalities of income distribution. Further, if nonagriculture remains inefficient but expands, it will need, and perhaps get, an increasing subsidy from the rapidly growing agricultural sector (turning the high-productivity industry, low-productivity agriculture assumption upside-down). Finally, in this section on transfer, Lewis notes that, with the coming of the seed-fertilizer revolution, "the increased input needs and physical output flows have created transport and storage problems which can be solved only by additional capacity in either or both systems. These considerations suggest that the absolute allocation of private and public capital to agriculture may well have to go up to optimize growth for the economy as a whole."

Turning more directly to income distribution, Lewis notes the need to tax away some of the gains of large Green Revolution farmers; to prevent urban wage-earners being subsidized by the even poorer peasant community; and to reverse the underpricing of capital goods. The arguments on this last issue are familiar; but Lewis cites an interesting case study in Pakistan for three points in particular (*10*): (a) small local firms produce capital equipment which is more consistent with local resource availabilities than is imported capital equipment; (b) capital goods produced by local concerns tend to be labor-complementing; and (c) the allocation system for imports at the official exchange rate had substantial adverse effects on small, local firms which are excluded from the privileged treatment received by the modern sector. These points heavily underline the Kilby-Johnston analysis.

In his last main section, Lewis moves on to suggestions for a better system of taxation. His main recommendations, in summary, are:

1) Revision of exchange rates to reflect real costs of foreign exchange to the economy;
2) Reduction of protection to nonagricultural sectors, which involves a subsidy from agriculture to inefficient use of resources;
3) Indirect taxation on domestic production of manufactured goods;
4 & 5) A land tax and a capital gains tax, both primarily aimed at large underutilized landholdings; and
6) An agricultural income tax—in effect, a progressive surcharge on land tax.

These measures are clearly designed to discourage inefficient industrialization and to direct agricultural taxation to the points where it can best be borne.

With regard to expenditure policies, Lewis, with equal consistency, deplores the use of subsidized credit or undercharged irrigation supplies; and he warns even more strongly against price-support policies for crops to a point where domestic prices are well above international prices.

Looking back over the course of this whole argument, it might well appear at first sight that much of the formulation of the orthodox theory of the instrumental role of agriculture in economic development is inappropriate to conditions today in many developing countries, or has been so misinterpreted by LDC governments as to produce positively injurious results. Indeed, it does look distinctly odd that economists still continue to speak of "releasing" labor for use in industry, when (as it were on the next page) they are deeply concerned with the surplus of labor in both urban and rural economy, anxious to stem the flow of labor to unemployment and squalor in large cities, rightly convinced that, at least within the present situation, there is no hope whatever of absorbing the growing surplus labor force into industrial wage-earning occupations in less than 30 to 50 years. It also seems odd to think of transfer of resources from at least one section of "agriculture" which happens to contain the vast majority of both total and agricultural population—the mass of small farmers hovering around the poverty line. "Cheap food for industrial workers" does not appear to leave room for the financial incentives which may be essential to induce the acceptance of technical change in traditional farming. The expansion of industry looks very difficult when 70 to 90 percent of consumers are in a poverty-stricken rural economy with little purchasing power to absorb industrial goods; and industrial exports on a large scale (to make up for low domestic demand) seem somewhat difficult for latecomers in a world of international trade dominated by nations that not only have a technological advantage but can use political and economic power to protect their position. This is the reverse of the situation in which Western economies achieved their industrial expansion in the nineteenth century, when the orthodox theory was elaborated. One could continue these apparent contradictions between theory and the present shape of events and needs; how do they arise?

Many arise from lack of specificity. "Agriculture" is highly heterogeneous, including modern plantations, prosperous farmers with broad acres of irrigated

land, and a mass of poor, small, semisubsistence farmers. Again, "structural change" involves movement into many different occupations, not only manufacturing; and manufacturing itself can vary from large capital-intensive factories to back-street workshops and cottage-industries. Again, "the role of agriculture" implies the role of a *productive* agriculture: considerable investment, especially in infrastructure, may be needed to make it productive before it can fulfill its role.

Some apparent conflicts arise from misinterpretation of the theory. For example, the word "transfer" does not necessarily imply an active robbing of the agricultural sector by taxation or otherwise, but a *de facto* movement of labor and investment of savings from agriculture into other sectors, possibly as a result of successful agricultural policies which increase marketed surpluses. As Lewis has pointed out, there is great danger in treating a general economic analysis as an instant guide to particular, topical policy.[19]

Again, some conflicts arise from inattention to timing: some unsuccessful policies result from premature attempts to squeeze agriculture before it is productive or to develop late-stage industries in early-stage situations: secular trends can mislead short-term policies.

Lewis's position in his paper is quite clear. He accepts the general validity of the Arthur Lewis model, but suggests that the analysis has been used as a rationalization for policies (however motivated) which have been at fault in the selection, capital structure, and technology of the industries favored. He does not, however, swing to the opposite pole of deploring all government manipulation, leaving an unfettered price system to its own devices. Perhaps the point at which the argument is somewhat less assured is in facing the real dilemma of where to find resources for development when much of agriculture is traditional and stagnant and domestic demand is both thin and concentrated in a narrow, import-using sector. In default of mining, theory may require industrial (as well as agricultural) exports at this point; but the real world, both of international trade and of domestic technical and managerial skills, presents, to say the least, formidable obstacles to this solution. Where it is true that agriculture provides the only hopeful source of transferable resources, then Lewis's proposals on taxation certainly specify the particular groups within agriculture which could contribute more than they do. Yet, even if it is true that self-employment, characteristic of so much of agriculture, is an easier source of savings than wage-salary employment, it must still be productive self-employment. To be productive it must first be fed: a starving goose will not lay many golden eggs to feed the rest of the economy. Perhaps it would be most appropriate to recall another statement by Sir Arthur Lewis (*12*):[20]

> The most certain way to promote industrialization in the Gold Coast is to lay the foundations it requires by taking vigorous measures to raise food production per person engaged in agriculture. This is the surest way of producing the large and ever increasing demand for manufactures without which there can be little industrialization.

Thus both the timing and scale of any transfer of resources from agriculture, in relation to the essential investments in infrastructure and improved technology

[19] Personal communication.
[20] For "food" perhaps read "marketed surpluses."

in the agricultural sector itself, and the destination and use of the resources transferred, remain key issues of policy choice.

Comment by Claudio Gonzalez-Vega

In a contribution to the seminar which followed the plenary conference sessions, Gonzalez-Vega, commenting on the Lewis paper, questioned further the proposition that, in the course of structural change, there should necessarily be a net outflow of capital from agriculture.

> The first question presumably has a different answer if one is interested in long-run tendencies as against short-term movements.
>
> a) In the long run there is the question of the presumptive "law" of the diminishing importance of the agricultural sector and the question of the necessity that this structural change be accompanied by a net outflow of capital from agriculture.
>
> One can conceive cases in which the share of agriculture in output is diminishing and in which several of the so-called contributions of agriculture to economic development are taking place, even without a net outflow of capital. This seems to have been the case of England in the 18th Century, despite Marx.
>
> b) In the short run there might be justifications for sizeable deviations from the general trend, both in terms of growth and of the "new" objectives. The first step should be to define these objectives, which determine the location of the optimum, very clearly.

By the "new" objectives Gonzalez-Vega is referring to employment, income-distribution, and poverty.

From the standpoint that resources should be invested where their social return is greatest irrespective of sector, the comment suggests that sectors might be distinguished by their growth potential. There are general reasons why the growth potential of industry is likely to be higher than that of agriculture, but in the short and medium term, especially in small countries, the reverse may be true. In Costa Rica, investment in bananas raised the agricultural growth rate above that of industry and the growth of the whole economy from 6 to 10 percent per annum. Lewis is right to admit this variation, and it becomes important to identify when the need for it arises—which is made more difficult by price distortions.

Turning to questions of the mechanism of capital transfer, and accepting the condemnation by both Lewis and Little of the maneuver of turning the terms of trade against agriculture away from their international level, Gonzalez-Vega puts rather more emphasis on allowing the price mechanism to attract flows of savings.

> Savings depend not only on the ability to save, determined in particular by income per capita, but also on the willingness and opportunity to save, influenced by the incentives provided by higher interest rates, a high productivity of capital, and the development of financial intermediation which provides liquidity, reduces risk, etc.

Savings react to real interest rates just as farmers do to prices. Subsidized interest rates in agricultural credit, and non-price rationing systems are not only inefficient

but promote consumption and send a false signal that capital is an abundant resource.

Finally, in connection with fiscal methods, Gonzalez-Vega remarks that levying a tax on land will not prevent undesirable portfolio investment, but simply shift it to other safer assets: deposits overseas, jewelry, luxury houses. The root of the trouble lies in "inflation and policies restricting the voluntary financial mechanisms" which make more socially productive investments unattractive; and the cure is an adequate monetary policy.

Comment by T. H. Lee

In his comment on the Lewis paper at the Conference, Lee emphasized his agreement with Lewis on the need to find investment resources from somewhere. He stressed the Taiwan experience of heavy government investment in agriculture, to which landlords and farmers contributed considerably from savings, followed by heavy taxation on the increased agricultural incomes deriving from the major investment (irrigation) and technological change (Ponlai rice, introduced in the second half of the 1920s). During the main irrigation investment (1930–40), irrigation rose to 53 percent of total farm land, land productivity was doubled, and off-farm sales rose to 70 percent of production. A considerable input was made in land survey, following which land tax revenue was doubled. Land tax rates were based on net income per hectare of land, with seventeen, and later more, land classifications. After World War II, tax was based on a multiple of tax rate x land area x so many kgs. of paddy—at first 12 kgs., rising (with increased productivity) to 19 kgs. in 1965, paid in kind. The main burden of Lee's comment is on the very careful timing of investment-productivity-taxation, and on the possibility, with both land survey and land reform, of capturing a large government revenue from a land and labor-intensive smallholder agriculture. In any comparison between Taiwan and countries with more recent development experience, it is essential to remember that the main technical change and investment came 50 years ago.

Raj Krishna

A final comment on taxation came from the paper by Raj Krishna,[21] unfortunately delayed and not fully absorbed in the Conference proceedings. Krishna deals first with the concept of intersectoral equity in tax burden. It is operationally superfluous: "sectors" cannot be taxed but only persons, families, or firms. If taxation: (a) treats all similar incomes (in whatever sector) equally and (b) is progressive, to offset vertical inequities, it has done all that fiscal justice can require.

He next attacks the belief that Indian agriculture is "undertaxed" in relation to other sectors. Since no general economic implications are drawn from his (negative) reply, the detail of this argument need not be repeated here.

The author then considers why free India apparently did not attempt to draw large investment resources from agriculture in the post-Independence era, as so many other countries did in their period of major industrialization (e.g., Meiji Japan, Russia). His answer is short and clear. Indian agriculture *was* heavily

[21] "Intersectoral Equity and Agricultural Taxation in India."

taxed—but by the British (60 to 75 percent of total revenue came from land tax in the first half of the nineteenth century), and the proceeds helped to industrialize not India but Britain. In consequence:

> After a century and a half of draining, technical stagnation, and growing population pressure, without any compensating rapid industrialization, Indian agriculture had hardly any taxable surpluses left on the eve of Independence. Instead of taxing agriculture heavily the government had to make substantial investments in agricultural development after the onset of planning in 1951.

Krishna then turns to "horizontal inequity," namely, the exemption of high personal incomes among upper-bracket farmers, as against similar incomes in nonagriculture. This is attributed to the political influence of these farmers at state government level. The author believes that a progressive income tax should be evolved from, and swallow, the old land-revenue system, in the shape of a tax, nominally on a land base but actually on income, based on a standard acre, with classifications: owner or tenant; irrigated or dry; crop-mix A, B or C; giving twelve variants. This could be reviewed at five-year intervals and adjusted for growing productivity and for prices; it is not dissimilar to the Taiwan system noted by Lee, originating in the Japanese system.

The paper finally turns to other reasons for heavier taxation on agriculture. While clearly at a very early stage of development, when agriculture produces a large percentage of gross national product (GNP), agricultural taxation must produce a large share of revenue, both these proportions fall over time. Government should tax *surpluses* in the economy, wherever they arise. "Since they happen to be with traditional landlords and moneylenders ... they have to be taxed there. But if they happen to be with a prerevolutionary nonagricultural bourgeoisie, they have to be taxed equally." So, too, with "unearned income"—largely property. There may be a case for a higher rate than on "earned income" but no case for taxing agricultural property more than urban property. So, finally, with labor: the case for taxing agricultural labor more than nonagricultural is *only* valid if the agricultural labor supply curve is backward sloping and the nonagricultural supply curve is not, or less so. In a word, "a plea for discrimination against the income of a production sector as such does not stand critical scrutiny."

PART III. IMPLEMENTATION

LAND REFORM

Doreen Warriner

Warriner starts her paper with a warning that the criteria for judging results may be historical, economic, social and political.[22] She concentrates on economic and, in some degree, welfare criteria, and gives as a definition of "land reform" for this paper "the redistribution of property or rights in land for the benefit of small farmers or agricultural laborers," with a recognition that it should mean more than that, but should at least mean that.

[22] "Results of Land Reform in Asian and Latin American Countries."

The motivation for land reform must be political; without political will no effective reform is possible, even if legislation is passed (to a large degree this is true of India and of several reforms in the Philippines). Since 1950 the "U.N. and various agencies have indefatigably encouraged member governments . . . to undertake reform to promote the economic development of their countries. . . . Naturally, all this propaganda has created the impression that development is the prime motivation. . . . Yet it must be recognized that the propaganda approach has its dangers. It involves constant pressure to inflate the concept of reform." Further, "International agencies, whether servants of one master or many, are constrained to work within a certain framework of accepted ideas. They are obliged to adhere to stereotyped doctrines or prescriptions for success, and cannot subject them to critical scrutiny by examining the results of the reforms in which these teachings have been applied." As a result, not much is learned from experience, and indeed by the mid-1960s "the process of oversell was beginning to kill serious interest." Hence the need for reassessment of results.

What then can serious land reform hope to achieve? "At least one very important thing," says Warriner, "to raise peasant living standards by raising peasant incomes." Whether the new recipients become better farmers depends on many things—particularly on whether they are given viable holdings, on whether they were real farmers or laborers before, on whether the landlord's positive functions are replaced adequately by government services. But, in the author's wide experience, peasant farmers can farm with knowledge and skill, often better than larger farmers.

Will production rise? Warriner says:

> The transfer of land from large properties into small ownership can be expected to lead to some increase in agricultural production, as a result of higher inputs of labor due to its higher marginal productivity, and also to higher inputs of capital, in certain conditions. However, I would not rule out the possibility of a decline in production in exceptionally large and chaotic reforms, since this has occurred in two recent cases and did occur in two of the old East European reforms.

Cline, in his paper, is a little more emphatic. He argues that genuine economies of scale in large farms are unlikely, if capital costs of machinery are properly valued; and that, in contrast, land utilization is less efficient on large farms than on viable small ones, due to: (a) holding land as portfolio investment; (b) uncompetitive semimonopsony in some areas; and (c) the known Latin American figures of comparative utilization by size of farm. He might have added the known results from Indian Farm Management surveys showing higher production per acre for small farms. Cline therefore sees land reform as the most hopeful of all available policies for improving income distribution and production, on the three provisos that land, before reform, is underutilized; that the reform is carried through with speed and certainty; and that credit and modern inputs are made available to the new farming owners.

Warriner, more cautious, notes that the expectation of higher output "rests on the implicit assumption that farmers . . . will work land when they get it, and that they will be prepared to work long hours at low rates of return. . . . Yet this assumption is not always valid" (Italy, Venezuela). Even if it is valid, there can be other causes of failure:

> Even though the former agrarian structure has apparently impeded growth, by causing poverty, underemployment, undercultivation and underinvestment, yet there are almost invariably other constraints—shortage of land, shortage of water, lack of infrastructure—which will persist after the structure has been reformed, and may even cause reversion to the old structure (e.g., debts due to harvest failure may compel peasants to resell their holdings).

The author then goes on to analyze the results of different types of reform in two groups of three countries: "integral" reform in Japan, United Arab Republic, and Italy; "simple" reform in Bolivia, Persia, Iraq. "Integral" implies not only redistribution but possibly a long list of supporting and complementary measures (though usually boiled down to credit and extension). "Simple" implies redistribution, and not much more. The "integral" reform countries were relatively advanced in agriculture (except for the Italian South); the "simple" fairly backward. The first group had already had previous reforms, and all had systems of land survey and registration. In the second group, only Iraq had this; in all three land ownership was highly concentrated. In Iraq and Persia the status of the working farm population resembled serfdom; in Bolivia they were serfs in law. The scope of the "simple" reforms was much larger in these three and the social changes were fundamental. (See Table 2.)

As to production, the effects were more favorable in the first group, chiefly through higher inputs of capital. In the simple reform countries there can be no certainty that production will increase. It can fall, either through long delays and uncertainty or through failure to replace the landlord's functions. Production in fact fell for a time in Iraq and Bolivia. In Persia production increased during the early stage, mainly from cultivation of additional land.

As to income, peasants are certain to gain whatever proportion of gross income was paid as rent, *less* installments of purchase price of the land. Net gain will depend on increases or decreases in production and costs. As to investment, integral reforms can greatly increase farm investments. Clearly, integral reform will have the biggest development potential, *if* the government has the administrative capacity to manage it. If not, let there be simple reform: "Freeing peasants from the burden of serf labor is the immeasurable social gain to be expected from primary reforms."

As to follow-through, Warriner lays great weight on the role which cooperation can play; it is even a fallback if government services fail altogether. In fact, the range of conditions and circumstances is so wide that no general institutional prescription makes sense everywhere, save perhaps that *some* form of grouping and collaboration between farmers will almost always be helpful.

Looking at differences related to pre-reform structure (latifundia in Latin America, tenancy and land-shortage in most of Asia), Warriner notices: (a) the greater revolutionary potential in Latin America, with peasants now finding political allies, sometimes Marxist, sometimes military, quoting the drastic reforms programmed for Peru; (b) the danger of giving both small and nonintensive holdings; (c) "where recipients of land are a proletariat, not a peasantry, they want better incomes and working and living conditions rather than independence as small farmers . . . ." Is this a case for state farms, or similar collectives-cooperatives? The Chilean reform had some advantages, but there are always

TABLE 2.—COMPARATIVE RESULTS IN INTEGRAL AND SIMPLE REFORMS*

	Integral			Simple		
	Japan	U.A.R.	Italy	Bolivia	Persia	Iraq
Date of reform laws	1946	1952, 1966	1950	1953	1962	1958
Farm land redistributed						
Thousand hectares	2,385	263[a]	700	4,000[b]		3,000[c]
Number of villages					12,000[d]	
Percent of total	30	11	4	70?	24	Over 50
Families receiving land						
Thousand families	4,218	264	100	266	587	300
Percent of total	Over 60	10	6	60?	25?	Over 50
Potential actual income gain						
Percent	100	50	50	...	70[e]	100[f]
Agricultural production index 1964/65 (1952/53–1956/57 = 100)	132	144	119	...	124	105
Wheat yield (*100 kg. per hectare*)						
1948–52 average	18.5	18.4	15.2	6.1	9.0	4.8
1952–56 average	21.5	21.7	17.7	5.9	9.3	5.8
1964–68 average	26.9	26.2	22.1	7.2	8.3	5.4

* Taken from Doreen Warriner, "Results of Land Reforms in Asian and Latin American Countries," forthcoming in *Food Research Institute Studies*, Vol. XII, No. 2.

The question marks (?) are Warriner's. Nearby she says, "In the second group [simple] land use classification is missing, and in consequence assessment of results is highly conjectural." The agricultural production index and wheat yields are from FAO, *Production Yearbook*, various issues.

[a] Distributed by 1966.

[b] Cultivable land; individual ownership.

[c] Distributed by 1970. Of this total 841,000 distributed, the remainder rented to tenants of Ministry of Agrarian reform.

[d] First stage only; distributed by 1965.

[e] Case study, M. R. El-Ghonemy.

[f] Case study, M. E. Adams.

problems of management and conflicts between per caput output and employment.

Far more attention should be given to the need for "rationalizing farm sizes and capitalizing farms for the types of farming which agricultural development policy aims at promoting," and to the need for infrastructure investment in relation to systematic land settlement.

In Asia, difficulties are perhaps greater. Change of structure from tenancy to freehold will not, in itself, always increase production; yet tenancy is even harder to control effectively than to abolish. There is less disruption of production where tenants simply become owners of an existing holding, but the danger, inherent in very high man-land ratios, whatever the tenure, is that holdings will be endlessly subdivided owing to demographic growth. The best temporary way forward is by "charging up myriads of small cells to higher land productivity" by the use of new methods which raise yields—an administrative challenge. Warriner remarks bluntly that *where ownership is unequally distributed, technological change is certain to result in increased inequality and unemployment.*[23]

[23] Editor's italics. In many countries it is a skewed distribution of operational units which is so likely to result in increased inequality and unemployment.

Her final conclusion, with an interesting example from Ethiopia, is worth quoting in full:

> Thus the land reform perspective is likely to change. Advocated for many years as a condition of development, because it was believed capable of promoting rapid increases in production, it can now be envisaged chiefly as a means for ensuring that the benefits of rapid technological progress are spread widely to ensure a general rise in living standards and an increase in rural employment.
>
> The only example of this new approach at present known to me is the quietly brilliant strategy initiated by the Swedish International Development Authority in Chilalo in the Highlands of Ethiopia, in the face of great obstacles, one of which is the tenure system.... The object of the SIDA strategy was to introduce a seed and fertilizer program, researched in its own laboratories on the site; this, at the time of my visit in 1970, was being vigorously implemented by peasant farmers ploughing their land five times to prepare the ground. But SIDA did not begin with the inputs; the essential first step was to get the peasants' confidence, because at first they had been convinced that the foreigners had come to take away their land (as foreign concessions in other areas had done).
>
> The agency therefore began by creating a market incentive, setting up milk collecting centers which, by bulk trading, could offer prices slightly above those ruling in the market (not previously organized). As farmers began to supply milk to these centers, SIDA proceeded to the next step, offering credits to buy seed and fertilizers to farmers selling milk regularly. At first the agency also provided machine service, but when they found that this benefited the larger owners in an outlying area, who were introducing machinery and tractoring off their share-croppers, they decided to give up this service, and to confine the issue of credit for seed and fertilizers to farmers with less than 25 acres, though larger farmers can still purchase these items for cash; thus the agency adjusted its program to benefit the smaller farmers. At the time of my visit, the project administrators were attempting to make the sale of the new inputs conditional on farmers agreeing to raise the crop share due to their share-croppers. They were also cautiously starting marketing cooperatives, under agency guidance; when these were working, control was to be transferred to the members. Whereas the conventional approach has hitherto been to carry out land reform, and then provide services, leaving markets to look after themselves, SIDA began by organizing the market; then went on to supply new inputs; and only when the output effects had been attested in practice did it begin to encourage cooperative selling and press for tenure reform.

This new approach underlines the need for new thinking on the strategic relationship between economic development and agrarian reform.

Comment by Dale W. Adams

Adams's comments generally supplement Doreen Warriner's paper. On *production* the weight of evidence is for a positive or neutral effect of land reform; only rarely does it decrease output. On *capital formation*, he agrees with Raup's view that reform tends to have positive effects on both farm and nonfarm rural capital formation (*16*). He adds a note on the more recent view that propensity

to save is reasonably high on small holdings where attractive incentives to save exist, thus supporting Cline's view. On *effective demand*, he agrees that reform can lead to a more broadly based demand for industrially produced goods through marketed surpluses. On *employment*, Adams suggests that too little research has been done to arrive at firm conclusions; there are certainly cases where parcelization of a large estate into profitable small holdings can have positive effects (Adams quotes tobacco farming in Colombia; Clayton and Dharam Ghai have quoted similar results in Kenya). On *structure and technology*, Adams questions the (alleged) view of Ruttan and Hayami that technological change produces structural and institutional adjustment, quoting in contrast the views of Gotsch, Carroll, Flores, and Barraclough that structural change is in many cases a prerequisite for development. Adams agrees with Warriner's position that the relative emphasis on reform and technological development depends on the circumstances of particular countries. Much here depends on the countries upon which each school of thought is really focusing; but Adams rightly emphasizes that Ruttan and Hayami have a long time-frame (in which, incidentally, *post hoc, ergo propter hoc* types of argument are always likely to flourish).

Finally, Adams ruefully observes that land reform will take place in many countries for political reasons, whatever economists think about it, and despite the rather uninspiring record of the United States government and international aid agencies. Economists "might find more professional satisfaction by helping to adjust traditional economic tools ... to get more equitable results from these techniques." One may question whether such a total retreat is really necessary. Economists can at least join hands with administrators in working out, for those governments who do decide upon reform, an economic and administrative tool kit which would help them to avoid the worst dangers of a political decision and achieve the best economic compromise: politicians do not often carry such a kit.

SECTOR ANALYSIS AND GEOGRAPHICAL PLANNING

In this section we consider two very different papers. The first, by Erik Thorbecke,[24] is "an economist's paper," providing an extremely valuable survey and critique of various approaches to the economic planning (from the Planning Ministry, as it were) of agriculture as a sector, including the subunits of the sector and its relation to the rest of the economy and to the outer world. The second paper, by Arthur Mosher, uses many of the same words, such as "sectoral" planning, but is concerned with general agricultural policy and organization rather than analysis, and with geographical areas differentiated by social and technical potential rather than with subsectors and economic functions analyzed as constituents of a single economic process.

Erik Thorbecke

Thorbecke states much of his problem in his second paragraph:

> The theoretical basis of sectoral analysis is derived from the body of macro- and microeconomic theory. As such, it has to face such intractable problems as that of the aggregation of the microbehavior of the farm as a producing

[24] "Preparing Sector Programs for Agriculture: Sector Analysis, Models, and Practice."

> and consuming unit and the disaggregation (or decomposition) of the agricultural sector from the macroeconomy. Whereas the state of both macro- and microeconomic theory is relatively advanced that of "sector theory" is still at an early state of development in the professional literature.

He goes on to specify the "hierarchy of linkages" which should be incorporated in a sector model, namely, farm, district, region, agricultural sector, whole economy, and world economy. (One might note that the criteria for these subdivisions are not *sui generis*—districts are groupings based on criteria which include farming technique, size of holding, quality of land, i.e., a mixture of technical and social factors; regions "by climatic, economic, or even administrative factors"; the agricultural sector presumably by economist's conventions as to the inclusion or exclusion of, for example, the fertilizer or tractor or textile industry.)

The author then deals with four main types of models, to wit: multilevel planning models, microeconomic dynamic models, simulation system models, and general equilibrium-consistency models.

These models are too complex for summarization here, and only the briefest comment is made on each. The multilevel planning model, being worked upon by the International Bank for Reconstruction and Development (IBRD) Center and cooperating economists and applied to Mexico, is a combination of an economy-wide model and a sector model built up from 20 district models, at present designed to deal with questions of prices, trade policies, employment and investment. The ultimate objective is to follow through the effects of an investment project on the district and subsequently on the agricultural sector and the whole economy through the linkages which have been built to relate the district submodel to the sector model and later to the economy-wide model. In this fashion, project analysis can be undertaken within a general equilibrium framework.

The microeconomic, dynamic type is, in contrast, built up from the producing farm-firm and consuming household. Concerned with farmers' choices, according to a ranking of farmers' preferred objectives, and extended through time by recursive programming, it is of great interest as a study of farm level behavior, but suffers from a difficulty of aggregation.

The simulation-type model is perhaps best represented by a consistency-type model of Nigerian agriculture, developed at Michigan State University. It simulates the effects of exogenous variables, policy instruments and technology. With over 2,000 equations, and costing about ten man-years of time to prepare, it is an expensive proposition. "The sheer size of the model, combined with the impossibility of checking the underlying assumptions, quantitative specification and the explanatory power of the multitude of building blocks forming the model make it very difficult, at this time, to evaluate the quality and overall performance of the model critically."

Finally, the general equilibrium-consistency model (Fletcher-Merrill-Thorbecke for Guatemala), more open-ended and, in a sense, conventional, has the advantages of relative ease in using available resources and data, but lacks reliance on an explicit quantitative model in the narrow sense.

Thorbecke concludes his paper with a section on the requirements of the users of sector analysis, in fact, their need for a reliable and scientific guide to

policy decisions in the agricultural sector. The author admits frankly that, at present, "there is still a large gap between what the models can deliver and what the users need and desire for policy formulation purposes." He believes, however, that the gap is narrowing and "it would not be surprising if the decade of the seventies did not go a long way toward bridging the gap between model design and policy requirements." His argument is frank, modest and persuasive; no one could argue the case better.

Is it a good case? One problem is that complex economic models are mainly read by economists, who usually believe in the genus, if not the particular variety. In two following papers (Mosher and Hunter) quite different criteria for intermediate aggregation are used, on technical, administrative and social grounds. A further particular difficulty lies in the policy uses to which aggregates can be put. Obviously, aggregates are useful for knowing *what to expect*—for example, fairly regular numbers of suicides per annum in a given culture; but they can be much less useful in showing *what to do*. An aggregate of dry land rice production may be composed by summing production from many different areas, and there could well be important differences in the response to incentives or any policy instrument among the different communities concerned. Thorbecke suggests that models might be useful in arriving at decisions regarding, for instance, choice of techniques on land reform policies; but do they include the type of data (political, motivational as well as economic) which would give guidance? One can but say that the attempt to find a bridge between micro- and macroaggregates is an exciting and useful one, since the micro models, if well constructed, should accurately reflect a range of farm-level realities; and a possible indication may be that policy decisions for local application must be made much nearer the micro level. A quite different *kind* of policy decision springs from macro models, and at present perhaps the important thing is *not* to assume that macro data can give guidance for micro action in the field. In this respect macrosimulation models need to be treated with exceptional caution.

Arthur T. Mosher

The second planning paper with local application is by Mosher. It deals with planning in close relation to local executive action, including local investment, services, and administration.[25]

Mosher adopts a three-stage description of the state of agriculture in different parts of a country—accepting the remark by D. W. Hopper, cited by Hayami and Ruttan, that "every developing country fits ... each of the stages" (6), by the simple (and true) rider that *parts* of a single country can, at any one time, be in different stages—and, by implication, that parts of different countries can be in any one of the same three stages: the "stage" is a local and temporary state of affairs. This state of affairs is described *de facto*—Stage 1 is a premodernizing stage, where very little qualitative change is taking place, small increases in production being largely due to extra acreage or labor: it is often described as "traditional," and is technologically pretty stagnant. Stage 2 is one where a single breakthrough is happening because "the last condition to be met" has fallen into place and a spurt of production, possibly in only one important crop, has started.

[25] "Planning to Create a Modern Agriculture."

Improvement on this will consist primarily in improving the quality of all types of inputs: land, labor, capital, agrisupport services. In Stage 3 agriculture is already modernized, and problems will consist in adjustments to world prices, or the pattern of consumption or other major needs of the economy.

In Stage 2, which is the center of Mosher's interest, a type of agricultural planning is required which is not commodity planning (Stage 3) but a transformation of agricultural structure with a heavy emphasis on agri-support services, including infrastructure (e.g., roads, water), research, delivery of research results and of other services, and closer linkages between agriculture and other parts of the economy. Planning here has a strong emphasis on public services. Perhaps Mosher's words should here be given, indicating how the components of Stage 2 planning fit together:

> I believe this framework for planning meets the criteria outlined above. The first component (research) provides the new technology and the new information on which improving the quality of all inputs and improving the efficiency with which they are used must depend. The second component (assuring adequate wholesale supplies of farm inputs) provides for making these inputs available for distribution and purchase. The third component (developing a rural infrastructure of agri-support services) provides a "rural circulatory system" to make physical inputs, credit and information conveniently available to farmers in their far-flung geographic locations and allows farm products to flow into the national economy.* This infrastructure includes retail outlets for farm supplies and equipment, markets for farm products, an agricultural extension service, production credit, local verification trials, farm-to-market roads, and roads connecting each farming locality center to its district wholesale center and headquarters. Each of these activities involves different processes and requires a different type of organization and administration, but it is the combination of all of them that provides the *geographic structure* of a modern agriculture. It is their high complementarity that leads to grouping them together as a single element or planning activity.
>
> * This infrastructure comprises the "Progressive Rural Structure" discussed in the author's "Creating a Progressive Rural Structure" (New York: Agricultural Development Council [ADC], 1969).

This passage summarizes, with an almost Utopian touch, a vast number of extremely complex tasks; it does not pretend to suggest how the multiple difficulties underlying each of them can be solved: would God such a system existed.

Mosher then points out that Stage 2 planning needs to be relevant to Stage 2 situations, so that planning must be disaggregated to geographical areas, and a further (but somewhat different) triple classification follows. First, areas of immediate growth potential (IGP), i.e., having a favorable agricultural situation, (soil, climate, water, etc.), new technology already available, good transport facilities. Here rapid modernization can happen, within a matter of three years. Second, areas of future growth potential (FGP), having, again, favorable agricultural factors but lacking some major elements in technology, or transport, or other essentials. Some years will be needed before the missing links are put in. Third, areas of low growth potential (LGP) (unfavorable agricultural conditions, no immediately visible cure for this and for other impediments to growth).

Mosher does not make policy suggestions that low growth—or even future growth—areas be neglected; he simply indicates that a different type and time-scale of planning, suited to each, must be adopted. He adds:

> If planning is to be disaggregated on the basis of varying current potentials for agricultural growth in different parts of the country then *district planning* becomes very important. A basic preparation for district planning is mapping the district to show the various IGP, FGP, and LGP Areas in each district and to depict what progress has already been made in developing a Progressive Rural Structure, or rural infrastructure of agri-support services. District planning can then proceed to make recommendations as to what activities in the judgment of district officers should be undertaken in the coming year and in each of several ensuing years with respect to IGP, FGP and LGP areas and with respect to each of the six major components of planning.

In the last sections of the paper, Mosher adds three important points. First, planning must give due consideration to sequences, gestation periods and complementarities ("b" comes after "a"; "c" takes three years before "d" is possible; "e" is useless without "f"). Second, disaggregation geographically is necessary because "a modern agriculture is achieved locality by locality and district by district, rather than commodity by commodity or public activity by public activity." Third—and this applies directly to Thorbecke's paper—the technical and mathematical planning techniques (he mentions simulation models, linear programming, cost-benefit analysis and input-output analysis) in Stage 2 must be regarded as prior to, or ancillary to, planning. "When it comes to making final allocations among the major activities involved in creating a modern agriculture in Stage 2 these mathematical techniques cannot help...." They may be useful in the central allocative process only in Stage 3, when a modern agriculture has been largely created: "when *production* planning, rather than achieving a major transformation within the structure of agriculture... has become appropriate."

There are a number of possible comments on Mosher's thesis. Perhaps the most important are:

1) The stages are *de facto*, without explanation of the elements, motives and the like, which, in particular, underlie the transition from Stage 2; and the IGP-FGP-LGP division neglects social factors in concentrating on technical potential and availability of investment or services—there are plenty of places, especially in Africa, where very "backward" people have been sitting on high potential without using it.

2) The capacity of different governments to achieve all the planning and service requirement in Mosher's version is extremely uneven.

3) It must be mentioned, though not as a criticism, that this is a planning description (from above down) and in consequence omits a host of problems (from below up), arising from the fact that agriculture is a matter of myriads of decision-making individuals (farmer organization and responses, political and social structure, income distribution).

The next set of papers (Hunter, Young, Schran, and Jiménez Sánchez) goes some way in dealing with these three points.

SOCIAL, ADMINISTRATIVE, INSTITUTIONAL, AND POLITICAL FACTORS

The paper by Guy Hunter is much the broadest attempt to look at the implementation of agricultural development as an activity of society as a whole, in which social, economic, administrative and political factors are, at all times, fused in the real world, though of course capable of analysis at the level of abstraction of the various disciplines. As such, it is probably the most vulnerable, and will need amendment from several disciplines.[26]

Guy Hunter

The paper starts from the proposition that the most intractable difficulty—not the only one—which confronts an attempt at broad-front development among small farmers is the weakness of administrative and institutional tools through which to inform, stimulate and service them.

> The fact is that where the farmer is weak in physical equipment, weak in financial resources, illiterate or semiliterate, bound by constraints of labor supply, by lack of physical investment (roads, water, storage, etc.), often by insecure or oppressive tenure, held in a social system which almost always incorporates at least some values which discourage individualist decisions—in such a case the farmer needs a great deal of external help before he can even stretch out his hand to the new opportunities which modern knowledge could offer him.

The paper then runs through a number of difficulties or deficiencies in the provision of effective services. These include: (1) lack of investment in local infrastructure and personnel; (2) ignorance of the *rationale* of local farming systems; (3) difficulties of coordinating the large number of concerned departments; (4) confusion as to the role of elected bodies and officials at local level; (5) commercial management, with a note on the conflict between "crop boards" and total farm management; (6) poverty itself—"only those choices of administration can be effective which accept the facts of poverty and work within its gradually lessening limitations."

In the second half of his paper the author moves away from this mainly conventional approach to individual problems and puts forward a general theory of social and economic change to which policy must be adapted. In outline, the theory is simple, if not self-evident. It is that, since society works as a whole, the process of transition is continuous, not in discrete "stages"; and, more importantly, that all aspects change, not at the same rate, but in a common direction. "Aspects" include internal relationships of the nucleus community (village); linkages to the larger local and, later, national community; technology; incomes; commercial competence; political organization and attitudes; social and economic institutions; availability of skilled manpower; administrative capacity; government revenue and resources. It is important that change is taking place, not merely locally, but also in government, the national economic environment, and politics.

The point of departure of this transitional process (in an agricultural development context) is the traditional village in a survival system, with high risk aver-

[26] "Agricultural Administration and Institutions."

sion, high suspicion of outsiders (and government), a traditional hierarchy or segmentary lineage system or caste structure, simple technology, no monetary savings, little or no commercial sophistication, and high social conformism. The interim end-point is a society founded on cultivators farming for the market; handling credit and money with confidence; using more modern technology; linked with wider organizations; organized horizontally rather than vertically (relations in a farmers' association rather than by caste, lineage, landlord-tenant, client-patron, subject-chief).

The problem posed is to adapt the institutional and administrative tools for accelerating this transition to the point on the transitional line reached in a particular area; again, as Mosher remarks, this is a question of localities, though defined by much more complex criteria. Hunter suggests three main types of factor which must be taken into account:

a) Technical factors: a dominant crop (tea, sugar, tobacco) may suggest a particular management organization; canal irrigation may impose certain imperatives; man-land ratio, animal or crop husbandry, and many other special technical situations, may predispose toward different organizational forms.

b) Factors related to the agency of change: It is useless to recommend organizational structures which are beyond the capacity (trained manpower, budgetary resources, administrative skills) of the agency introducing developmental change. In countries short of manpower and skills, simplifying chains of command and coordination may be an essential step, even at the cost of occasional mistakes. The balance between *speed of decision* (usually involving a delegated, authoritarian structure) and *quality of decision* (involving coordination of many specialists and interests) must always be related to resources.

c) Social, economic and political factors: i.e., many of those listed in the description of transition above.

The practical implications flowing from the general theory, in which policy tools applicable to early and late points of transition are contrasted, include the type of extension service required; credit, in relation to economic development; and the gradually diminishing role of government action and increasing role of normal commercial exchange as farmer resources and sophistication grow. These are the policy propositions which need testing, both by field research and from academic disciplines.

The paper ends with a summary of recommendations and a restatement of the general theory:

> Finally, I have suggested that most of these recommendations fall into a more general framework. There is, I suggest, a range of human situations, moving along a line from traditional society to a modernized agricultural economy. There is a range of technical solutions which have to be fitted to this changing local scene, both as to costs and benefits and as to the availability of skills. There is also a range of administrative methods to choose from; and, again, these must be fitted to the attitudes and capacities of the farming community, to the quality of the surrounding economy, and also to the capacity of the administering authority. Recommendations on bureaucracy and politics, on commercial or cooperative systems, on technology are interdependent, with a common relationship to the general style and achievement of a society at a given time.

In general, Hunter's paper supports and adds to the Mosher thesis, particularly as to local planning and attention to timing and sequences. The differences lie at four major points. First, the transition is continuous rather than in simply identified Stages, and the rationale of the transition is treated in depth. Second, it is from this rationale that the paper derives implications for a closer adjustment of administrative tools to the social and political as well as to the technical situation. Third, the capacity of government to manage complex administrative tasks, in skills, personnel and revenue, is itself regarded as a changing factor, i.e., part of the whole transition. Finally, the growth of political alongside administrative activities is taken into account. It is clear that, at this stage, only very broad indications of the criteria for adapting institutions and administration to the technical and social possibilities of a given situation can be put forward. But even broad indications would help to avoid major mistakes and give a basis for more intelligent classification and use of the experience of past failures and successes.

We can now turn to the only major paper on politics (Young), coupled with two shorter papers with interesting administrative implications (Peter Schran and Jiménez Sánchez).

M. Crawford Young

The short paper by Crawford Young[27] falls roughly into two parts. There is first a review of the rather hesitant attempt of political science to find an adequate theory of politics in developing countries which is applicable to the process of development. Second, there is a partial application of a theory of systems capacity.

Young starts from a remark of James Coleman that "the time has come to recognize the professional respectability as well as the practical essentiality of the ancient and honorable hybrid discipline of political economy" (*4*). In fact, political scientists have not yet an adequate answer to the economists who accuse them of failing to produce a theory of development which has actual relevance. While recognizing the contributions of the school of Gabriel Almond, and of Easton, Apter, Huntington, or Eisenstadt, Young observes that general theories of political systems have had mainly an audience within the discipline, and in particular have failed to illuminate the practical problems of political choice. "Macro theories offer little enlightenment on microbehavior; there is no way to deduce from the categories and relationships suggested by theories of political development the more specific questions which would illuminate the linkage between the local agencies of the political system and the rural smallholders who constitute the units of production." There is an analogue in economic theory: "the culture of the discipline allocates status and prestige to highly formal abstract models of the whole economy." Young makes an honorable exception for Albert Waterston in economics and Colin Leys's short book in political science (*13*).

However, there are signs of hope. The 1966 version of Almond's standpoint, and the 1971 *Crises and Sequences of Political Development* (*2*) shift the emphasis to system capacities and other elements of the working process of politics. "The more durable issues of the uses of Africanized political power to cope with poverty and underdevelopment came to the fore."

[27] "Reflections on the Politics of Agricultural Development." This paper was produced as a hurried draft and is not for formal quotation.

Young, while noting a more hopeful trend toward policy-related issues among political scientists, also records the increasing pessimism which is showing in their work. "Decay and instability are really more salient than political development," Huntington argues. "The most important political distinction among countries concerns not their form of government but their degree of government. Politicization of mass publics has outstripped the capability of new states to cope with their expectations" (7). Thus the author moves to discussion of "system capacity" and particularly the ability "to influence... the behavior and structure the incentives of smallholders." He notes, in three major states of Africa (Zaire, Nigeria, and Algeria), the tendency, after a period of near-collapse, for a reaggregation of power to appear round three pillars: the Army, the Administration (in all three countries), and Party (in Zaire and Algeria). In fact, the period of diminished governmental capacity and rashly increased burdens *is* giving way to a stronger center and more cautious programs. The emphasis on the center is particularly strong, to the enfeeblement of the periphery. In consequence, in the agricultural sector, agricultural administration can become like an inverted pyramid, with its top on the ground—"Actual contact is maintained by the weakest links in the communications chain . . . in Zaire and . . . Uganda." "Again in Zaire there is a vast gap between the capacity of the system to aggregate and centralize power resources and its ability to maintain rural infrastructure or provide local services." Simultaneously, the powers of the central bureaucracy and district commissioners have been increased, at the expense of local politization. (The author here refers to Zaire and Uganda; but the same process has occurred in Kenya, in some degree in Zambia, and in several States of India: there may be a link here with Hunter's suggestion that governments in search of speedy development through simpler administrative systems may be well advised to shirk the troublesome complications of giving development functions to highly party-political indisciplined local elected bodies).

Another perplexing problem of politics "is to pursue policies which raise production and diffuse innovation without reinforcing or even creating inequalities"; the reader will hear echoes of the Cline and Kilby-Johnston papers in this observation: the economists have gone some way to provide data and argument which would be helpful on this issue.

Probably even more difficult, though perhaps less explosive than local inequalities, are the regional inequalities growing up around points of rapid development. Young quotes the huge inequalities between North and South in the Ivory Coast, accompanied by momentous population shifts, both internally and by the immigration of almost 1 million (out of 4 million) "foreign Africans." Uganda is another example in Africa, the Punjab in India/Pakistan, and Shahid Javed Burki, in a short contribution to the Conference, noted the internal migrations in Pakistan and in the Philippines, mainly due to the exceptional gains of middle-level farmers in Green-Revolution areas and consequent shifts in labor supply.

Local inequality is not only related to resources, but to the nature of government services. Young notes that "the level at which government extension services can be effective is with cultivators... who can deal directly with the well-qualified district agricultural officers rather than the field assistants," and quotes cases from Kigezi. This is indeed widespread, not only in Africa but in the Indian

subcontinent as a whole. Wealthy Punjabi farmers will go outside government altogether and ring up a university specialist or, increasingly, a specialist supply firm.

The author concludes his paper with some suggestions for further political research:

> These sparse reflections, hopefully, suggest some directions in which political science may contribute to a clarification of choices available to new policies in agricultural development. We feel that the central concept of system capacities can provide a linkage between the disciplinary capabilities of political science itself, and concrete issues of agricultural development. We have not, in these remarks, explored the issues of equality and differentiation which Coleman links to capacity. We have left untouched such important questions as the impact of ideology in shaping and constraining policy choice; this, we would suggest, is largely an élite input, felt at the center, rather than an integrated conceptualization of rural smallholder demands at the periphery. Much more could be said about the options available in the structuring of incentives for the smallholder base to the rural economy. The implications of such pervasive phenomena as corruption, the decline of local governments, the militarization of politics, and the demise of political parties have been hinted at, rather than fully developed. The predilection for mechanization and large-scale projects as foci for agricultural investment, and cooperatives as a device for rural encadrement and marketing structure deserve more than the passing references they have received here. With all of these gaps, we cannot claim to have established our case for the value of a political economy; we can only hope that we have suggested its potential role.

Peter Schran

An interesting comment on strongly centralized government reaching down to the rural areas and agricultural production was given to the Conference by Peter Schran in his paper on China.[28]

He describes three main power organizations at the center. First, the Bureau of Commune Management of the State Council, which collects data from communes and sets targets for them. The planning function, which makes plans on the basis of information collected by the Bureau, is carried out by the Department of Commune Affairs (Ministry of Agriculture); control and supervisory functions are carried out by the Rural Work Department of the Chinese Communist Party. Both the Bureau and the Party maintain a hierarchy of officials running down to the commune level.

The commune nowadays is at the traditional "central place"—a small market town or large village to which most activities of the surrounding hamlets flow. (At one time, the government attempted to make this a wider area, partly in order to break down all traditional organizations and partly for [mistaken] technical reasons). The commune elects its own management committee (of which an official is the director) and a supervisory committee consisting exclusively of Party members.

Below the commune, and in some degree managed by it, are two levels of collectives: the Production Brigades and Production Teams. A team normally

[28] "The Organization of Chinese Agriculture."

incorporates a hamlet or small village; a brigade groups several teams. At one time the communes were more dominant, organizing almost all forms of activity including some garden plots, home handicrafts, and even household services (cooking, laundering, childcare). Although these functions have lapsed, the commune still has considerable powers. It owns the land, which is granted for use to the teams on conditions; it collects state taxes in kind from the teams. It also collects quotas of production set by the state trade organs. Finally, it imposes on the teams model regulations for management practice. These regulations specify the form of team organization, election of team leader, and set standard shares of production costs, of collective accumulation, of welfare payments, and of distributed income. Ninety-five percent of land is operated through the collective system, 5 percent through very small "private" gardens or plots (about one-tenth of an acre). Although these plots are popular—they escape land tax, compulsory saving—they occupy too small a share of land to be of great importance; and the cultivator is bound to contribute the largest part of his effort to the collective enterprise, on pain of losing his ration.

Baldly described, this seems a grimly authoritarian system. But it *is* the system, and therefore the only way in which millions of rural Chinese can find a living. For the reasons why it works, one would have to read the author's book on Chinese agriculture, where at least two major points stand out. First, that land reform brought very real benefits to small men. Second, that Peking retreated somewhat from an all-out attack on all domestic and local structures, allowing a rather higher element of traditional relationships to be reestablished.

Leobardo Jiménez Sánchez

A few final comments on the implementation of agricultural development can be drawn from a case history of the Puebla corn-growing scheme in Mexico, presented to the Conference by Leobardo Jiménez Sánchez, the coordinator of the Project on behalf of the International Center for Maize and Wheat Improvement (CIMMYT).[29]

The Puebla Project lies in a rainfed area, where the farm population is about 260,000 (47,500 farmers with average family size of 5.5), living in 200 communities of about 1,300 members: rainfall is about 800 mm. per annum, population growth 3.5 percent (whole country). The average holding was about 2.5 hectares, likely to be divided, again on average, into three separate parcels. Out of this total, in the course of the four years 1968–71, the Project had come to include just over 5,000 farmers cultivating 14,440 hectares (average of 2.9 hectares).

In describing the purpose of the Project, the author points to the difficulties of developing smallholdings, and emphasizes that these are exceptionally acute where farming is a high-risk activity, with high population density. The sources of difficulty listed are variable rainfall, insecure tenure, limited capital resources, low formal education, traditional technology, subsistence agriculture, high population density, and mutually uncooperative farmers. He adds that such an area is not an attractive investment for private capital, and that, to increase production, a very favorable political and administrative environment will be necessary.

[29] "Strategies for Increasing Agricultural Production on Small Holdings—The Puebla Project."

In fact it may be noted that the conditions at the Project were not as unfavorable as those in many Asian or African countries; the area chosen was one of relatively good rainfall and soil, well supplied with all-weather roads, where 62.9 percent of farm families had electricity (double the percentage in England in 1939!), 59.8 percent radio; 29.7 percent cook by electricity, gas, or fuel oil. Average family income was about $500 (i.e., just under $100 per caput). Almost all cultivators were owners.

On the commercial side, just over 60 percent of farmers did not sell corn at all, and only about 12 percent received credit of any kind at the time of the initial project survey.

The strategy used in the Puebla Project at the beginning included the following components: (1) development of new technology, with the participation of farmers in research conducted on their own lands; (2) effective communication of agricultural information; (3) ready availability of production credit; (4) opportune availability of adequate agronomic inputs; (5) an acceptable relationship between the cost of inputs and the selling price of the product; (6) convenient markets; (7) crop insurance; and (8) farmer organization.

The Project, after some difficulties at the start, has had encouraging successes. From an average corn yield of 1,300 kg/ha. for the whole area, yields have risen to 1,917 in 1970, with the "high-yield plots" reaching 2,670 kg/ha. Almost 50 percent yield increase for the whole area and over 100 percent in high-yield plots scattered in the working area, sampling different climatic and soil conditions, is a remarkable achievement. Credit issued rose from about $50 per Project member in 1968 to $160 in 1970, falling back, however, to $118 in 1971 (which turned out to be a bad year; fertilizer price was reduced, but administrative arrangements for fertilizer procurement deteriorated). The staff engaged were four agronomists (of which two were on varietal research), five information officers, an evaluator, and a coordinator. Reception of the scheme first met with hostility, later with enthusiasm from farmers in general in the area.

Unfortunately, we have not been given the nature of the initial hostility or the reasons for the relatively low proportion of adoption (5,000 out of 47,000 farmers). It may be that the improvements, great as they were, did not seem to be within the grasp of many farmers, although in theory yields could have been quadrupled by optimum performance. With a proportion of well-trained staff of roughly 1 to 500 adopting farmers, and highly-motivated staff at that, the investment is fairly high by the standards of staffing, both as to quality and quantity in a great many LDCs.

It is interesting that no officially preferred structuring of farmer organization was used; indeed the paper says, "The Puebla experience indicates that no attempt should be made to impose a particular organization model on the farmers; the expected reaction to such an attempt would be indifference, if not rejection on behalf of farmers." It may be that one lesson is that four years is not a long time to break through a predominantly subsistence culture, and that the relatively modest attack on limited fronts was wise. The future history of the Project, and closer analysis of both social and economic factors involved, will prove of great interest.

PART IV. RESEARCH

Gilbert Levine

The paper by Levine is almost wholly concerned with agronomic and varietal research, with a strong emphasis on water and on the IRRI rice research program.[30] In face of the manifold "development needs," and corresponding range of research required, the author has sought to suggest four general guidelines which would be "applicable for any set of assumptions" about needs.

The first of these is "*look at the production environment first.*" And this, by way of example, is narrowed down to the soil-plant-water environment. He points to a serious lack of full information on the available supply of water, to inadequate knowledge of the effects of moisture stress at various stages of plant growth, and, to move a little into the social environment, grave mistakes in assumptions about farmers' attitudes to water management.

The second guideline is "*think small.*" This phrase really needs translating into: "limit objectives and sharply focus research." The IRRI Program focused on a sharp increase in paddy yields for a limited production environment with no water problems. All social and economic factors, with the exception of input-output relations, were assumed not to be of primary importance. The second limiting aspect was not to carry out multiple adaptive research but to delegate it by encouraging other institutions to do it, and by providing training facilities. The payoff was remarkable; but so, as Levine admits, were the costs. He quotes Randolf Barker as estimating that 20 percent of rice land in Asia would show significant yield increases from the new varieties, 50 percent no significant change, 30 percent a yield decrease. Moreover, he quotes the Tungro epidemic in Luzon and Bicol resulting in "almost complete crop failure"—and might have quoted near-catastrophe in the Cauvery Delta in Tamil Nadu, where tens of thousands of farmers lost not only crop but the expensive inputs as well. In a second example, Levine quotes the solution of a problem of low sugar content in cane, solved by narrowly focused research on soil moisture in the period immediately before harvest. But there is little more moral to this than that identified problems lying within a scientific discipline are easier to solve than many of the interdisciplinary problems of agricultural development.

The third guideline is "*identify the problem*"—and define it. This section mainly concerns the isloation of academic research from field problems of development, and research springing from "the interests of research workers rather than in response to the needs of the agricultural producers . . . ." Levine also notes the tendency to serve large farmers rather than small, and the additional gap when extension services are governmental and research is done in universities and colleges.[31] It might be noted that the British colonial tradition was to have applied research and extension both under, or closely associated with, Ministries of Agriculture. The American land-grant-college concept, as applied in India, has taken research away from the Ministries but left two-thirds of the extension work with them, with extremely mixed results, lately commented upon by the Indian National Commission on Agriculture.

The last guideline, "*consider adaptation first,*" appears to be based on the fact

[30] "Matching Agricultural Research Priorities with Development Needs."

[31] The reader may compare this with the Ruttan-Hayami thesis on socialized research.

that "traditional practice is an evolved adaptation to the total environment. Radical changes from this practice, to be successful, usually must be accompanied by relatively large changes in this environment." The difficulty of making such changes leads to the guideline. Major irrigation might appear to be an exception; but the author suggests that successful irrigation usually represents *successive* improvements in water supply, delivery, and utilization. It is at least doubtful if this rule is general—the Sudan Gezira would be one exception; and the many cases where irrigation has not paid good dividends (including several in Thailand) could be attributed to a failure to do adequate agronomic or social research at all. Clearly, research resulting in practices easily fitted to existing farming systems and farmers' knowledge is a more hopeful proposition than radical change; but, as S. K. DeDatta pointed out in comment, some radical changes (for example, in weed and pest control) have been highly effective. It has also often been observed that in new settlement areas, where settlers were freed from old customs, radical change is often acceptable.

Paul P. Streeten

A further comment by Streeten, focused on economic and social research, may best be included here; it is in many ways a fitting close to a summary of papers. In an earlier session, R. B. King had pointed to the gap between "thinkers and doers." It is here that Streeten starts:

> Let us begin by reverting to the distinction between thinking and doing. It is the widespread belief that all that needs to be known for the promotion of development is already known and it only remains to get on with the job. The tacit implication of this doctrine is that it is the inertia or stupidity of people in the developing countries that prevents existing knowing *how*, and *doing* is itself a certain form of *knowing*.
> Without going so far as to say that appropriate knowledge itself inevitably and always leads to action, I do wish to emphasize that what we regard as existing knowledge is in many cases inappropriate and therefore unusable. . . . I conclude that the distinction between knowing and doing can be a false one. If something is known and not done, there remains the question: why is it not done? Knowing *that* is rather different from knowing *how*, and *doing* is itself a certain form of *knowing*.

Streeten moves on to the dilemma between generalization and particularism:

> On the one hand, we have those who affirm that there is one economics and one economics only, applicable to all times and all places. On the other hand, there is the view that each case is unique. If taken seriously, this view leads to the conclusion that we cannot learn anything from experience elsewhere or at another time. The first view is based on a confusion between logic and economics. While the laws of logic are universal, those of economics are bound to vary between periods and cultures. The second view is too nihilistic and is tantamount to the abandonment of thinking, for all thought is generalization. I should therefore like to plead for an intermediate research technology, for an intellectual framework that lies somewhere between the claims to universality and complete specificity. Some of the categories proposed in this Conference seem to me to meet these specifications.

The next issue concerns multidisciplinary and interdisciplinary studies. Streeten points out that there are cases where several specialists can, within the boundaries of their discipline and using the specific contribution of this discipline, contribute to the solution of certain complex problems (e.g., nutrition, land-settlement, family planning, slum clearance). Streeten moves next to a more fundamental point:

> But interdisciplinary studies in the second sense call for a drastic revision of the theories, the models, and even the concepts used *within a given discipline*.[32] One of the lessons that has emerged from our discussions is the need to reformulate an agricultural production function so as to include several so-called noneconomic variables. It might well be that agricultural output depends not only on the inputs of tools and equipment, fertilizers, labor, and land, but also on such variables as the level of nutrition of the farmer, his level of health, the distance of his farm from a town, the system of land tenure, and even the caste system and religious beliefs. Such a reformulation would amount to a redefinition of some of our basic concepts. Much work remains to be done on this. We have in the past transferred not only inappropriate industrial and agricultural technologies, but also inappropriate technologies of economic analysis. What is called for is a more realistic conceptual framework which will have to draw on the material of hitherto separate disciplines.

Streeten then puts these issues in a different frame, in the form of a policy dilemma, whether to attempt to tackle several related problems at once, or to select one or two strategic variables and hope that the others will fall into place. "This dilemma brings out the fact," pointed out by Walter Falcon, "that our studies have been at the same time too broad and too narrow; too broad because they did not take account of the differences between cultures and regions, between attitudes and institutions in different settings; too narrow because they did not take into account the need for complementary noneconomic measures." In taking this attitude (put forward by both Mosher and Hunter), of too broad generalization within too narrow a frame, Streeten comes down for a more inclusive framework of *research*, without committing himself on *policy* and action. In particular, he stresses the need to include the political dimension, observing that distortions in factor prices (e.g., high-cost import substitution and discrimination against smallholder agriculture) are not due to blind ignorance of simple truths but to political pressure groups and vested interests: change in policy here requires not more knowledge but a political will to alter the thrust of policy.

In his final paragraph Streeten reverts to the new emphasis on poverty and employment, with a strong criticism of the concept of draining rural "surpluses" into other sections of the economy.

> The rural sector is not likely to remain the sector from which labor, savings, food, foreign exchange, and taxes will be squeezed in order to develop imposing but inefficient urban industries. On the contrary, if we wish to combine economic growth with greater equality, wider employment, and a wider spread of the benefits of progress, we shall have to retain and re-

[32] Editor's italics.

channel these surpluses within the rural sector. A strategy that cares for the masses of really poor people in the poor countries will present quite different problems from one based on using the rural sector as a milch-cow.

PART V. LESSONS AND PERSPECTIVES

This was primarily an economist's Conference; but it was also illuminated and criticized from time to time by contributions from other fields, especially politics, and by interventions from administrators and overseas members concerned with day-to-day decisions. For this reason, final comments naturally concern more the state of thinking about development than the actual program and strategies for agricultural development in the 1970s. As King observed, from the point of view of a donor agency:

> It seems to me that the main problem is not so much to know what it is best to do in given circumstances in order to promote optimum agricultural development for the benefit of the particular country being considered, but to know how best to go about it. There are in any developing country a number of constraints which prevent even the best considered plans from being put into effect. Most of these center round the political and administrative framework within which one has to operate.

In fact, however, there *is* still a considerable problem in knowing what is best to do. In looking at the Conference from the point of view of the "state of the art," our impression is that this meeting marks the end of one era, not the start of another, although there are hints of ideas struggling to be born. We might illustrate this in four main ways.

First, we are beginning to see the end of one major axiom, at least in the form in which it has been traditionally expressed: i.e., that it is the business of agriculture, as a low-productivity sector, to provide a flow of food, labor, and capital to other, higher productivity sectors with greater elasticity of demand. While this is true as a secular trend, it can provide a bad starting point for short-term policies in dominantly agricultural countries, since it tempts toward a treatment of agriculture and the whole rural economy as a "milch-cow" and as purely instrumental. There is a danger of neglecting its need for attention and resources before it can fully play its secular part. Both the paper by Stephen Lewis and the comment by Claudio Gonzalez-Vega admit that there are periods when agriculture has a higher productivity, and may require a high priority in short- and even medium-term investment. It is more than possible that the axiom, in its simple form, derived from a nineteenth century economics which assumed large export markets for manufactures, rather than their almost total dependence on the domestic market, dominated as it is by the level of purchasing power in the rural economy. The emphasis in this Conference on the inefficiency of much import-substitution industry, on the distortion of prices against labor intensity and against agriculture, and on the vital role of marketed surpluses of agricultural output (not only food, and including export) for the development of manufacturing and services, for employment, and for income distribution, marks a turn, still hesitant, toward a more careful formulation.

Secondly, we can see a decisive turn away from what was once a much used concept of "backing winners"—usually, large farmers. The recent emphasis on poverty and unemployment as key issues of development policy is reflected in at least half a dozen papers, and by many speakers in the Conference. Cline, Warriner, and Young, from their different standpoints, all emphasize in very similar phrases, that, in an unequal society, technological change will almost automatically increase the skewing of income distribution, unless direct policy measures are taken to prevent it; Cline, in particular, stresses the tendency of the seed-fertilizer strategy to increase inequality. The Kilby-Johnston emphasis on a "unimodal" strategy and the Mellor-Lele analysis of the effects of labor's share in income point in the same direction, with both poverty and employment at the heart of the argument. Perhaps the Ruttan-Hayami thesis, that technological change and factor prices almost ineluctably push society and its institutions to take advantage of new opportunities, is the main paper that takes a somewhat different view, since, as the others argue, the natural result may be for the powerful in economic and political terms to "internalize" the gains for their own profit.

Third, as Streeten emphasizes, the idea that experts know the answers, but unfortunately developing countries do not take their advice, received some hard knocks. As Julius Eweka stressed in a brief comment on the Conference, basic planning data are sorely lacking in many countries; we are still ignorant of the full rationale of existing farming systems; very few economists have revised a Western-based set of economic concepts and tools to fit the very different societies overseas; as the papers of Mellor and Lele showed, we still have very shaky and incomplete information (and theory) on the multiplier effects of increased farm incomes under various distributions. Thorbecke, Mosher, and Hunter all pointed to serious gaps in both theory and practice, particularly between aggregative macroplanning and the realities of local implementation.

Fourth, the all-powerfulness of economics as "the" discipline for setting development strategies was much more strongly questioned. King, Eweka, Young, Streeten, and others pointed to the gap between "thinkers" and "doers," both in the intrinsic quality of much academic research and in its application to policy issues. Among many Conference members there was disquiet about the model-making fashion. Beckford, in two passages quoted in the text, emphasized the rigidities in developing countries which may make nonsense of the smooth working of traditional economic formulations. There was an increasing realization of the vital importance of the assumptions underlying models, and not only of those stated but of those subconsciously assumed from Western experience. Moreover, description of the behavior of variables within fixed assumptions, where both are expressed wholly in economic terms, can give a seriously misleading impression of actual behavior and its underlying motivation, especially in those societies where noneconomic motives and values play a large part in regulating choices: "rigidities" is an inadequate description of complex and ascertainable patterns of behavior. The lack of time-series data was seen to detract seriously from the value of some models as interpretations of the dynamic and changing structure and performance of less developed economies; and indeed, for policy-makers and administrators in any country of the world, timing is of the essence of successful policy. In Streeten's "too broad and too narrow"

category might well fall the Ruttan-Hayami thesis, with its tendency to suggest that, because society eventually makes use of technological change, the causes can be found in the economists' language of factor prices, without need to call on other disciplines which embrace the social and political aspects of society.

Thus the impeachment falls into three parts. First, there are tacit assumptions in the Western economist's tool kit which do not hold good for many developing societies, or at least describe them in misleading terms. Second, model-making and other aggregative techniques are particularly liable to fall into an assumption trap, by their degree of abstraction from actual conditions, by the very process of aggregation in dealing with societies with wide differences in behavior pattern and economic response as between different localities, and sometimes by a lack of dynamics. Third, an interdisciplinary approach is not secured by adding in more separate disciplines. We could perhaps carry Streeten a little further by pointing out that what is needed is an interdisciplinary *hypothesis*, i.e., a hypothesis *about* the interrelationship of those different aspects of behavior—social, economic, political, administrative—from which the disciplines originally took their names. This is, of course, a hard saying: for the structuring and rewards of university life are built upon high-disciplinary specialization. Perhaps it is up to those who have already won their spurs in a narrow field to venture on more dangerous ground in the attempt to reassemble the scattered fragments of a whole reality. This is not (as Streeten unintentionally implies) ground reserved for economists only.

Apart from this questioning of past performance, there remained one major issue which escaped general discussion. The importance of the price system, as a whole, was constantly stressed—there are many quotations in this summary. But the relation between a "right" price system which, in Little's words, would "scan the otherwise unavailable factual screen, and produce the answers," and the conscious use of planning, including the price mechanism, was barely discussed, save indirectly by Streeten and in a brief comment by Albert Fishlow on Little's paper, in which he observes that the "distortion" of prices in favor of industrialization, though now an object of criticism, reflected an earlier, conscious, and not always unsuccessful determination to make a start on industrialization. In a world where developed countries can still rig markets in their own favor by a wide range of interference with prices of many different kinds, and where less developed countries are struggling, again often by deliberate interference with prices, to elbow their way into a modernized production and trading system, how far is it possible to "get the prices right" in the terms used in several contributions? The Conference was, perhaps, stronger in pointing out the dangers of "distortions" than in defining "right" prices in the present international context.

Diagnosis comes before treatment; but there is some comfort in the frequent emphasis in the Conference on the vital role of institutions and services through which technological advances and structural transformation can be mediated to reach the mass of small farmers. And indeed some comfort is needed; for by common consent the present state of implementation, even of good policies, leaves much to be desired, and the present state of theory even more. Mosher's mainly hortatory prescription for local planning may well go in the right direction; Hunter's charcoal sketch of an interdisciplinary hypothesis needs filling

out with research and professional critique from several disciplines; Thorbecke's admirable conspectus of the state of sectoral analysis frankly admits its present shortcomings, though with a hope of remedy; Young's observations on the contribution of political science—there was no presentation from public administration, formal sociology, or economic anthropology—shows just how much ground remains to be covered.

There were a few other obvious gaps in the Conference—indeed what Conference does not have them? Latin American and Asian situations were far better covered than African; there was little discussion either of mineral-led economic growth (oil, copper, precious metals) in contrast to agricultural societies, or of the causes of the exceptional degree of structural difference between Latin America and both Asia and Africa: we are still far away from satisfactory typologies of development, and, as Beckford remarks, some at least of the most useful studies are those which establish at least one specific type.

These comments may seem to have a negative bias; and this must be corrected in three ways: first, to recognize the value of demolition work to clear the ground for new building—there was plenty of that; second, to weigh fully the many detailed treatments of special topics—taxation, mechanization, secondary effects of agricultural advance, factor prices, land reform—which cannot fail to be useful, both to theory and to practical administration; and third, to record some hints of new directions of thought which may later bear valuable fruit.

Of these new horizons, one may mention first the recognition that more detailed study of the effects of increased farm incomes on the whole ambient rural economy, or crafts, industries, and services, and on "structural transformation" may have much to contribute. Again, the recognition of the vital role of administration, institutions, and services, in relation to the capacities of government to provide them, in relation to political structure and objectives, in relation to farmers' capacity to respond, and in relation to employment and income distribution, has considerable potential. Perhaps also a few studies which stood traditional theory on its head and propounded a theory of agriculture-led economic change as a short-term possibility might provide insights into the problems of income distribution, employment, and resource use which would be highly stimulating. Certainly the general consensus that many LDC economies need both better description and better theoretical analysis in their own terms, and not from a Western reference, cannot fail to be helpful.

Finally, there is perhaps a growing recognition that history did not start in 1947, when "development" came on the agenda. There is, lying largely unused by modern development theory, a mass of history, often by first-rate scholars; there is a rich vein of economic anthropology, containing so much of the data which economic aggregative theory neglects; there are some beginnings of "political economy." Societies did not begin yesterday, and there have been many insights into their differing patterns of growth. We have perhaps neglected to visit often enough the storehouses of scholarship, and, in the struggle to develop the specialized tools of the disciplines, lost sight of the concept of whole societies and their total style of evolution. "Agriculture," which includes the way of life of what is still a majority of the human race, is, above all, an interdisciplinary subject; and there are signs of hope (though as yet little achievement) in the

greater interest in interdisciplinary work. Meanwhile, as this Conference showed, a great deal of specialized work has been done in fitting together isolated pieces of the jigsaw puzzle; but the total scene is not yet clear. Until the center is filled in, it would seem that the "state of the art" is that we hope to be useful to policy-makers and administrators; but we are not always very useful just yet.

CITATIONS

1 M. M. Billings and Arjan Singh, "The Effects of Technology on Farm Productivity in India," *Dev. Digest*, Jan. 1971.

2 Leonard Binder et al., eds., *Crises and Sequences in Political Development* (Princeton, N.J., 1971).

3 S. R. Bose and E. H. Clark, "Some Basic Considerations on Agricultural Mechanization in West Pakistan," *Pakistan Dev. Rev.* (Karachi), Autumn 1969.

4 J. S. Coleman, "The Resurrection of Political Economy," *Mawazo* (Kampala), June 1967.

5 P. N. Dhar and H. F. Lydell, *The Role of Small Enterprises* (Bombay, 1961).

6 D. W. Hopper, "The Role of Agriculture in the World Economy: Discussion," *J. Farm Econ.*, May 1961.

7 S. P. Huntington, *Political Order in Changing Societies* (New Haven, Conn., 1968).

8 Nurul Islam, "Factor Intensities in Manufacturing Industries in Pakistan," *Pakistan Dev. Rev.*, Summer 1970.

9 W. O. Jones, "Measuring the Effectiveness of Agricultural Marketing in Contributing to Economic Development: Some African Examples," *Food Res. Inst. Studies*, IX, 3, 1970.

10 Hiromitsu Kaneda and F. C. Child, "Small-scale Agriculturally Related Industry in the Punjab" (Univ. Calif., Dept. Econ. Working Paper No. 11, Davis, Sept. 1971).

11 T. H. Lee, *Intersectoral Capital Flows in the Economic Development of Taiwan, 1895–1960* (Ithaca, N.Y., 1971).

12 W. Arthur Lewis, *Report on Industrialisation and the Gold Coast* (Accra, 1953).

13 C. T. Leys, *Politicians and Policies* (Nairobi, 1969).

14 I. M. Little, Tibor Scitovsky, and M. F. G. Scott, *Industry and Trade in Some Developing Countries: A Comparative Study* (Dev. Ctr., Org. for Econ. Co-operation [OECD], Oxford, 1970).

15 J. W. Mellor and Uma Jayant Lele, "A Labor Supply Theory of Economic Development" (Cornell Univ., Occas. Paper No. 43, Ithaca, N.Y., 1971).

16 P. M. Raup, "Land Reform and Agricultural Development," in *Agricultural Development and Economic Growth*, ed. by H. M. Southworth and B. J. Johnston (Ithaca, N.Y., 1967).

APPENDIX

CONFERENCE ON STRATEGIES FOR AGRICULTURAL DEVELOPMENT IN THE 1970S

Sponsored by the Food Research Institute on the occasion of its fiftieth anniversary in collaboration with the Agricultural Development Council and the Overseas Development Institute, Stanford University, December 13–16, 1971.

PAPERS PRESENTED*

Randolph Barker, Mahar Mangahas, and William H. Meyers, "The Probable Impact of the Seed-Fertilizer Revolution on Grain Production and on Farm Labor Requirements"; comment by Walter P. Falcon.

Shahid Javed Burki, "Political Economy of Agricultural Development from an Asian Perspective."

William R. Cline, "Interrelationships Between Agricultural Strategy and Rural Income Distribution" [*XII, 2*];† comment by Gerardo Sicat.

Guy Hunter, "Agricultural Administration and Institutions" [*XII, 3*].†

Peter Kilby and Bruce F. Johnston, "The Choice of Agricultural Strategy and the Development of Manufacturing" [*XI, 2*];† comment by Paul G. Clark.

Dudley Kirk, "Prospects for Reducing Birth Rates in Developing Countries: The Interplay of Population and Agricultural Policies" [*XI, 1*].†

Raj Krishna, "Intersectoral Equity and Agricultural Taxation in India." (Presented by John W. Mellor in Krishna's absence.)

Gilbert Levine, "Matching Agricultural Research Priorities with Development Needs"; comment by S. K. DeDatta.

Stephen R. Lewis, Jr., "Agricultural Taxation and Intersectoral Resource Transfers" [*XII, 2*];† comments by T. H. Lee and Claudio Gonzalez-Vega.

Ian M. D. Little, "The Influence of Economic Policy in Less Developed Countries on the Capital Intensity of Investment and the Growth of Employment"; comment by Albert Fishlow.

John W. Mellor and Uma Jayant Lele, "Domestic Markets and the Growth of Farm Cash Income"; comment by C. Peter Timmer.

Arthur T. Mosher, "Planning to Create a Modern Agriculture."

Eric M. Ojala, "Impact of the New Production Possibilities on the Structure of International Trade in Agricultural Products" [*XI, 2*];† comment by George S. Tolley.

Vernon W. Ruttan and Yujiro Hayami, "Strategies for Agricultural Development: The Evolution of Thought"; comment by George L. Beckford [*XI, 2*].†

Leobardo Jiménez Sánchez, "Strategies for Increasing Agricultural Production on Small Holdings: The Puebla Project"; comment by J. G. Kibe.

Peter Schran, "The Organization of Chinese Agriculture."

Erik Thorbecke, "Preparing Sector Programs for Agriculture: Sector Analysis, Models, and Practice" [*XII, 1*].†

Doreen Warriner, "Results of Land Reform in Asian and Latin American Countries"; comment by Dale W. Adams [*XII, 2*].†

M. Crawford Young, "Reflections on the Politics of Agricultural Development."

* Papers not published can be obtained from the Food Research Institute at the cost of photographic reproduction.

† Indicates volume and number of *Food Research Institute Studies* in which this paper or a version of it has been or will be published.

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