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FOOD, HEALTH, AND POPULATION:
POLICY ANALYSIS AND DEVELOPMENT
PRIORITIES IN LOW-INCOME COUNTRIES

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June 1979
WP-79-52

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FOREWORD

Roughly 1.6 billion people, 40 percent of the world's population, live in urban areas today. At the beginning of the last century, the urban population of the world totaled only 25 million. According to recent United Nations estimates, about 3.1 billion people, twice today's urban population, will be living in urban areas by the year 2000.

Scholars and policy makers often disagree when it comes to evaluating the desirability of current rapid rates of urban growth and urbanization in many parts of the globe. Some see this trend as fostering national processes of socioeconomic development, particularly in the poorer and rapidly urbanizing countries of the Third World; whereas others believe the consequences to be largely undesirable and argue that such urban growth should be slowed down.

This paper focuses on the food, health, and population problems of low-income countries: those with a 1976 per capita GNP of \$250 or less. In this subset of developing countries, which account for roughly a third of the world's population, the bulk of the population and labor force are still dependent on agriculture for employment and income. Much of the world's poverty is concentrated in the rural areas of these low-income countries. The design and implementation of agricultural strategies is therefore of central importance in achieving accelerated economic growth and the reduction of poverty. The authors also stress the potential contribution of integrated nutrition, health, and family planning programs in improving the nutritional status and health of the rural population and in reducing fertility levels compatible with sharply reduced mortality rates.

A distinctive feature of the monograph is the explicit attention that is given to "good policy analysis" in the process of designing feasible and effective strategies for promoting rural

development. It is a joint effort by an agricultural economist and a policy analyst. Johnston, on leave from the Food Research Institute at Stanford University, has devoted many years to research on problems of rural development. Clark is a member of the Institute of Resource Ecology at the University of British Columbia. During the past five years he has been involved in major collaborative research projects with IIASA, aimed at advancing the art of policy design through case studies of environmental and resource management. The authors present their own conclusions regarding priorities for rural development. They attach equal importance, however, to their attempt to make the debate on these complex and controversial issues more focused, more realistic, and more productive.

A list of the papers in the Population, Resources, and Growth Series appears at the end of this paper.

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ABSTRACT

This paper presents a policy analysis of rural development strategies in low-income countries.

Governments, development agencies, and scholars are now giving increased attention to structuring and supplementing growth strategies to reduce the most serious deprivations of poverty. The objectives of such strategies are inevitably multiple and conflicting, with any given allocation of development resources incurring a high opportunity cost in terms of activities foregone. Furthermore, the inherent complexities of the issues involved have led to great uncertainty and disagreement regarding the choice of development strategies that are likely to be most effective. Too often, this disagreement has prohibited emergence of even the minimal consensus required for effective action.

No research, however good, will eliminate the uncertainties of development. No models, however comprehensive, will reveal "optimal" strategies for development in the real world. We argue that a systematic analysis of the major components and interactions of a rural development strategy can nonetheless facilitate the ongoing process of development policy design, implementation, and improvement.

The major focus of our analysis is policy-feasibility, not optimality. We seek to define the constraints that determine the rural development objectives that are in fact obtainable with existing resources and organizational skills. We particularly emphasize the dominant constraints imposed by the structural and demographic characteristics of the low-income countries, showing that the concentration of population and poverty in rural areas will continue to be a distinguishing feature of these countries into the next century. Equally important are the interactions of malnutrition, infection, and unregulated fertility which continue to

inflict high mortality and morbidity rates on infants and small children, despite the overall improvements in mortality rates and longevity of recent decades. We also analyze the relationships among various socioeconomic factors, fertility rates, and population growth, and explore their implications for the design of feasible development policies. The lack of consensus required for effective action is especially evident in the case of nutrition-related aspects of development programs. We therefore devote special attention to the interrelationships among food intake, nutrition, and health.

In our view, the essential problem is to strike a suitable balance between production-oriented and consumption-oriented (i.e., redistribution and service) activities in development strategies. Toward this end, we analyze the complementary as well as the competitive relationships between such activities. Based on this analysis, we propose a two-pronged approach emphasizing a broad-based strategy for agricultural development, and an integrated approach to nutrition, health, and family planning services which focuses on inexpensive preventive and promotive activities. We stress the need to focus the debate on these issues through a typology that recognizes the constraints and characteristics of the low-income countries. Finally, we argue that any development strategy is necessarily an experiment. It is essential that we learn *how to learn* from such experiences and from this how to contribute more effectively to a continuing process of adaptive policy design, implementation, and re-design.

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FOOD, HEALTH, AND POPULATION:
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Bruce F. Johnston and William C. Clark

I. INTRODUCTION

A short list of development objectives presently ranking high in most developing countries would include accelerating the growth of output, expanding employment opportunities for a rapidly increasing population of working age, eliminating the most serious manifestations of poverty such as malnutrition and excessive mortality and morbidity, and slowing population growth.

One difficulty in attaining these objectives stems from their interrelatedness. A wide spectrum of policy makers and development specialists recognizes that rapid population growth and unequal income distribution exacerbate the task of reducing poverty in developing countries: but growth of output is emphasized as a necessary if not sufficient condition for success. The current emphasis on satisfying the basic needs of the poor also directs attention to the fact that wellbeing is influenced significantly by the *composition* of output as well as by the growth and distribution of income. For example, Preston (1978, p. 14) has offered evidence demonstrating that "unstructured" economic development is generally inefficient at reducing mortality levels relative to more "structured" development in which a larger fraction of income is directed toward educational expenditure or preventive health measures. Increasing life expectancy, especially by reducing

the wastage of life that results from high rates of infant and child mortality, is clearly an important development objective. But it is equally clear that reduced mortality which is not followed by a reduction in fertility will literally "compound" the problems of poverty through the awesome long-run effects of population growth.

Another difficulty is the extremely limited resources which developing countries can bring to bear on their multitude of problems. The dearth of purchasing power, much less investment potential, implicit in the World Bank's definition of low-income developing countries* poses severe constraints on any programs requiring capital accumulation or income transfers. Perhaps even more important is the lack of entrepreneurial, administrative, analytic, and other skills in any substantial portion of the developing countries' populations. Any decision to do one thing therefore incurs an extremely high opportunity cost in terms of other urgent activities which must be foregone. Policy makers seeking to shape development strategies in the developing countries therefore face the most difficult imaginable forms of "multiple conflicting objective" decision problems (Bell, Keeney, and Raiffa, 1977).

These problems are accentuated by the fact that "the new nations are constantly prodded and preached at by competing politico-ideological mentors" (Harari, 1978, p. 178). As the most recent of many examples, there is now growing pressure from some quarters to adopt a "basic needs strategy" in which "supply management" would somehow insure that the distribution and composition of output would meet the most basic needs of poor families even at very low levels of per capita income (Streeten and Burki, 1978).

The proposals for a "basic needs strategy" are vague however and there is no evidence of an emerging consensus concerning policies and programs to achieve such a restructuring of the distribution and composition of income. Moreover, the advocates of a basic needs strategy have not faced up to the problem of political

*That is, a 1976 per capita GNP of \$250 or less.

constraints. Thus Srinivasan (1977, p. 22) has emphasized that:

.....there is an inherent contradiction in the position adopted by some basic needs proponents. It blames the existing socio-political framework with its vested interests for preventing the poor from sharing in the fruits of development, while at the same time these institutional bottlenecks are assumed to be somehow less relevant for a basic needs strategy.

In concluding his essay on "Development, Poverty, and Basic Needs" Srinivasan declares that

It would be tragic if the serious misunderstanding of the performance of past development strategy leads to the adoption of development policies based on ill-defined concepts such as basic needs, to the detriment of growth.

In his view

.....the only sensible approach is to emphasize growth as in the past, by supplementing (rather than supplanting) the growth strategy with policies toward better distribution of the benefits of growth... (Srinivasan, 1977, p. 26).

More generally, the "prodding and preaching" by competing political mentors has been matched or exceeded by that of the academics and development specialists. The rapid growth of the literature on development problems has accentuated the disagreement concerning the types of development strategies that offer the greatest promise for reducing poverty and related deprivations. Some argue that the decisive factor is economic growth, explicitly or implicitly defined as accelerating the growth of average per capita GNP. This is often linked with the view that policy-induced distortions of relative prices are primarily responsible for unsatisfactory rates of growth of output and employment. Another viewpoint focuses on the adverse effects of rapid population growth, sometimes arguing that this factor has directly reduced the rate of increase in per capita incomes by some 2.5 to 3.5 percent. Adverse effects on economic growth of a high

dependency ratio, reduced savings, a slower rate of increase in capital per worker, and a deteriorating land/man ratio are also stressed. On the other hand, some belittle the importance of rapid population growth, frequently citing the argument by Mandami (1972) that the poor have large families out of economic necessity. Poverty, they suggest, is "merely" a problem of unequal distribution of income--between rich and poor countries and between rich and poor households within developing countries. (A recent example is Rush, et. al., 1978.)

Much of this disagreement is substantive, reflecting the enormous uncertainties and complexities associated with development problems. Some are semantic, or reflect differing implicit assumptions regarding the scope and nature of the issues involved. A certain amount derives from demonstrably faulty analysis and reasoning. But whatever the causes of contemporary disagreement, one consequence is abundantly clear: development decision makers are not benefiting from research and analysis on development problems to nearly the extent possible and desirable.

In a number of comparably messy problem areas, efforts to make research more responsive to actual decision needs have led increasingly to an explicit focus on policy analysis. As a recent editorial in *Science* put it (Morgan, 1978):

Good policy analysis recognizes that physical truth may be poorly or incompletely known. Its objective is to evaluate, order, and structure incomplete knowledge so as to allow decisions to be made with as complete an understanding as possible of the current state of knowledge, its limitations, and its implications. Like good science, good policy analysis does not draw hard conclusions unless they are warranted by unambiguous data or well-founded theoretical insight. Unlike good science, good policy analysis must deal with opinions, preferences, and values, but it does so in ways that are open and explicit and that allow different people, with different opinions and values, to use the same analysis as an aid in making their own decisions.

Policy analysis is thus concerned not so much with particular solutions to problems, but with the design of procedures by which solutions can be shaped in an environment of uncertainty, conflict,

and constraint. It is precisely such procedures which have been so little discussed or utilized in the contemporary development debate.

This monograph represents an initial attempt to apply policy analysis procedures to the design of rural development strategies in low-income countries. We agree with Majone's (1975) argument that preliminary analyses of government programs should concentrate on investigating their *feasibility* in terms of the relevant *constraints* on their adoption and implementation. In his view, most "bad" decisions are decisions that result in failure because the policy adopted was simply not feasible. A major source of failure and frustration in policy design thus stems from the fact that "many otherwise competent and reasonable people tend to equate the desirable with the feasible" (Majone, 1975, p. 50). As we shall make clear in successive chapters, we believe that the contemporary development debate could serve as an archetype for this characterization.

Judgments concerning the feasibility of alternative development strategies will always differ. The following observation by Michael Polyani remains as valid in today's world of formal policy analyses as it was more than a quarter of a century ago:

The existence of social tasks which appear both desirable and feasible and yet are in fact impracticable has set the stage throughout history for a wide range of human conflicts. All the battles of social reform were fought on these grounds, with conservatives often harshly overstating, the progressives recklessly underestimating the limits of manageability. (Quoted in Majone, 1975, p.69).

Nonetheless, we believe that by attempting the critical and systematic evaluation of alternative proposals, policy analysis "can assist the policy maker in the difficult task of deciding which social objectives are in fact attainable at a given time, and with given resources and organizational skills" (Majone, 1975, p. 69). And this is indeed the task facing policy makers in the developing countries today.

We begin our analysis in Chapter II with a treatment of the constraints that derive from development policy posed by the

structural and demographic characteristics of the developing countries. These characteristics have extremely important implications concerning the design of feasible strategies to attain the objectives of growth and reduction of poverty. In particular, it is clear that the concentration of population and poverty in rural areas will continue to be a distinguishing feature of these countries for many decades. The very fact that such a large percentage of their population is and will continue to be rural also means that reducing fertility to levels compatible with sharply reduced death rates will be difficult and time-consuming.

The second sector of Chapter II reviews health-related factors, emphasizing the remarkable progress that has been made in reducing mortality and increasing life expectancy even in the low-income developing countries. At the same time we note that mortality and morbidity among infants and small children are still excessively high. The persistence of serious health problems during this vulnerable period of the first three years of life is shown to be due to the interrelated effects of malnutrition, infection, and unregulated fertility.

Two important policy declarations which have been adopted by the "world community" have focused attention on these problems of malnutrition and ill health.

The World Food Conference held in Rome in 1974 adopted a "universal declaration" calling for "the eradication of hunger and malnutrition" and, with great optimism, fixed 1985 as the target date for reaching that goal (UN, 1975). A parallel resolution concerning health was adopted at the International Conference on Primary Health Care organized by the World Health Organization and the United Nations Children's Fund which was held at Alma-Ata in the USSR in September, 1978. Thus the Declaration of Alma-Ata states that:

A main social target of governments, international organizations and the whole world community in the coming decades should be the attainment by all peoples of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life (WHO, 1978).

Since action so often fails to match the noble rhetoric, it is easy to be cynical about such declarations. Nonetheless, such statements represent a challenge that deserves to be taken seriously. A major obstacle to achieving progress in reducing the nutritional, health, and other deprivations associated with poverty is the lack of a workable consensus concerning the policies and programs that are likely to be both feasible and effective in achieving the multiple objectives of development. Surprisingly, one of the areas in which this consensus has failed to develop involves the much studied relationships among fertility, the rate of natural increase, and various socioeconomic parameters of development. We present some of the relevant evidence in the third section of Chapter II, with a view towards establishing the constraints and opportunities it implies for the design of development strategies.

Inability to reach the degree of consensus required for effective action appears to be especially serious in the case of nutrition and nutrition-related programs. Chapter III accordingly gives particular attention to the interrelationships among food intake, nutrition, and health. We argue that there is emerging agreement concerning the need to give a high priority to strategies designed to foster broadly based agricultural development and to promote widespread improvements in the health of the rural population. The degree of consensus concerning this two-fold emphasis on promoting broadly based agricultural development and on an integrated approach to the delivery of nutrition, health, and family planning services is, however, still limited, and we give particular attention to areas of continuing controversy.

In Chapter IV we develop the major thesis of the monograph that systematic analysis of the major components of a rural development strategy, and of the interactions among those components, can facilitate the inherently difficult task of decision making for multiple objectives. An elementary principle of systems analysis is to limit or bound a problem in order to simplify it "to the point of analytical tractability" while retaining "all vital aspects affected by possible solutions" (Afifi, et al., 1974, p. 341). Hence our focus is on the low-income developing countries

and on the rural population in those countries. Even so, the range of problems to be considered remains extremely large.

To further simplify the analysis, our examination of the interrelationships among the determinants of rural wellbeing in Chapter IV concentrates on the problem of determining an appropriate balance between "production-oriented" and "consumption-oriented" activities in rural areas. The latter are defined to include measures for redistributing current income flows, e.g., through free or subsidized distribution of food, as well as social services such as education and health. We stress that there are important complementary as well as competitive relationships among the various production- and consumption oriented activities that constitute a country's rural development strategy. An attractive feature of integrated programs to improve "family health" in rural areas is the opportunity that they provide for promoting improvements in nutritional status and health while at the same time contributing to a reduction of the high rates of population growth which would otherwise compound the problems of underemployment, land fragmentation, and inadequate social services.

In Chapter V we propose two strategies which appear to merit high priority as governments give increased attention to structuring and supplementing growth strategies in order to reduce the most serious deprivations of poverty.* The first proposition concerns the central importance of a country's agricultural development strategy as it affects not only the rate but also the "pattern" of agricultural development, i.e., the extent to which the great bulk of its farm population is able to participate in gains in productivity and income. The second proposition concerns a rural health strategy utilizing an integrated approach to the delivery of a "package" of nutrition, health, and family planning

*And governments in many developing countries are giving increased attention to the problem of persistent poverty. To cite one recent example, President Daniel Arap Moi's Introduction to Kenya's Development Plan 1979-1983 (Kenya, 1979) states:

Our concern for improvement in the wellbeing of the people is reflected in the theme "alleviation of poverty" which has been given a dominant position in the formulation of strategies and policies contained in this Plan.

and emphasizing inexpensive preventive and promotive activities. We argue that such strategies offer promise of being economically and politically feasible and administratively workable even in the low-income developing countries on which the monograph is focused.

In summarizing our conclusions in Chapter VI, we stress that progress in achieving the multiple objectives of development may be unsatisfactory because policies and programs are focused too narrowly on growth or because decision makers opt for an unrealistically wide range of activities so that plans and pilot projects are not translated into programs which have a significant impact on the mass of the rural population. Owing to the pervasiveness of poverty and the severe resource constraints in the low-income developing countries, there is a particular risk that welfare measures based on redistribution of current income will have only limited impact on their rural population and may on balance affect the rural poor adversely. Srinivasan (1977, p. 21) has stressed the importance of distinguishing between middle-income countries such as Brazil and Mexico where

.....a moderate redistribution of current income flows would be adequate to meet the basic needs of the entire population

and low-income countries such as Bangladesh, India, or Pakistan

.....where even the most radical redistribution feasible will still leave a large section of the population with deficiencies in their consumption of basic needs...

Finally, we develop Hirschman's (1971, pp. 19-20) view that an emphasis on "uniquely correct policies" and "absolute priorities" is bound to be counterproductive. Despite the great amount of research and analysis which has been, is being, and will be done on development issues, a great deal of uncertainty will always remain. We must learn to maximize our learning from the actual experience of development--to learn from our successes and our inevitable failures in a dynamic, adaptive process of development policy design.

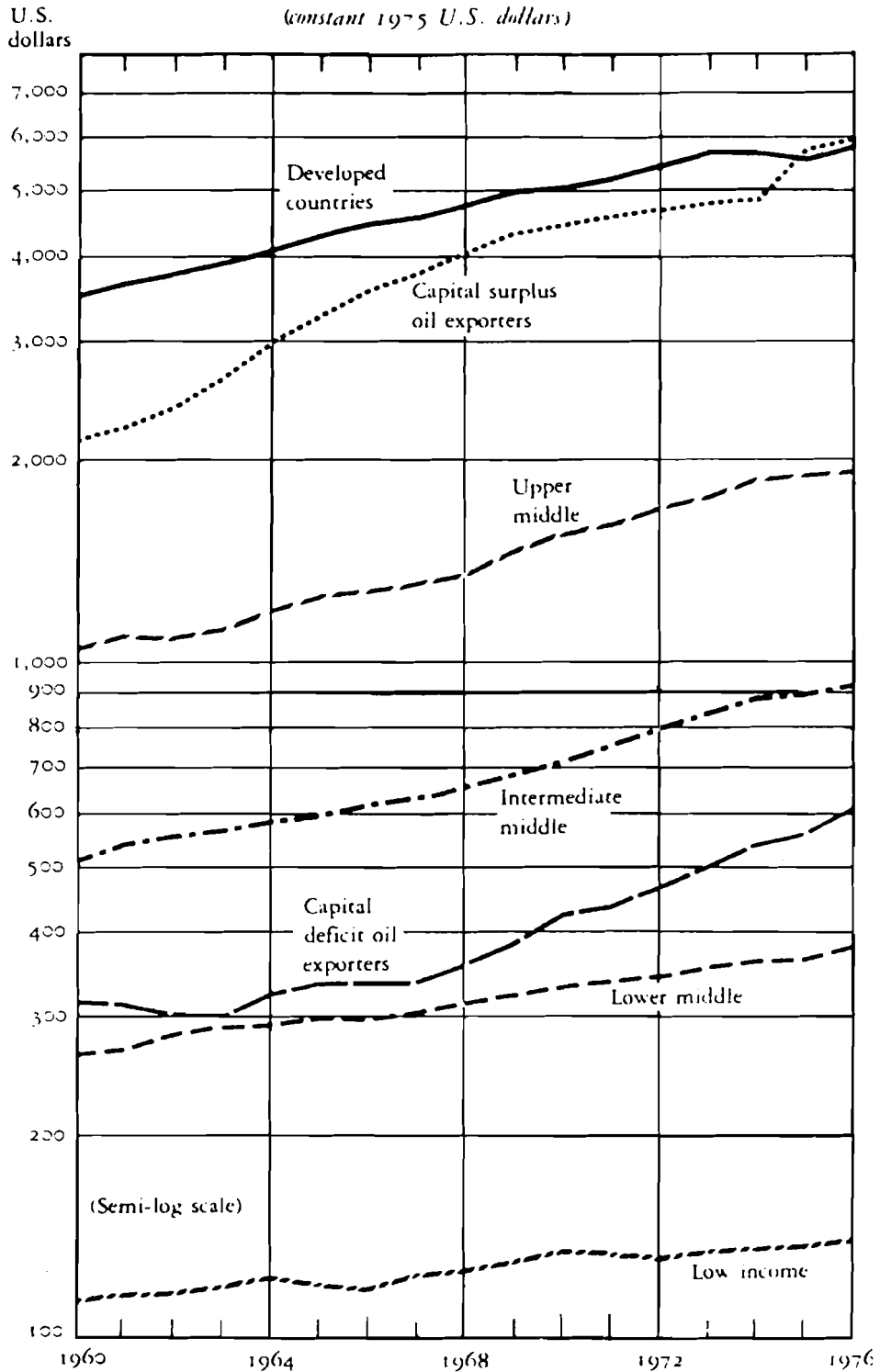
II. STRUCTURAL, DEMOGRAPHIC, AND HEALTH FACTORS IN LOW- AND MIDDLE-INCOME DEVELOPING COUNTRIES

The past two decades have been marked by highly uneven progress among the large and diverse group of developing nations. Figure 1 summarizes the economic growth experience of seven groups of countries. It is apparent that the differences between growth rates of the low-income and other developing countries is greater than that between those other developing countries and the developed ones. This distinction is further emphasized in Table 1. The 10 low-income countries included there account for some 25 percent of the world's population. Moreover, they are representative of the range of variation in income and in other basic indicators that characterizes the 34 countries with 1976 per capita GNP of \$250 or less. The eight middle-income countries in the B panel of Table 1 are a more arbitrary selection, but they give a fair indication of the range of variation in income and other characteristics of the 58 countries in that category.

An important first step in assessing strategies for development in the low-income countries is to consider the implications of these and other features which set them apart from the other developing countries. In this chapter, we highlight some of the most significant characteristics through comparison of their (1) structural and demographic relationships, (2) changes in mortality rates, life expectancy, and morbidity, and (3) changes in fertility and rates of natural increase. Our goal throughout is to establish the fundamental quantities and constraints with which any particular set of development priorities must contend.

Demographic and Structural Features

Of great relevance to the design of strategies for rural development is the structural contrast between low- and middle-income countries that is reflected in the percentage of their labor force still dependent on agriculture for a livelihood. This contrast has important implications with respect to the persistence as well as the current extent of rural poverty.



*Reproduced from World Bank, Development Policy Staff, *Prospects for Developing Countries 1975-85*. Washington, D.C., 1977.

Figure 1. Growth of GNP per capita of Developing Countries 1960-76. Plot is semi-log, so that lines of equal slope represent equal rates of growth.

Table 1. Low-Income and Middle-Income Developing Countries, Basic Indicators for Selected Countries.

A. Low Income Countries	Pop. (millions) mid-1976	G N P p e r c a p i t a		Percentage of Labor Force in Agr.	
		(US dollars) 1976	Av. Ann. Growth (%) 1960-76	1960	1970
1. Ethiopia	28.7	100	1.9	88	84
2. Bangladesh	80.4	110	-0.4	87	86
3. Zaire	25.4	140	1.4	83	79
4. India	620.4	150	1.3	74	69
5. Pakistan	71.3	170	3.1	61	59
6. Tanzania	15.1	180	2.6	89	86
7. Madagascar	9.1	200	-0.1	93	89
8. Sri Lanka	13.8	200	2.0	56	55
9. Indonesia	135.2	240	3.4	75	66
10. Kenya	13.8	240	2.6	86	82
Average for 34 countries		150*	0.9	88	85
B. Middle Income Countries					
1. Nigeria	77.1	380	3.5	71	62
2. Philippines	43.3	410	2.4	61	53
3. Colombia	24.2	630	2.8	51	38
4. Korea, Rep. of	36.0	670	7.3	66	51
5. Costa Rica	2.0	1040	3.4	51	42
6. Taiwan	16.3	1070	6.3	56	37
7. Mexico	62.0	1090	3.0	55	45
8. Brazil	110.0	1140	4.8	52	46
Average for 58 countries		750*	2.8	60	51

Source: World Bank (1978) pp. 76,77,102,103. This source gives estimates for 125 countries with the following breakdown by category: low-income, 34; middle-income, 58; industrialized, 19; capital surplus oil exporter, 3; and centrally planned economies, 11.

*The range is from \$70 to \$250 for the low-income countries and from \$260 to \$3,920 for the middle-income group.

In a number of low-income countries, 70 percent or more of the labor force is still dependent on agriculture; only in Pakistan and Sri Lanka was the share of agriculture less than 60 percent in 1970. The middle-income countries other than Nigeria had all experienced considerably greater structural change even a decade earlier, and the contrast between the two groups of countries was considerably more pronounced by 1970 (Table 1). Of the 24 low-income countries not included in Table 1, only in Benin (with 50 percent) was agriculture's share in the labor force in 1970 less than 60 percent. However, the labor force structure in many of the "lower middle-income" countries is more similar to the low-income category than the more affluent of the middle-income countries. Thus 14 out of 20 middle-income countries with 1976 per capita GDP in the range of \$260 to \$550 still had 60 percent or more of their labor force in agriculture in 1970. But in only five of the 38 middle-income countries with per capita GNP above \$550 was agriculture's share above 60 percent in 1970.

The sources of the contrast in the composition of the work force between low- and middle-income developing countries are many and complex. But this complexity must not obscure the fundamental implications which these demographic-structural relationships pose for future problems and policies of development.

Some divergence in patterns of labor force distribution is to be expected if only because of the way that sectoral growth rates are influenced by the initial weight of each sector in the total labor force. By definition, the rate of growth of a country's labor force depends on the rates of growth of labor force in each sector multiplied by sectoral weights. However, for countries that are still predominantly agricultural, it is of interest to write that identity as though the rate of change of a country's farm labor force (L'_a) is determined as a "residual" which depends on the rates of change of the total labor force (L'_t) and non-agricultural labor force (L'_n) and on agriculture's initial share in the total labor force ($\frac{L_a}{L_t}$).

to show to surprise of... (mirrored text)

of vln... (mirrored text)
La' = (L't - Ln') / (La/Lt + Ln') (1)

the middle-income countries other than Ni... (mirrored text)

even a decade earlier... (mirrored text)

The rationale for writing the identity as in equation (1) with... (mirrored text)

the rate of change in the agricultural workforce (L') as the "de- (mirrored text)

pendent variable" has been set forth elsewhere (Johnston, 1969, (mirrored text)

pp. 67-71) The principal qualification, especially if income- (mirrored text)

earning opportunities in agriculture are severely restricted, is (mirrored text)

that a sizeable fraction of the "residual" workforce will migrate (mirrored text)

to urban slums and eke out an existence in petty trade, by work- (mirrored text)

ing as casual laborers, or in various illicit activities. (mirrored text)

It follows from equation (1) that it is the combination of (mirrored text)

a high rate of growth of the total labor force and the initial (mirrored text)

dominance of agriculture in the total workforce that accounts (mirrored text)

for the fact that the farm labor force and rural population in (mirrored text)

the low-income developing countries have been growing rapidly in (mirrored text)

spite of the very high rates of urban growth experienced by most (mirrored text)

of these countries. On the other hand, except for Nigeria and (mirrored text)

the Philippines, the middle-income countries shown in Table 1 (mirrored text)

have all reached the "turning point" where the absolute size of (mirrored text)

their workforce has begun to decline. (mirrored text)

The influence of differences in agriculture's initial share (mirrored text)

in the labor force on the time required to reach that turning (mirrored text)

point can be illustrated by hypothetical calculations based on (mirrored text)

the simplifying assumption of constant growth rates. For a coun- (mirrored text)

try that has 70 percent of its labor force in agriculture in the (mirrored text)

initial year, associated with growth rates for its total and non- (mirrored text)

agricultural labor force of 2.5 and 4.0 percent respectively, it (mirrored text)

would take 52 years to reach the turning point when its farm work- (mirrored text)

force begins to decline. But if agriculture's share in the total (mirrored text)

labor force in the initial year had already declined to 50 percent (mirrored text)

only 16 years would be required to reach the turning point. It (mirrored text)

is equally apparent from equation (1) that the time required to (mirrored text)

reach the turning point is also sensitive to the rate of growth (mirrored text)

of the total labor force. Thus with 70 percent of the labor force initially dependent on agriculture and with non-agricultural employment increasing at the same 4.0 percent rate, it would require 96 instead of 52 years to reach the turning point if the total labor force were increasing at 3.0 rather than 2.5 percent per year (FAO, 1975, p. 127).

It is inescapable that under even the most optimistic of assumptions, most of the present low-income developing countries will remain predominantly rural societies into the 21st century. Their rural populations are likely to increase more than three-fold before they begin to decline, posing truly staggering problems for the maintenance, much less improvement, of present levels of employment and wellbeing.

Introducing explicit consideration of rural-urban migration and changing fertility rates into the analysis leaves the qualitative character of this conclusion unchanged. Andrei Rogers (1978) has explored the future consequences of various assumptions about changes in mortality, fertility, and migration that yield numerical estimates of the future size, age composition, and spatial (urban-rural) distribution of population. The projections in Table 2 depict the increase in total population and "labor force" (actually the population of working age defined as 15 through 64) over a 50 year period related to his two alternative assumptions with respect to fertility--fertility unchanged and fertility reduced--and his two assumptions about internal migration--migration unchanged and migration increased. The specific assumptions are summarized in the B panel of Table 2.

Inasmuch as the two scenarios with "fertility unchanged" imply an initial rate of natural increase of 3 percent which increases somewhat over the first 30 years as mortality continues to decline and fertility remains at its initial high levels, the projected growth of population by Year 50 is very great indeed. The increase from 1.0 to 6.4 million in Scenario 3, which assumes that unchanged fertility is associated with increased migration, is a little less than the increase to 6.7 million in Scenario 1 where fertility and migration are both unchanged. This is a consequence of Rogers's assumption that the constant rate of natural increase is slightly lower in urban than in rural areas.

Table 2. Alternative Projections of Urban and Rural Population and "Labor Force" Over a 50-Year Period. (Million persons).

A. The Four Scenarios

(1) Fertility and Migration Unchanged	Initial Year		Year 50	
	Population	Labor Force*	Population	Labor Force*
	Urban	.2	Urban	2.0
	Rural	.8	Rural	4.7
	Total	1.0	Total	6.7
(2) Fertility Reduced, Migration Unchanged			Urban	1.0
	Same		Rural	2.3
			Total	3.3
(3) Fertility Unchanged, Migration Increased			Urban	4.2
	Same		Rural	2.2
			Total	6.4
(4) Fertility Reduced, Migration Increased			Urban	2.0
	Same		Rural	1.1
			Total	3.1

B. Rogers' Assumptions Underlying the Four Scenarios

Initial Values:

	Urban	Rural
Death Rate	11/1000	15/1000
Birth Rate	40/1000	45/1000
Outmigration Rate	10/1000	7/1000

Future Paths:

Mortality	Decline over 25 years (urban) and 35 years (rural) to a level with an expectation of life at birth of 70 years; unchanged thereafter
Fertility	In (2) and (4) a reduction of 50% over 20 years (urban) and 30 years (rural); unchanged thereafter
Migration	In (3) and (4) an increase of 500% over 50 years

*The "labor force" is simply the population of working age--15 through 64.

Source: Andrei Rogers (1978) pp. 176-177.

Scenarios 3 and 4 in which the "migration increased" assumption is combined, respectively, with unchanged and reduced fertility result in a very large increase in the degree of urbanization by Year 50 because of the assumption that rural outmigration would increase by 500 percent over the 50-year period. In terms of composition of the "labor force", the rural work force would account for only about a third of the total labor force at the end of 50 years compared to its initial share of 80 percent. Under Scenarios 1 and 2, with the rate of migration unchanged, there is only a small decline to 70 percent in spite of the much more rapid increase in the urban than in the rural labor force. Even in Scenario 2 with reduced fertility there is a 500 percent increase in the urban labor force and a 250 percent increase in the rural work force. It is also worth noting that the 300 percent increase in the total labor force in that scenario is considerably larger than the 230 percent increase in total population, reflecting the fact that there is a substantial lag before a reduced rate of natural increase is reflected fully in a slower rate of growth in the population of working age.

Actual rates of structural change and trajectories of growth of population and labor force are likely to fall somewhere between Rogers's alternative assumptions. But under any realistic set of assumptions it is apparent that the growth of demand for enlarged food supplies merely to keep pace with population growth will be substantial. And the challenge of expanding opportunities for productive rural employment in pace with the growth of the population of working age is perhaps even more formidable. Even with the combination of reduced fertility and greatly increased migration assumed in Scenario 4 there would be a 75 percent increase in the rural workforce. The problem of declining size of farm units and increased landlessness would not be intensified nearly as much as under the less optimistic assumptions of Scenario 2, but would still remain substantial.

It seems most unlikely that the growth of the rural sector can be substantially mitigated by urban growth rates above those used in Rogers's analyses. The investment and other requirements that would be required even to permit the 13-fold increase of urban employment of his Scenario 4 are staggering.

In fact, the rapid urban growth in developing countries during the past 25 years has been associated in most instances with a considerable increase in unemployment and underemployment and "pathological" growth of urban slums. The UN projections shown in Table 3 suggest that even by the year 2000 major cities in a number of countries may reach a size that implies staggering problems of urban management: meeting requirements for water, sanitation, and other services, and coping with problems of poverty in urban slums. Indeed such problems seem so enormous that it is hard to believe that the population of Mexico City, for example, will actually approach 32 million by the year 2000. But given the momentum that characterizes population growth, the main consequence of slower urban growth during the next two decades would be more rapid growth of the rural population. Accelerated growth of towns and smaller cities could also reduce the concentration of population in a single metropolitan area such as Mexico City, and this is obviously one advantage of a more decentralized pattern of industrial growth.

Table 3. Population Estimates and Projections for Selected Cities in Africa, Asia, and Latin America*

City	Population (millions)			Multiple Increase over Base Year	
	1950	1975	2000	1950-1975	1975-2000
Nairobi, Kenya	0.1	0.7	3.4	5.5	4.5
Lagos, Nigeria	0.29	2.1	9.4	7.2	4.6
Jakarta, Indonesia	1.6	5.6	16.9	3.6	3.0
Karachi, Pakistan	1.0	4.5	15.9	4.3	3.6
Mexico City, Mexico	2.9	10.9	31.6	3.8	2.9
Sao Paulo, Brazil	2.4	10.0	26.0	4.1	2.6

* Data from United Nations (1976), pp. 77-83.

Because of the difficulty of finding even precarious sources of income in urban areas, intensified pressure of population on the land in the better endowed and more populous rural areas can be expected to lead to considerable rural-to-rural as well as rural-to-urban migration wherever arable land is available. This applies especially to the countries of tropical Africa, although even there the potential for expanding the area under cultivation has already been reduced considerably (Johnston, 1978, pp. 78-81).

This phenomenon of rural-to-rural migration is strikingly apparent in Machakos District, Kenya, an area just to the east of Nairobi. At the time of the first population census in 1932, almost 90 percent of the district's population was concentrated on 25 percent of the land area where it was about equally divided between "high potential" hill areas with ample and reliable rainfall and the relatively favorable "medium potential" areas which surround the high potential areas. The district-wide growth rate of population increased from about 2.5 percent in the 1932-48 period to 2.8 percent between 1948 and 1963 and to 3.5 percent in the 1963-69 period (which is the current estimate of the population growth rate in Kenya as a whole). However, the rate of population growth has been declining in the high potential areas because of outmigration caused by the increasing pressure of population on the land. But in the less favorable medium potential areas characterized by low and erratic rainfall, the growth of population has greatly exceeded the rate of natural increase. Between 1963 and 1969, immigration in this marginal zone was so large that population grew by nearly 14 percent per year whereas in the high potential zone the rate of growth declined from 2.8 percent in the 1932-48 period to 1.6 percent in the 1963-69 period because the increase in the rate of natural increase was much more than offset by outmigration (Lynam, 1978, Ch. 2).

Although this rural-to-rural migration affords some relief to population pressure in the more productive but densely populated farming areas, the influx of population into marginal areas is magnifying the demands for famine relief on the frequent occasions when the level or distribution of rainfall is more unsatisfactory than usual. The increasing hardship experienced by the

households affected is also accompanied by degradation of the land because of soil erosion which is aggravated by the cutting of trees and shrubs for firewood and for making charcoal, an especially significant source of income in seasons when crops fail. This Kenya example is paralleled by similar problems in the semi-arid areas of many developing countries. The introduction of moisture- and soil-conserving farming techniques and more productive crop varieties could be expected to increase both the level and stability of crop yields in such areas, but there has been relatively little location-specific research directed at evolving technologies adapted to the physical and socioeconomic conditions of semi-arid farming regions in less developed countries. This is, of course, only one of many examples of the dependence of agricultural development on technical as well as economic and institutional factors.

Several general conclusions derived from this analysis of demographic-structural relationships need to be underscored. First of all, even with a tremendous acceleration in rural-urban migration, rural development strategies in the low-income developing countries must take account of the fact that their agricultural population and work force will increase substantially over the next century. More generally, the momentum of population growth in these countries means that the rate of rural-urban migration will mainly affect the relative importance of problems of "hyperurbanization" versus "rural overpopulation" (Rogers, 1978, p. 190). Opting for, or accepting, hyperurbanization cannot be expected to mitigate problems of rural development.

Past experience shows a high correlation between a country's level of economic development and its degree of urbanization, but little or no correlation between development and the rate of urban population growth. It is not surprising that urbanization, i.e., the percentage of the population located in urban areas, is highly correlated with per capita GNP. Urbanization reflects the degree of structural change that has taken place in an economy and the growth of specialization and of functional differentiation among educational and research institutions as well as production units. And this spread of specialization and increasing interdependence

between sectors such as agriculture and industry as well as among individual firms is both cause and effect of rising levels of productivity and output (Johnston and Kilby, 1975, Ch. 2).

Nor is it surprising that there is essentially no correlation between rates of urban growth and rates of growth in per capita GNP (Rogers, 1978, pp. 192-193). For many of today's developing countries, rapid urban growth is to a large extent merely a reflection of rapid growth of the total population (UN Population Division, forthcoming). And a rapid rate of increase in a country's total population will have the effect of slowing the processes of structural change and urbanization as well as hindering the rate of increase in per capita incomes.

Mortality, Life Expectancy, and Morbidity

Mortality, life expectancy, and morbidity characteristics constitute a second dimension along which low and middle-income developing countries are strongly differentiated. To at least as great an extent as the broad structural-demographic considerations discussed in the preceding section, these health-related issues define the special nature, constraints, and extent of development problems in the low-income countries.

A number of demographic and health-related indicators are summarized in Table 4 for the same set of 10 low-income and 8 middle-income countries that were included in Table 1. Virtually all of the 92 countries in those two categories achieved a substantial increase in life expectancy between 1960 and 1975; in percentage terms the 22 percent increase from 36 to 44 years as an average for all of the low-income countries was a bit larger than the increase in life expectancy from 49 to 58 years in the middle-income category. In only 4 of the 28 low-income countries was the reduction in the Crude Death Rate (CDR) less than 10 percent. Of the 10 countries in the A panel of Table 4, the 19 percent decline in the CDR in Ethiopia from 31 to 25 per thousand was the smallest reduction except for Sri Lanka where the CDR was already down to 10 per thousand in 1960. The reduction of CDRs in the middle-income countries from an average level of

Table 4. Demographic and Health Indicators.

A. Low Income Countries*	Crude Birth Rate per Thousand		Crude Death Rate per Thousand		Life Expectancy at Birth		Mortality Rates Infants 0-1	
	1960	1975	1960	1975	1960	1975	1960	1975
Ethiopia	51	49	31	25	34	38
Bangladesh	51	46	25	18	39	42	..	140
Zaire	47	44	25	20	40	44	104	..
India	44	36	21	15	42	50	139	122
Pakistan	49	47	23	16	42	51	142	113
Tanzania	51	47	27	19	37	45	190	..
Madagascar	50	50	27	20	36	44	69	53
Sri Lanka	36	27	10	9	61	68	57	45
Indonesia	47	40	23	17	40	48	82	..
Kenya	49	50	20	15	43	50	..	51
Average for 34 countries	48	47	26	20	36	44		
B. Middle Income Countries*								
Nigeria	50	49	26	22	34	41	207	163
Philippines	45	36	15	10	49	58	85	72
Colombia	45	33	12	8	55	61	100	56
Korea, Rep. of	41	24	13	8	53	61	58	38
Costa Rica	47	29	10	6	61	68	71	38
Taiwan	40	23	7	5	64	71	31	14
Mexico	44	40	10	8	56	63	74	50
Brazil	40	38	11	8	56	61	70	..
Average for 58 countries	45	40	17	12	49	58		

*Listed in order of per capita income per Table 1.

Source: World Bank (1978) pp. 104, 105, 108, 109.

17 per thousand in 1960 to 12 per thousand in 1975 represented a somewhat greater percentage decline than the average drop from 26 to 20 per thousand in the low-income countries.

The changes in mortality and life expectancy have been influenced to a large extent by reduced mortality among infants and small children. There is, however, great variation in the degree to which infant and child mortality rates have been brought down to "acceptable" levels. It will be noted that the estimates of infant mortality in 1975 in the 10 low-income countries range from 140 per thousand in Bangladesh to 45 per thousand in Sri Lanka. Among the middle-income countries the range of variation is truly enormous--from 163 per thousand in Nigeria to only 14 per thousand in Taiwan.* The high figure for Nigeria is not surprising inasmuch as its increase in income is so recent and has been almost entirely the result of rapid expansion of petroleum exports, a development which has still had only limited impact on the great mass of the population.

Changes in negative health indices such as mortality rates do not provide a very satisfactory measure of the health status of a population. Health is difficult to define, and in developing countries "Morbidity data are scarce, poorly standardized, and cannot be quantified..." (WHO, 1976a, p. 10). It is tempting to make inferences about improvements in health and in the "quality of life" on the basis of the evidence that is available concerning reduced mortality. Thus T.W. Schultz (1979, p. 16) has argued: "The increase in the survival rate of children is the most telling indirect evidence... that supports the hypothesis that child quality has been increasing in low-income countries..."

*The statistics available concerning infant mortality are often seriously underestimated and figures for individual countries show a great deal of variation. For example, a 1966 estimate for Madagascar is 102 per thousand compared to the figures of 69 and 53 per thousand for 1960 and 1975 shown in Table 4. Moreover, the 1966 figure was based on a "retrospective survey", an estimation procedure which generally leads to substantial underestimation. In Algeria, for example, infant mortality was estimated at 112 per thousand in 1969 on the basis of retrospective observation whereas an estimate for 1970 based on repeated visit surveys is 145 per thousand. A comparison of the two types of estimates in a number of localities in tropical Africa indicates considerably larger differences. (See Vallin, 1976, pp. 661-2.)

And lower death rates among infants and children mean that parents do not experience the tragic loss of children as frequently as in the past. However, the medical and nutritional scientists who participated in the Ninth Session of the Joint FAO/WHO Expert Committee on Nutrition asserted that in many situations "there is no corresponding improvement in health of the children who survive" so that the gains represented by reduced mortality "are illusory" because "the health and well-being of many of the survivors is at an appallingly low level..." (FAO/WHO, 1976, p. 8). And the fragmentary evidence that is available concerning morbidity and malnutrition among children in developing countries lends support to that view. Thus, according to a recent study in a Guatemalan village, just over half of the 1 to 3 year old children were sick on an average day (Martorell, 1979a). On the basis of anthropometric measurements carried out in conjunction with a series of nutrition surveys in Central America, it has been estimated that 71 percent of children under 5 were malnourished; 3.4 percent were subject to severe Protein-Energy Malnutrition (PEM); 21 percent to moderate PEM, and 47 percent to mild PEM (Martorell, 1979b, p. 6). Survey data, reported in Kenya's development plan for 1979-1983, indicate that 5 percent of all pre-school children are subject to severe PEM and 30 percent to moderate or mild PEM (Kenya, 1979, p. 151). Similar estimates apply to many other developing countries.

Evidence from a number of surveys in Asia, Africa, and Latin America document the fact that the frequency, duration, and severity of infectious diseases and many other health problems are much greater in developing nations than in high-income countries. Moreover, it is clear that the high rates of mortality and morbidity are concentrated among infants and small children and that the main health problems are related to multiple causal factors. Thus the summary view expressed in the Sixth Report of the WHO Expert Committee on Maternal and Child Health is that

the priority health problems of mothers and children are related to the synergistic effects of malnutrition, infection, and unregulated fertility together with poor socio-economic conditions, including scarcity of health and other social services. (WHO, 1976a, p. 10.)

WHO health statistics indicate some reduction in the concentration of mortality among infants and small children between 1960 and 1972. But even for the latter year, it is estimated that mortality among children under 5 years accounted for about half of all deaths in Egypt and Ecuador and close to 40 percent of deaths in all age groups in the Philippines. The concentration might be even greater among low-income countries than in those middle-income countries. In contrast, in Hong Kong the proportion of all deaths accounted for by children under 5 declined from more than 30 percent in 1960 to less than 10 percent in 1972 (WHO, 1976a, p. 83). That dramatic change can no doubt be attributed mainly to a substantial strengthening of health services, rapid increase in per capita income, and a sharp reduction in fertility. (The birth rate declined from 35 to 18 per 1000 between 1960 and 1975.)

A large-scale Inter-American Investigation of Mortality in Children carried out under the auspices of the Pan American Health Organization appears to be the best source of information concerning the causes of infant and child mortality in developing countries. A major finding of that study is that in the 13 Latin American projects analyzed, nutritional deficiency was the underlying or associated cause of death in 52 percent of 33,826 deaths among children under 5 years in the populations studied. (Puffer and Serano, 1973, p. 167).

Studies carried out in Guatemala by the Institute for Nutrition for Central America and Panama (INCAP) provide particularly valuable information concerning the interrelations between diet, infectious disease, and the development and health of children. The problems start with the health and size of mothers. The prevalence of intrauterine infection, which is very much higher in developing countries than in the developed countries, is "among the most important causes of fetal growth retardation in Guatemala and, most likely, in similar areas as well" (Martorell, 1979a, p. 1).

The relationships between the size of mothers and their food intake during pregnancy and the size and survival prospects of infants are also highly significant. Nutrition scientists estimate that the total energy cost of a normal pregnancy is approximately

80,000 calories of which some 36,000 calories represents the fat that should be gained during pregnancy for use during lactation. In a study of rural Guatemalan women it was found that nearly 20 percent of those with calorie supplementation during pregnancy of less than 10,000 calories gave birth to low birth-weight babies, i.e., less than 2.5 kgs, whereas this percentage was less than 10 percent among those with energy supplementation of 20,000 calories or more. The correlation between the height of mothers and the percentage of low birth-weight newborns is also striking. Thus close to a fourth of mothers that measured 141 cm or less had low birth-weight infants compared to a little over 10 percent when the maternal height was 151 cm or more. Furthermore, for the larger group of mothers measuring 148 cm or less, mortality among their newborns averaged 96 per thousand compared to 24 per thousand for newborns of mothers taller than 151 cm. These are striking differences "given that these are all women from poor isolated communities with only subtle variations in socio-economic status" (Martorell, 1979b, p. 5). The strongest correlation is between maternal head circumference and birthweight. Nearly 30 percent of babies born to women with head circumference of less than 50 cm weighed less than 2.5 kgs whereas only about 3 percent of the mothers with head circumference of 53 cm or more had low birth-weight newborns.

Although the linkage between birth-weight and infant mortality in developing countries and the significance of that linkage are well documented. According to the well-known study of the village of Santa Maria Cauque in Guatemala by Mata and his co-workers, 42 percent of the newborns weighed less than 2.5 kgs compared to about 10 percent in the U.S. (Martorell, 1979b; Mata, 1978). The truly dramatic effects of low birth-weight apply to the relatively small percentage of newborns weighing less than 2 kgs. Over half of the babies with birth-weights between 1.5 and 2 kgs died compared to only 2.3 percent of those weighing more than 3 kgs.

The excess risk was much less among the larger fraction of newborns (34 percent of the total) weighing between 2 and 2.5 kgs, but even so infant mortality in that group was three times as high as among newborns weighing more than 3 kgs. Only 10 percent of the Guatemalan babies had birth-weights over 3 kgs compared to 69 percent of newborns in the U.S. (Martorell, 1979b, p. 3).

The high correlation between the head circumference of mothers and the frequency of low birth-weights among newborns directs attention to some of the long-term consequences of malnutrition and illhealth in the first years of life. The effects of malnutrition on growth in stature are most pronounced during the first 2 or 3 years of life. "In the case of head circumference, any retardation would most likely have to occur in the first two years of life" (Martorell, 1979b, p.4). Thus malnutrition and retarded growth in early childhood not only increases the risk of mortality and the prevalence of morbidity, but in the case of girls will also impair their ability to deliver a healthy child.

It is now generally accepted that malnutrition during the first 3 years of life often impairs the mental as well as the physical development of children. In the case of severe malnutrition at an early age, this may well be due to physiological factors. The more persuasive evidence, however, is related to the behavioral consequences of the syndrome of malnutrition, frequent illness, and apathy. A village study carried out in Mexico by Dr. Alfonso Chavez and co-workers at the National Institute of Nutrition matched two groups of children according to the physical and socioeconomic characteristics of their parents. For one group the mothers received a small food supplement during pregnancy and their children were given a small supplement from 5 or 6 months until age 3. The mothers and infants in the control group received no supplement to the normal diet. Carefully trained observers who were well acquainted with the villagers studied the children and families for several days at a time throughout the study period. It was found that the children that received no supplemental food spent more time in the crib and less time exploring their environment. But the children that received supplementary food had a higher level of "cognitive stimulation" both because they were more active and because they demanded and received more interaction from their parents and siblings (Levitsky, 1976).

An encouraging implication of the view that impaired mental development is mainly a consequence of the behavioral effects of malnutrition is that the impairment need not be permanent. A

very comprehensive and interesting study of 7500 families in Colombia from February 1971 to August 1974 examined the effects of integrated health, nutritional, and educational interventions on the cognitive and motor development of experimental and control groups of children. In order to have reference standards for "normal" physical and psychological development that did not depend on foreign standards, a group of children from families of high socioeconomic status was also included. A variety of cognitive measurements were made at intervals to obtain estimates of "general cognitive ability" of experimental groups that were included in the intervention program for either one, two, three, or four periods of nine-months duration. The most important conclusion of the study was "that combined nutritional, health, and educational treatments between 3½ and 7 years of age can prevent large losses of potential cognitive ability, with significantly greater effect the earlier the treatments begin" (McKay et al., 1978, p. 277). A large deficit in cognitive ability was apparent at age 3½ as between the "normal" children from families of high socioeconomic status and those subject to nutritional and other poverty-related deprivations. It seems likely on the basis of the Mexican study mentioned earlier and other evidence that this cognitive deficit among children from poor families could have been reduced significantly by action to improve their nutritional status and health during the critical period from birth to age 3 or 3½.

In a sense the health situation parallels the half-completed demographic revolution that characterizes most of today's developing countries. Largely as a result of a "campaign approach" remarkable progress has been made in reducing mortality and increasing life expectancy. The dramatic reduction of malaria and the virtual eradication of smallpox are two notable examples of ways in which the application of modern public health techniques has reduced the prevalence of certain types of illness and increased life expectancy. Nevertheless, in many countries mortality and morbidity among infants and small children are still shockingly high, especially in the low-income countries and some of the "low-middle-income" countries such as Nigeria, Senegal, or the Philippines.

Further progress in improving the health of these vulnerable groups will require improvements in both the coverage of health programs, and in the integration of services which those programs provide. One knowledgeable health specialist with extensive experience in less developed countries suggests that "Typically, health coverage reaches only 10 to 15 percent of rural populations" (C. Taylor, 1977, p. 79). That estimate may overstate the neglect of rural areas, but there is no doubt that poor access to health services in rural areas is a major factor responsible for the persistence of high rates of infant and child mortality and morbidity.

It is especially important that development programs explicitly recognize that the two-way interactions between malnutrition and infection are particularly significant causal factors responsible for high mortality and morbidity and retarded development among children in low-income countries. On the one hand, there is a good deal of evidence which demonstrates that the body's defence mechanisms against infectious disease are impaired by malnutrition. Of equal importance, however, are the ways in which frequent bouts of diarrhea and other health problems contribute to malnutrition. In part this is a direct result of decreased food intake because of loss of appetite or the cultural practice of withholding food when a child is sick. In addition, infection causes defective absorption of nutrients because of vomiting or malabsorption *per se*. Finally, infection often reduces the availability of protein and other nutrients to a child because of altered metabolism, and in many cases there is loss of iron and other nutrients because of parasitic infestation. Once again, studies carried out by INCAP in Guatemala provide useful documentation of the quantitative significance of the adverse effects of illness on food intake among small children (Martorell, 1979a).

Fertility and Rates of Natural Increase

The rapidly declining mortality rates discussed in the previous section reflect a remarkably successful effort to improve the health and wellbeing of a substantial portion of the world's

population. It is the persistence of high fertility rates in the face of this falling mortality that gives rise to the most striking feature of the last thirty years' demographic experience. These unprecedentedly high rates of natural increase constitute both a major constraint on, and a major target of, feasible development policies in the developing countries. In this section we examine the dimensions of this constraint, and some of the attempts to assess how it might be relaxed through various factors affecting fertility reduction.

Table 5 summarizes some of the relevant data on fertility, rates of natural increase, and their correlates in the developing countries. In the low-income countries the average decline in the Crude Birth Rate (CBR) between 1960 and 1975 was only from 48 to 47 per thousand against a decline from 26 to 20 per thousand in the Crude Death Rate (CDR). Thus the rate of natural increase rose from 2.3 to 2.8 percent. Because the 1960 CDR of 26 per thousand was much below the "traditional" levels of mortality of some 40 to 45 per thousand that had prevailed in many countries until the late 1940s, the 2.3 percent growth rate of population in 1960 was already exceptionally high. In Western Europe, Japan, and most other areas that have passed through the "demographic transition", the rate of natural increase was only about 1.0 to 1.5 percent during their periods of rapid population growth because they experienced a much more gradual decline in mortality.

A noteworthy feature that has emerged during the past 10 to 20 years is the great variation among developing countries in the extent to which fertility had declined. Even among the comparatively homogenous group of low-income countries, the 1960 to 1975 change in fertility ranged from an estimated 15 percent *increase* in Haiti (from 39 to 45 per thousand) to a 25 percent decrease in Sri Lanka (from 36 to 27 per thousand).

Fertility levels are influenced by numerous biological factors, e.g., the extent to which conception is reduced by postpartum amenorrhea, as well as the attitudinal and societal factors which determine both the motivation to practice family planning and the knowledge of and access to effective contraceptive methods. It is, therefore, not surprising that Cassen (1978 a, p. 332), in

Table 5. Birth rates, death rates, and related statistics in various groups of countries, and in individual countries with significant declines in natural increase rates.^a

Country/Group Average	1960		1975		1960-1975 Change in Natural Increase (% Points) (5)	1975 Infant Mortality (Per 1000) (6)	1974 Adult Literacy Rate (%) (7)	1976 Per Capita GNP (U.S. Dollars) (8)	Agriculture's Share in Labor Force 1960 (%) (9)	% of National Income Received by Lowest 20% (10)	Family Planning Effort (11)
	CBR (1)	CDR (2)	CBR (3)	CDR (4)							
Average of 34 Low-Income Countries	48	26	47	20	+0.5	122	23	150	88		
Average of 58 Middle-Income Countries	45	17	40	12	0.0	46	63	750	60		
Average of 11 Centrally Planned Economies ^c	24	10	18	9	-0.5	n.a.	n.a.	2,280	48		
Average of 12 Countries with significant declines ^d	41	11	28	8	-1.0	43	82	1,129	46	5.1	
Sri Lanka	36	10	27	9	-0.8	45	78	200	56	7.0	M
Colombia	45	12	33	8	-0.8	56	74	630	51	4.0	M
Korea, Rep. of	41	13	24	8	-1.2	38	92	670	66	10.0	S
Tunisia	47	19	34	13	-0.7	63	55	840	57	n.a.	M
Costa Rica	47	10	29	6	-1.2	38	89	1,040	51	5.0	S
Chile	37	12	23	8	-1.0	79	90	1,050	30	5.0	M
Taiwan	40	7	23	5	-1.5	14	82	1,070	56	n.a.	S
Jamaica	39	10	30	7	-0.6	20	86	1,070	39	n.a. ^e	S
Panama	41	10	31	7	-0.7	36	82	1,310	51	3.0	M
Trinidad & Tobago	38	9	23	6	-1.2	38	90	2,240	22	n.a.	M
Venezuela	46	10	37	7	-0.6	46 ^f	82	2,570	35	2.0	W
Cuba	33	9	21	6	-0.9			860	39	n.a.	M

Source: World Bank (1978: 76,66,102-105, 108-111); except for column (10) which was taken from World Bank (1976: 515, 517) and (11) from Cassen (1978).

Table 5 Notes:

^a A CBR decline which exceeded the CDR decline by more than 5 per 1000 is arbitrarily defined as "significant".

^b Family planning effort is based on a classification of countries by Lapham and Mauldin (1972), where S = Strong, M = Medium, W = Weak.

^c In the Soviet Union and Poland, the CBRs declined from 24 to 18, and their CDRs remained constant at 8 and 9 per 1000 respectively. However, as industrialized countries which already had low rates of natural increase in 1960, their inclusion did not seem warranted. According to the estimates for China, included in this source, the rate of natural increase had already declined to 1.5 percent in 1960. The estimated reduction in the CDR, from 16 to 9 per 1000 between 1960 and 1975, slightly exceeded the estimated decline in the CBR from 31 to 26.

^d Hongkong and Singapore with declines of 1.5 and 1.7 percent respectively, in their rates of natural increase, are excluded because of their predominantly urban character.

^e Estimated at 2 percent for 1960.

^f The source gives no estimates for infant mortality in Cuba but reports that in 1960 the population per physician was only 1,200 compared to the 1960 estimates of 3,050 and 37,000 for the middle-income and low-income categories.

an excellent review of "Current Trends in Population Change and Their Causes", reports that "Despite the great intensification of research in the last decade, the factors influencing levels of and changes in fertility remain elusive". The determinants of changes in a country's rate of natural increase are even more complex inasmuch as those changes also depend upon changes in mortality rates. Whereas the rate of natural increase in the low-income developing countries rose by 0.5 percent between 1960 and 1975, the average rate of natural increase in the middle-income countries remained constant at 2.8 percent because the decline in the CBR from 40 to 45 per thousand was exactly offset by a decline in the CDR from 17 to 12 thousand.

In an effort to explore some of these complex determinants of natural increase rates we have also listed in Table 5 several characteristics of those countries which achieved "significant" declines in population growth over the period 1960 to 1975. The somewhat arbitrary criterion for inclusion was that the total decline in CBR exceed the total decline in CDR by more than 5 per thousand. Hongkong and Singapore also qualified by that test of "significance", but they are of less interest and are omitted from the table because their populations are so overwhelmingly urban. China did not qualify for inclusion because, according

to the World Bank estimates on which Table 5 is based, the 1960 to 1975 decline in its CDR from 16 to 9 per thousand slightly exceeded the estimated reduction in the CBR from 31 to 26 per thousand. Given the low level of mortality that has now been reached in China, it seems virtually certain that the further reductions in fertility that are to be expected will be considerably larger than future declines in the death rate.

Although all of the countries listed in Table 5 appear to have entered the second phase of the demographic transition with fertility declining toward sharply reduced levels of mortality, they show great variation with respect to the other characteristics summarized in the table. The greatest variation is in annual per capita income (Col. 8) which ranges from \$200 in Sri Lanka (the only low-income country in the table) to over \$2,500 in Venezuela. The fragmentary evidence on income distribution in Column (11) shows enormous variation. In the petroleum producing countries of Venezuela and Trinidad, the bottom 20 percent of the population received only 2 or 3 percent of the total national income whereas in Korea the bottom 20 percent received 10 percent of the total. Infant mortality rates also vary widely and, on average, do not differ significantly from those of the middle-income developing countries. Sri Lanka's rate at 45 per thousand was indeed much below the average of the low-income category. But in Columbia, Tunisia, and Chile the estimated infant mortality rate was above the average for middle-income countries.

The estimates pertaining to adult literacy, and family planning effort show somewhat greater similarity and tend to some extent to distinguish the countries in Table 5 from the more typical low- and middle-income countries. Agriculture's average share in the labor force in 1960 fell well below the value for developing countries as a whole. Variation among individual countries remains substantial however, ranging from only 22 percent in Trinidad and 30 percent in Chile to 66 percent in Korea. Korea, however, was the only country where the percentage of the labor force in agriculture was above the average for the 58 middle-income countries. And Sri Lanka's share at 56 percent was much below the average for the low-income countries.

In the case of adult literacy, Sri Lanka is again greatly above the group average for low-income countries, and only Tunisia among the middle-income countries had an adult literacy rate below the average for that category. Finally, it will be noted that all of the countries had family planning programs rated as "strong" or "moderate" with the exception of Venezuela where the program was rated as "weak". In contrast, among 93 countries classified according to their family planning effort, over 70 percent had no programs at all or weak programs (Tsui and Bogue, 1978, p. 22).

The same general trends, and the same lack of definitive relationships emerge from studies designed to elucidate factors affecting fertility *per se*. We make no effort here to review the voluminous literature on that subject, but three recent empirical studies merit attention.

The most recent study is an analysis based on changes in Total Fertility Rates (TFRs) between 1968 and 1975 (Tsui and Bogue, 1978). Changes in a country's BDR, CDR, and the rate of natural increase are, of course, influenced by changes in the age composition of the population. TFR is free of that distortion because it is defined as the number of children a woman would have had throughout her childbearing years if she experienced the age-specific fertility rates of all women in that population during the year to which the TFR estimate pertains. There are, however, serious data problems in estimating TFRs for developing countries, and a number of the estimates by Tsui and Bogue and their associates at the Community and Family Study Center at the University of Chicago appear to overstate the decline in TFRs between 1968 and 1975. They estimate, for example, that in Kenya the TFR declined from 7.7 in 1968 to 6.6 in 1975 whereas most estimates suggest little or no decline in fertility in Kenya (Casen, 1978a, p. 336). They use several approaches to examining the relationship between changes in TFRs and a number of socioeconomic indicators. Among those indicators, a country's infant mortality rate and literacy (or some other measure of education) tend to be most significant for all countries and for each of the developing regions.

Tsui and Bogue place principal emphasis on the fact that their estimated correlations and regression coefficients suggest that a country's family planning effort has an independent and highly significant influence on the reduction in TFRs (Tsui and Bogue, 1978, pp. 23, 31). However, as Demeny (1979) has pointed out, there are no cogent reasons for inferring causation from this statistical correlation. In fact, Demeny believes that it is more plausible to argue that countries where there is relatively strong demand for fertility control because of the effects of socioeconomic change on attitudes toward family size will also be the countries that demand strong family planning programs. We find it difficult, however, to reject the view that family planning programs have a "causal" effect at least in the sense that effective spread of information and easy access to reliable contraceptives will, *ceteris paribus*, mean a more rapid decline in fertility. Moreover, the recent evidence which points to rapid declines in fertility in Mexico and Indonesia following an abrupt change in government policy from pro-natalist to vigorously anti-natalist seems to clearly imply that "program effect" has had a significant effect on fertility (Nagel, 1978; Hull et al, 1977).

Studies of the relationships between fertility and per capita income have often failed to demonstrate any clear and consistent relationship. It has often been suggested that this relationship is influenced by the distribution as well as the level of income since the changes in attitudes and motivation which influence decisions about family size are not likely to occur unless families are actively involved in socioeconomic change. Unfortunately, the hypothesis has rarely been tested because of the lack of data about income distribution. However, a regression analysis by Yotopoulos (1977, p. 19) in which the Total Fertility Rate in a set of 66 developed and less developed countries is regressed on both per capita income and an index of the "evenness" of income reveals a strong negative relationship between the dependent variable and both independent variables. Support for the view that a relatively equal distribution of income contributes to fertility reduction has also been provided by earlier studies by Bhattacharyya (1975) and Kocher (1973) which report on inter-country comparisons which indicate that reaching a given level of per

capita income is more likely to lead to a reduction of fertility when the distribution of income is relatively equal.

It is also worth noting that the "pattern" of development in 5 of the 12 countries included in Table 5--Sri Lanka, Korea, Costa Rica, Taiwan, and Cuba--has permitted unusually widespread participation in gains in income and broad coverage in terms of access to health services. And in the first four countries more than half of the labor force was still dependent on agriculture in 1960. It is suggested in Chapter V that broadly based strategies for agricultural development as illustrated by Taiwan, may well be especially propitious for fostering the attitudinal changes that facilitate a slowing of population growth.

Finally, reference should be made to a major study by Mauldin and Berelson (1978a) of the factors associated with fertility decline. In a provocative critique of that study, Dixon (1978) has raised some challenging questions, and the replies by Mauldin and Berelson to two of those questions are highly relevant to this monograph.

Their answer to the question whether family planning effort is more important than socioeconomic conditions in inducing fertility decline is: "probably not". They reiterate their belief that family planning programs have a significant, independent effect additional to the effect of socioeconomic factors, but they particularly stress their view that the best results are obtained when the two are combined.

In response to Dixon's question concerning the type of social setting that is most conducive to fertility decline, Mauldin and Berelson (1978b, p. 288) emphasize that "health and education seem to be of particular importance". However, they go on to suggest that "better questions are: what 'restructuring' of development would achieve the developmental goal and at the same time achieve more fertility reduction in the process, and how is to be brought about given the political, economic, and cultural realities of the matter?"

We strongly concur in this view. In Chapters IV and V we expand on it to explore the interactions among the production- and consumption-oriented activities that constitute a country's rural

development strategy and to consider their effects on the inter-related objectives of accelerating growth, expanding employment opportunities, reducing poverty, and slowing population growth.

The analyses of this chapter provide the framework of structural, demographic, and health considerations and constraints within which that exploration is carried out. In summary, the following conclusions seem particularly germane:

- (1) Most of the low-income countries will remain predominantly rural well into the next century. Two and more-fold increases in the rural population during this period will pose tremendous demands on agriculture and for the creation of productive rural employment.
- (2) Impressive reductions in mortality have not been paralleled by increases in the health of the survivors. Small children and mothers are especially prone to excessive morbidity. The contributing factors are complex and synergistic: any marked improvement is likely to require simultaneous advances in nutrition, sanitation, and the delivery of basic health services.
- (3) Persistent high rates of fertility, coupled with falling mortality rates threaten the low-income developing countries with crippling population growth rates. Many factors correlate with fertility reduction in the few countries which have significantly reduced their growth rates, but no firm causal linkages have emerged. There is, however, general agreement that integrated strategies for development and fertility reduction are most effective. The key question for development policy is how such strategies can best be designed and implemented.

III. FOOD, NUTRITION, AND HEALTH IN RURAL DEVELOPMENT STRATEGIES

The previous Chapter attempted to define the demographic and structural dimensions of the development problem faced by low-income countries. It highlighted the rural component of those problems and focussed particularly on the need for broad-based efforts to improve the health of small children and mothers. In this Chapter we discuss questions of food production and nutrition as they bear on those development needs. We begin by reviewing past efforts to bring food and nutrition considerations together in effective development strategies. Next, we outline what appear to be some emerging areas of recent consensus. Finally, we discuss some of the more important issues of continuing controversy. It is upon this background of structural-demographic constraints and the contemporary policy debate that we will base our own proposals for development policy design in Chapters IV and V.

On the Multiple Determinants of Rural Wellbeing

Although there is now general recognition that malnutrition and ill-health represent especially serious and widespread deprivations in developing countries, there is a large gap between stated goals and actual achievement. To a considerable extent this seems to be a consequence of the failure to develop an overview of the development problem *per se*, and an appreciation of the relation of particular programs, policies, and considerations to the problem as a whole.

An interesting report on the *Application of Systems Analysis to Health Management* (WHO, 1976b) contains one of the few attempts in the literature to take a comprehensive view of the determinants of rural wellbeing. Figure 2 is a truncated version of a diagram included in that report. The main purpose of the diagram was to illustrate the need to consider a hierarchy of goals in health planning, including the "related policy objectives" shown in Figure 2 and also specific "strategic" and "operational" objectives which are not shown. In this view of the broad policy objective of upgrading rural wellbeing, activities directed at increasing agricultural incomes, improving rural education, and reducing the health problems of the rural population are viewed as three parallel objectives.

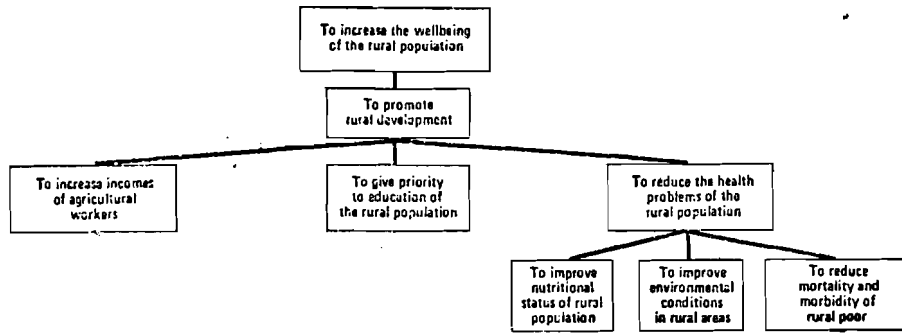


Figure 2.

Source: WHO (1976b), p. 26.

The design of effective strategies to promote improvements in rural wellbeing must, however, consider explicitly the inter-relationships among various components of rural development strategies. The relationship between rural education and agricultural research is one interesting example of the importance of such interactions. Since the early 1960s, two major but essentially separate themes of the agricultural development literature have stressed the importance of improving rural education and of strengthening agricultural research. A number of empirical studies have provided impressive evidence concerning the extremely high returns that can be obtained from investments in agricultural research.* The evidence from empirical studies of the returns to investments in education is mixed. A number of studies report statistically significant positive effects of education on farm production, but according to several of the studies in developing countries the level of education appears to have little or no impact on the productivity of farmers.

* See especially Boyce and Evenson, 1975. Hertford and Schmitz have pointed to factors that may have led to some overestimation of the returns to research, but their general conclusion is that the estimates have not been "grossly inflated. The evidence in this regard appears to be overwhelming: agricultural research does pay handsome rewards indeed". (Hertford and Schmitz, 1977, p.162)

The interactions between investments in agricultural research and in education are stressed in an exceptionally acute analysis and review of the evidence concerning returns to investments in education as they affect the pace of technical change and increases in the productivity and incomes of farmers. Welch (1978, p. 260) does not assume that "education is productive independently of other factors" but rather that it enhances the ability of farmers to learn and to make judgments concerning alternatives. Hence, it is not surprising that in situations where research programs are generating new production possibilities there are significant returns to education whereas in stagnant agricultural environments, where locally adapted technical innovations are not available, farmers' education seems to have little effect on agricultural productivity. This example, concerning the interactions between research and education, emphasizes that the critical problem in designing effective rural development strategies is to establish and maintain an "effective" balance among the various components of such strategies.

Food, Nutrition, and Health

The relationship between production-oriented measures that influence the level and distribution of food supplies and direct interventions to improve health call for special attention. In the extreme case, it is obvious that interventions aimed at directly improving nutritional status and health cannot be expected to achieve very much if the level of food intake is grossly inadequate because of serious food shortages. That relationship is all too apparent in the sharp increases in mortality that have been associated with two recent food crises in Bangladesh. An increase in postneonatal infant mortality in Matlab Thana, the rural district where the Cholera Research Laboratory has been collecting quite accurate vital statistics, increased from 48 per thousand live births in 1973-74 to 92 per thousand in 1974-75 when flood damage caused a severe food crisis (Chowdhury and Chen, 1977, p. 52).

There are a few nutritional problems related to a deficiency of a specific nutrient that can be corrected by a direct intervention. The prevention of goiter through the addition of potassium iodide or iodate to salt is the classic example of such an intervention which can yield large benefits at small cost and without any change in the level of food intake. Deficiencies of vitamin A, which quite often lead to blindness among children, and nutritional anemias are widespread and serious problems in many less developed countries. There are probably situations in which programs for distributing high potency vitamin A capsules or iron and folate tablets to vulnerable groups represent a cost-effective intervention. On the other hand, a cogent argument can be made that in rural areas a more self-reliant approach should be followed which emphasizes increased production and consumption of leafy green vegetables, the leaves of certain fast-growing trees, and hardy fruit trees such as papaya.* Green leaves have the advantage of being a good source of calcium and certain other essential nutrients in addition to vitamin A and iron, and increased production and consumption of such items can be promoted by local initiative at the village level.

There is now a consensus that the potential benefits to be realized from programs to increase the intake of one or a few nutrients is rather limited. This is a marked change from the situation in the late 1960s when it was widely believed that a "protein gap" represented the most serious nutritional problem in developing countries. That view encouraged an excessive preoccupation with direct action to increase protein intake by promoting the distribution of high protein foods such as fish protein

*In the Philippines considerable success has been achieved in promoting the drumstick tree which provides a cheap, year-around source of supply of green leaves to be used as a spinach. A fairly large-scale pilot project in the Philippines known as "Project Compassion" has given considerable attention to promoting kitchen gardens as part of an integrated approach to fostering improvements in nutrition and health and adoption of family planning. The emphasis is on assisting local communities to identify problems and to utilize local resources to achieve targets that are adopted for objectives such as reducing malnutrition, improving environmental sanitation, and slowing population growth. District-level and village nurseries that produce seeds and seedlings for the kitchen gardens appear to have been quite successful in increasing production of leafy green vegetables and the planting of drumstick trees.

concentrate and special products such as Vitasoy or Incaparina, and by the genetic manipulation of staple foods in order to increase the quantity, and/or quality of their protein content. At one time the U.S. Agency of International Development actually created a separate office specifically for the promotion of fish protein concentrate. Even now a good many agricultural scientists place considerable emphasis on the objective of altering protein content in plant breeding programs for maize and other cereals.

Since the early 1970s there has been fairly general agreement among nutrition scientists that the "protein gap" view of the world food problem was based on an inaccurate diagnosis of the causal factors responsible for Protein-Calorie Malnutrition or Protein-Energy Malnutrition (PEM) as it is now more commonly labeled. There are areas where emphasis on a "protein gap" is valid. This applies particularly to parts of tropical Africa where the population relies heavily on staples such as cassava or bananas, which are exceptionally poor sources of protein both quantitatively and qualitatively. In such areas protein deficiencies are often serious even though the local diets provide an adequate energy intake. In the more common situation, however, protein deficiencies are related to inefficient utilization of dietary protein because of the inadequate intake of energy. The body's requirement for energy tends to take precedence over other nutritional needs so that a part of the dietary protein will be "burned" for energy and therefore will not be available to perform its distinctive functions in supporting growth, tissue repair, etc. Thus efforts to increase protein intake by the special measures mentioned above or by expanded production of meat and other livestock products do not warrant the high priority which they received in the late 1960s. On the other hand, this view of the major nutritional problem emphasizes the great importance of action to increase the level and reliability of yields and output of rice, wheat, maize, and other cereals. In commenting on this key issue, the nutritional scientists responsible for the preparation of the FAO/WHO report on *Food and Nutrition Strategies in National Development* emphasized "that a great deal of malnutrition due to inadequate intake of protein as well as

to vitamin and mineral deficiencies, still exists in the world" but that "in most cases these deficiencies are the result of inadequate intake of *food*, being thus unavoidably associated with inadequate intakes of energy" (FAO/WHO, 1976, p. 33).*

A few nutritionists have argued that even an emphasis on efforts to increase productivity and output of beans and other pulses is misplaced because of the need to give priority to increasing the energy intake of poor households. However, the protein in pulses effectively complements the protein in cereals because the limiting amino acids in the two food groups are different. It is also significant that beans are very good sources of calcium, iron, and the B vitamins. At the present time there would probably be general acceptance of the statement that "A diet based on appropriate proportions of cereals, legumes, green vegetables, oils, and a small quantity of food of animal origin will supply all physiological needs" (FAO/WHO, 1976, p. 34). The Committee did note that "animal products are good sources of a variety of essential vitamins and minerals, as well as protein and fat, and nutritional adequacy is more easily achieved if the diet includes at least small amounts of those foods."** But it was also stressed that the diet pattern in the developed countries "has no unique advantage for the health and nutritional status of man" and that there is in fact a need to discourage the increase in effective demand for animal fats and refined sugars that has typically accompanied socioeconomic development. Increased knowledge

*The term malnutrition is used in this paper to refer to "an impairment of the state of health due to nutritional causes" (Morgen, 1978, p. 103). Sometimes a distinction is made between malnutrition and undernutrition, the latter referring to an insufficiency of energy intake. But because of the interactions between the quality and quantity of dietary intake that generally characterize Energy-Protein Malnutrition, it is now more usual for nutritionists to use the term to describe quantitative as well as qualitative deficiencies. Malnutrition, in this sense of "bad nutrition", also embraces "overnutrition" leading to obesity which may contribute to diabetes, heart disease, and other health problems.

**Meeting the need for vitamin B-12 requires either that the diet include at least some food of animal origin or a food of vegetable origin (such as *tempeh* or *miso*, soy-based products important in Indonesia and Japan) prepared by a process involving selected bacterial or mould systems.

about the dietary factors that increase the risk of heart disease, stroke, and cancer has also led to an emphasis on increased consumption of whole grain cereals and other foods with a high fiber content (Farquhar, 1978, Ch. 6).

This recognition that Protein-Energy Malnutrition is the most widespread and serious nutritional problem in developing countries underscores the central importance of improving levels of food intake. The per capita availability of calories in most developing countries is only marginally adequate. According to recent FAO estimates, the number of persons in developing countries consuming less than a "critical minimum energy intake" increased from 400 million in 1969-71 to over 450 million in 1972-74 (FAO, 1977, p. 53). In a World Bank monograph, Reutlinger and Selowsky estimate that 840 million persons had "calorie-deficient diets" in the mid-1960s, and a later publication using their methodology estimates that 1.3 billion persons were "underfed" in 1975 (Reutlinger and Selowsky, 1976, p. 2; IFPRI, 1977a, p. 16). The differences between those alternative estimates illustrate the difficulties of quantification which stem from conceptual problems as well as serious data deficiencies. The most important conclusion is that Protein-Energy Malnutrition and deficiencies of vitamin A, iron, and other essential nutrients are widespread problems which adversely affect the quality of life of many individuals and often impair their ability to learn and to work productively.* There is a danger, however, that techniques which overestimate the magnitude of malnutrition will encourage a sense of despair rather than support for effective action to reduce nutritional and other serious deprivations (Sukhatme, 1977

*There is a need for better understanding of the functional significance of various types and degrees of malnutrition, but there is no doubt that nutritional deprivation represents an especially serious manifestation of poverty.

p. 19).^{*} There is, of course, a high correlation between food intake and income so that malnutrition tends to be concentrated in the low-income segments of a country's population.

Given the fact that even the *average* per capita availability of food is so marginal in most of the developing countries, it is a matter of great concern that there has been such limited progress in improving per capita food supplies in the developing countries. It is apparent from Figure 3 that in the period since 1961 - 65 total food production increased more rapidly in the developing countries than in the developed countries. Moreover, the 3.3 percent rate of increase in food production in the developing market economies during the 1960s was appreciably higher than the 2.6 percent annual growth in population. During the years 1970 - 76, however, the average rate of increase in food production was only marginally higher than the 2.6 percent rate of population growth so that per capita output increased by only 0.2 percent. Furthermore, in the "most seriously affected" countries, i.e., those identified by the United Nations' system as having been affected most adversely by the food shortages and sharp increases in agricultural, petroleum, and fertilizer prices during the 1972 - 74 period, there was an annual decrease in per capita food production of some 0.4 percent (FAO, 1977, p. 4). The existence of serious malnutrition in the poorest segments of a country's population can be viewed as a distributional problem. But in the low-income developing countries poverty is such a huge and pervasive problem that even if it were politically and administratively feasible to alleviate nutrition deprivations in the

*The essential feature of the Reutlinger-Selowsky methodology is to estimate the variation in calorie intake associated with income and to assume that all persons with consumption below the estimated average calorie requirement have intakes below individual energy requirements. P. V. Sukhatme (1977) has pointed out that this simplifying assumption leads to a substantial overestimate. On the basis of his very considerable knowledge of India's food economy, Sukhatme suggests that if allowance were made for variations in individual calorie requirements the estimated incidence of calorie-deficient diets in India might be reduced from about 40 to 15 percent in rural areas and from about 50 to 25 percent in urban areas (Sukhatme, 1977, p. 16).

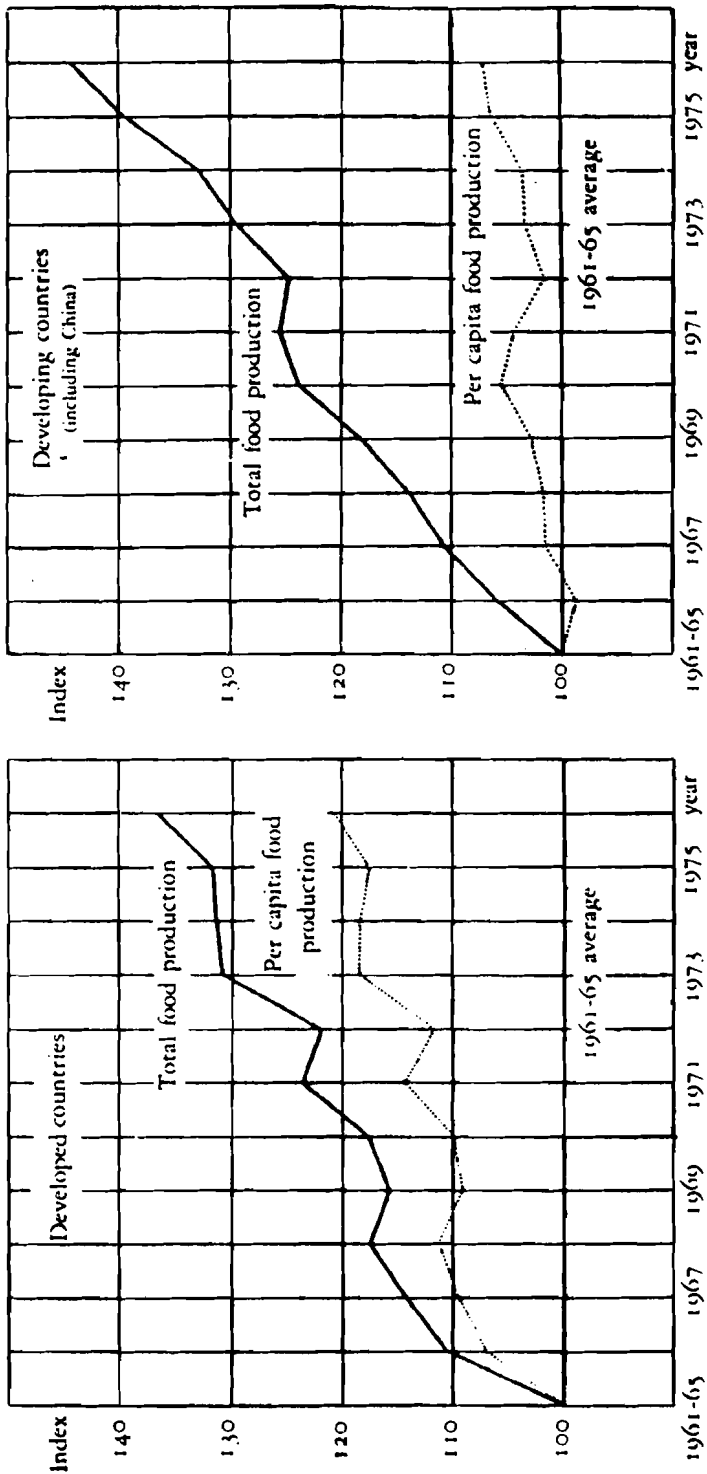


Figure 3. Total and per capita food production in Developed and Developing Countries, 1961-65 to 1976*

*Reproduced from Food and Agriculture Organization of the United Nations (1977), p. 5.

immediate future by redistributive measures, there remains a need to achieve rapid growth of agricultural production simply to keep pace with population growth. Moreover, to the extent that development leads to widespread increases in productivity and incomes, the growth of effective demand for food will be considerably greater than the rate of population growth because of the relatively high income elasticity of demand for food among low-income households.

Projections of food output and consumption by the International Food Policy Research Institute (IFPRI, 1977b) indicate that the shortfall in food production in the Developing Market Economies will increase from 37 million metric tons in 1975 to 120 - 145 million metric tons in 1990. Population growth alone will account for some 70 million tons of the projected deficit in 1990. An additional 50 million tons would be required to satisfy effective demand with slow growth in incomes whereas the additional quantity required to meet market demand would approximate 75 million tons with higher rates of growth of per capita income. For the low-income developing countries which have the most serious food deficits and nutritional problems, food production would have to grow at 4.5 to 4.6 percent per year to overcome existing energy deficits and to meet the growth in demand associated with population growth and modest increases in per capita income. These required growth rates are a third higher than those obtained over the last two decades. The low-income developing countries thus face a formidable task in achieving a rate of growth of agricultural output that will avoid a worsening of the food supply/demand situation which would inevitably have especially serious consequences for low-income households. Moreover, reduction of the nutritional problems which are concentrated among the low-income rural households will require a pattern of agricultural development that enables disadvantaged groups such as very small farmers and landless laborers to participate in gains in productivity and income so as to raise their food intake levels by increased production and enlarged purchases of food.

Emerging Areas of Consensus

Two recent reports by UN "expert committees" are of special interest because they seem to provide the basis for a new consensus with respect to the type of activities which are likely to be feasible and most effective in reducing nutritional and other health deprivations in developing countries. One is a report on *Food and Nutrition Strategies in National Development* prepared by a group of nutritionists, economists, and administrators brought together for the 9th Session of the Joint FAO/WHO Expert Committee on Nutrition (FAO/WHO, 1976).^{*} The work of the Committee involved a mutual learning experience and led to a considerable, although by no means complete, convergence of views among the various viewpoints and disciplines represented. The other is the Sixth Report of WHO's Expert Committee on Maternal and Child Health entitled *New Trends and Approaches in the Delivery of Maternal and Child Care in Health Services* (WHO, 1976a). The Report on the Conference On Primary Health Care is also a land mark in this emerging consensus (WHO, 1978). In contrast, the resolutions adopted at the World Food Conference (UN, 1975) are so numerous and wide-ranging that they are of limited value in determining priorities and making choices among alternatives.

The emphasis in the Report of the Joint FAO/WHO nutrition committee (hereafter referred to as the Joint Committee Report) is on the substantive and procedural issues that arise in "the formulation and implementation of effective food and nutrition strategies that constitute an integral part of a country's efforts to promote development and which are feasible given its resource constraints" (FAO/WHO, 1976, p. 13). The policies and programs that receive attention are related to both "production- and consumption-oriented" activities, to apply the terminology used in the present monograph. The former influences the level and distribution of food consumption through their impact on the rate and pattern of growth of output whereas the latter are aimed more directly at influencing the nutritional status of particular segments of the population.

^{*}The Committee included six nutritionists (J.M. Bengoa, D.L. Bionovsky, H. Ghassemi, C. Gopalan, M.C. Latham, and P.R. Payne); five economists (B.F. Johnston, J.L. Joy, F.J. Levinson, S.O. Olayide, and V. Trickovic) and two administrators (Asok Mitra and R.A. Noordin). D.H. Calloway served as a consultant to FAO and assisted in the preparation of this report.

A major theme of the Joint Committee Report is the need to structure the pattern of development so that the mass of the population will be able to participate in gains in productivity and income and thereby make it "possible simultaneously to reduce poverty and achieve a high and sustained rate of economic growth" (p.20). It is argued that an essential need is to expand opportunities for productive employment--including self-employment in agriculture--at a rate which exceeds the rate of growth of the labor force. For countries where the bulk of the population still depends on agriculture for employment and income, the type of agricultural strategy that is pursued will, it is noted, have a decisive impact on the extent to which a growing labor force can be absorbed into productive employment. It is also emphasized that the success of efforts to improve returns to labor and to raise per capita incomes will "be facilitated by a slowing of the present rapid rates of population growth" (pp. 23-24).

Although considerable attention is given to various direct measures for nutritional improvement, the discussion emphasizes the need to assess such measures in relation to the constraints that limit the options that are feasible and their impact on the underlying causal factors responsible for malnutrition. It is noted, for example, that supplementary feeding programs "are costly and make large demands on technical and administrative manpower" and that they fail to "correct the underlying problems and may even favor their perpetuation by relieving the sense of urgency and thus diverting attention from the need to implement more fundamental measures" (pp. 36-37). On the other hand, it is suggested that measures to control "disease-induced nutrition problems, such as failure to eat, withholding of solid foods, poor digestion, and malabsorption" are likely to be "far more enduring and less costly than more direct nutrition interventions" (p.38). It is also noted that programs for the control of infectious diseases and for improving nutritional status are appropriately concentrated on mothers and small children because malnutrition has its major impact on those vulnerable groups. In addition, it is suggested that there are cogent reasons for integrating a family planning program with mother and child care and nutrition activities "under the overall umbrella of family health" (p. 39).

Another element of food and nutrition strategies that receives attention is the need to influence the composition of the foods that are produced and consumed so as to improve the nutritional quality of the diet of all income groups. It was noted, for example, that the spread of high-yielding varieties of wheat and rice in India permitted a substantial increase in the availability of protein and calories supplied by foods that are basic staples for millions of low-income households. But the higher productivity of the new varieties also encouraged a shift of acreage away from legume and oilseed crops which are important in supplementing the amino acids, vitamins, and minerals available in a predominantly cereal diet. This was offered as an example of the need to orient agricultural research and extension activities toward increasing the output of products that are especially important to the nutrition of low-income households.

The potential contribution of nutrition education is stressed, but it is cautioned that implementation of effective nutrition education programs will require "a complete re-orientation of the philosophy and operation of most ongoing nutrition education programmes" with an emphasis on complementing existing diets rather than imparting a mass of general information on better nutrition. Another priority mentioned is the need for action for the protection and promotion of breast feeding. An oblique reference is made to the unfortunate effects of promotional activities for infant formulas in the Committee's recommendation that governments should review their policies on commercial advertising. Contamination and other serious problems associated with bottle feeding are stressed. There is a need for special foods to supplement breast feeding during the critical period from about five to six months of age up to three years. It is noted that commercially manufactured weaning foods can be of value for populations with cash incomes living mainly in urban areas but that more attention should be given to weaning foods that can be prepared in the home by combining locally available foods. A common problem with traditional weaning diets in many areas is that their calorie density is so low that infants and small children often fail to ingest enough food to fully satisfy their energy needs. Inasmuch as competing demands on the mother's time and energy may make it difficult

to meet that problem by more frequent feeding, mixtures with a small amount of vegetable oil are valuable because of their higher calorie density. Cereal-legume mixtures enhance the quantity and quality of protein in weaning diets, and they may also reduce the risk of Protein-Energy Malnutrition by improving appetites.

The Joint Committee Report also includes an extensive discussion of organizational requirements for food and nutritional planning. In our judgment, however, the more important contributions of the report are related to the problem of determining the balance of production- and consumption-oriented activities that merit priority in a country's development strategy. We turn to these critical issues of priority setting in Chapter IV.

The Report of the WHO Expert Committee on Maternal and Child Health (hereafter referred to as the MCH Report) marshals persuasive evidence concerning the reasons why it is important for activities aimed directly at improving nutritional status and health to give first priority to infants and small children and mothers. The MCH Report effectively reinforces and supplements that part of the Joint Committee Report. The MCH Report reviews (1) recent knowledge of health problems in mothers and children, (2) new approaches in the delivery of care to these vulnerable groups, and (3) the need for reorientation of training and education for personnel at all levels. It is also emphasized that

The major problem in MCH care, as in other health services, is unequal distribution of health care...resulting in an imbalance in resources, both human and capital, devoted to basic rural services *versus* urban specialists and hospital care. (WHO, 1976a, p. 49).

It is further argued that

...the main challenge is to reverse this imbalance and develop an effective health care delivery system that is sufficiently extensive to reach the whole population...The highest and inescapable priority is for the development of *primary health care* for underserved populations, particularly at the village level...Such primary health care would require maximum utilization of local resources, often including, in the case of MCH care, utilization of traditional birth attendants, village health workers, and other personnel with appropriate and realistic training. Once the total population is covered by primary health care services the quality and kinds of service can be expanded as resources permit. (WHO, 1976a, p. 49).

The emergence of a consensus is also apparent in the similarity between the views expressed in this MCH Report and those endorsed by the International Conference on Primary Health Care held at Alma Ata in September 1978. Thus a key recommendation of the Alma Ata Conference is that primary health care should "focus on problems of the highest priority" and "that single-purpose programmes should be integrated into primary health care activities as quickly as possible" (WHO, 1978, p. 25). While noting that problems and the ways of solving them will vary from one country and community to another, it is recommended

...that primary health care should include at least: education concerning prevailing health problems and the methods of identifying, preventing, and controlling them; promotion of food supply and proper nutrition, an adequate supply of safe water, and basic sanitation; maternal and child health care, including family planning; immunization against the major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; promotion of mental health; and provision of essential drugs. (WHO, 1978, pp. 24-25).

Given the severe resource constraints in the low-income developing countries, the admonition that primary health care should include "at least" that range of activities may be viewed as overly ambitious as an initial set of objectives. It is for that reason that there is great merit in the incremental approach emphasized in the MCH Report. That report also gives considerable attention to determining priorities among the activities to be included in MCH programs, an issue that is examined in more detail in later chapters.

The need to coordinate health sector activities with the policies and programs of other sectors was also stressed at the Alma Ata Conference. Thus the joint report by the Director-General of WHO and the Executive Director of the United Nations Children's Fund presented at the Conference states that

Health cannot be attained by the health sector alone. In developing countries in particular, economic development, antipoverty measures, food production, water, sanitation, housing, environmental protection and education all contribute to health and have the same goal of human development. (WHO, 1978, p. 40).

That observation underscores another area of convergence. As noted earlier, the Joint Committee Report emphasized the need for a high and sustained rate of economic growth *and* for structuring the pattern of development so as to enable the mass of the population to participate in gains in productivity and income. And with respect to nutrition-related health activities and nutrition intervention programs, the Joint Committee Report stressed the advantages of an integrated approach to the delivery of nutrition, health, and family planning services over single-service programs. It also stressed that there are other complementarities among the elements of a food and nutrition strategy (FAO/WHO, 1976, p. 40). It is because of the nature of these interrelationships among the various components of a rural development strategy that it is so important for such strategies to be designed explicitly to further the attainment of multiple objectives. Before examining the competitive and complementary relationships among various components of a rural development strategy, however, it is necessary to consider some of the viewpoints which differ from the emerging consensus that is apparent in the reports just examined.

Areas of Continuing Controversy

There is a variety of reasons for resistance or outright opposition to broadly based employment-oriented strategies for rural development. And the same applies to the reluctance to support an integrated approach to the delivery of health, and family planning services. Part of the opposition is simply a reflection of vested interests of influential private groups such as large farmers in the one case and of a considerable fraction of the medical profession in the other. Vested interests within the bureaucracy of individual countries and also in external aid agencies are also a significant source of resistance. This is particularly true in the case of nutrition and family planning administrators who often prefer single-service programs concentrating respectively on nutritional or population objectives. In addition, however, serious arguments have been advanced that programs concentrated exclusively on either population or nutrition will be more effective than an integrated approach.

Several recent contributions to the literature on food and nutrition planning argue that priority should be given to measures aimed directly at the reduction of nutritional deprivation. In their World Bank monograph on *Malnutrition and Poverty*, Reutlinger and Selowsky assert, without any supporting argumentation or evidence, that reduction of malnutrition

.....would require a rate of growth in food production and consumption that could be achieved only if large subsidies were paid to maintain high incentive prices to farmers and low food prices to consumers.

And they go on to conclude

A realistic solution to the problem therefore must lie in target-group-oriented programs specifically designed to allow people of low income to achieve minimal standards of adequate nutrition. (Reutlinger and Selowsky, 1976, p. 4.)

The authors do not suggest any criteria for the choice of target-oriented programs. However, the specific intervention which they advocate is an urban food stamp plan, which as they demonstrate, would be more cost effective than a general food price subsidy or an income transfer. They do note, however, that programs to assist farm families must be directed at increasing and stabilizing food production (Reutlinger and Selowsky, 1976, p. 7).

Given the magnitude of rural poverty, the problems that commonly arise because of "urban bias", and the resource constraints that characterize developing nations, the appropriateness of giving a high priority to an urban food stamp plan, especially in low-income developing countries, appears questionable. In an exceptionally cogent and concise analysis of the problems of urban poverty, D.C. Rao makes three points which are pertinent to this issue. First, he argues that "most less developed countries do not have the resources to implement a major consumption transfer strategy", a proposition which is particularly applicable to his own country, India, and to other low-income nations. Second, he suggests that "success in ameliorating the condition of the urban poor may well result in a growth in their numbers resulting from in-migration". His third point emphasizes "the dominant importance of rural development in coping satisfactorily with the problem of urban poverty" (Rao, 1974, pp. 140, 142, 157).

The FAO Nutrition Consultants Report No. 35 on *Food and Nutrition Planning* (Joy and Payne, 1975a) represents a very different approach from Reutlinger and Selowsky, but has in common a strong emphasis on selecting measures aimed directly at preventing or alleviating nutritional deprivation identified in "specific people". The stress on redistribution is highlighted by suggesting an analogy between Britain's food problem during World War II, which Boyd Orr characterized as "not one of supply but one of more equal distribution of the food which is available", and the food problems now facing developing countries.

In contrast with the pessimistic view of the potential for expanding food production expressed by Reutlinger and Selowsky, Joy and Payne argue that there is substantial "slack" which could readily be translated into increased food production if only the nutritional needs of poor households could be expressed as effective demand. This leads them to a view in which agricultural development and many other elements of a rural development strategy would, in effect, be subsumed under "nutrition planning". Thus, they go beyond the conclusion that development strategies need to give high priority to structuring growth so as to narrow inequalities in income distribution and argue that an assessment of the seriousness of nutritional (and other) deprivations should directly determine decisions with respect to development goals and measures to achieve those goals. They

..... propose the following approach to the articulation of a unified system of values for planning: that planning should be directed to the reduction of deprivation. Planning goals would therefore be stated in terms of reduction of deprivation as measured by explicit indicators. Deprivation might range through many dimensions from nutritional deprivation to cultural deprivation, from a lack of health and of unachieved potential to a lack of an enjoyable or socially acceptable diet. (Joy and Payne, 1975b, p. 4.)

They emphasize that for this to be possible nutritionists " must provide a methodology...for assessing relative degrees of intensity of need and hence for establishing a ranking order of needs" and they further state "that effective planning will only be

possible when the effectiveness of various measures in bringing about changes in nutrition indicators is also known in quantitative terms" (Joy and Payne, 1975b, p. 4). Although there is certainly a need for research to provide better understanding of the functional significance of different types and degrees of under- and malnutrition, that represents a very formidable and long-range research undertaking (Calloway, 1977).

The approach advocated in the report by Joy and Payne also seems unrealistic and potentially counterproductive in its emphasis on detailed planning of both production- and consumption-oriented measures aimed at the reduction of nutritional and related deprivations "*in relation to specific people....*" (Joy and Payne, 1975a, p. 39). This is to be based on ad hoc analyses of target groups in specific local areas to determine "how their deprivations might be prevented or alleviated..." Additional questions arise concerning the administrative workability and political feasibility of some of the recommendations related to planning at the national level. An example is their suggestion that "until staples are adequately available at low prices, resources should not be diverted to the production of luxury foods" (Joy and Payne, 1975a, p. 49).

Related discussions of the "nutrition planning" approach to improving rural well-being have created a burgeoning literature over the past decade. Two recent publications have presented assessments of the "state of the art" of "nutrition planning" or "nutrition programming" (Joy, ed., 1978; Austin et al., 1978). A brief and reasonably accurate conclusion would be that the art of "nutrition planning" is in a state of disarray. Indeed there is a substantial and probably growing body of opinion that rejects the idea of "nutrition planning" as even a quasi-discipline and contends that the need is to introduce nutritional considerations more effectively into agricultural, health, educational, and general development planning.

A report on *Nutrition Intervention Assessment and Guidelines* prepared by a multidisciplinary group at the Harvard Institute of International Development (Austin, et al., 1978) at the request of the Sub-Committee on Nutrition of the UN's Agency Coordinating

Committee provides a useful compilation of information currently available. At the same time that report epitomizes a problem which is especially acute in the low-income developing countries. Given their resource constraints, poor countries must make hard choices among (at least) the seven types of "nutrition interventions" examined in the report:

1. Direct feeding
2. Nutrition education
3. Formulated foods (especially high-protein foods such as Vitasoy)
4. Fortification (and direct distribution of specific nutrients such as vitamin A capsules)
5. Consumer price subsidies
6. Agricultural productivity
7. Integrated nutrition, health, and family planning programs

Examples of several of these interventions are to be found in most developing countries. Most, however, are essentially token projects with such limited coverage that their nationwide impact is slight. There is considerable recognition of this in the Report, but the authors do not confront the difficult task of identifying criteria that could provide useful guidance to decision makers faced with the problem of determining priorities within the severe resource constraints that limit what is possible. This shortcoming seems to be a consequence of terms of reference which called for an assessment of *nutrition* interventions rather than assessing priorities among the nutrition-related components of a national development strategy. The rate and pattern of agricultural development are clearly key determinants of food intake and nutritional status; but it is anomalous to treat "agricultural productivity" as a nutrition intervention.

Another line of argument specifically challenges the idea that rural development strategies should be expressly designed so as to further the attainment of multiple objectives. An especially clear statement of this view is contained in a recent paper by Edward Schuh (1978), an agricultural economist whose views

have been influenced considerably by research on agricultural development problems in the U.S. and Brazil. In his Comment on the paper, Emery Castle (1978, p. 328) accurately states that "Schuh's major thesis is that policies to promote the generation of additional income streams should be uncoupled from policies to redistribute income or wealth".

Somewhat similar views have been expressed by David Hopper (1968, 1978). Thus Hopper has argued that developing countries "cannot afford the luxury of mixed goals", and hence "the production of food must be accepted as *the priority objective...*" Hopper is especially critical of "policies to discourage the development of mechanized agriculture because of its assumed impact on rural labor-force employment..." (Hopper, 1968, p. 105). Hopper's more recent discussion of these issues emphasizes particularly the irrationality and adverse effects of an outright prohibition of tractors or certain other types of equipment.* However, in citing Brazil as a shining example of a country "where farm-output growth has been high under essentially market conditions", Hopper ignores the fact that policy distortions often encourage the adoption of inappropriately capital-intensive technologies by a sub-sector of large-scale farm units with privileged access to credit from institutional sources. The subsidized credit provided for purchase of tractors in Brazil and many other developing countries have often represented *negative* real rates of interest and an income transfer to a relatively affluent segment of the population (Abel, 1978, p. 193; Gonzalez-Vega, 1976).

It is important to recognize that there is an element of validity in the arguments emphasized by Schuh and Hopper because policies justified on the basis of welfare objectives often have the effect of distorting relative prices and blunting producer incentives so that their net effect is to exacerbate rather than alleviate problems associated with poverty. Expensive schemes for

*Economists are understandably concerned about prohibitions which have the effect of placing an infinite price on a productive input. To our knowledge, however, the only example of such an action is the recent prohibition of combine-harvesters in India. It seems difficult to fault that decision because combine-harvesters clearly have no beneficial effect on crop yields, and in India and other low-income countries they can have a very serious adverse impact on the income-earning opportunities of the poorest rural households.

urban food subsidies are an especially important case in point. It is interesting to note in this connection that the Reutlinger-Selowsky proposal for urban food stamp plans has been endorsed by a World Bank economist who has been studying the adverse effects on agricultural production of the price distortions that have been such a common feature of agricultural policies in developing countries. His argument is that a shift to a food stamp scheme restricted to poor households would be less costly and less damaging to production incentives than the urban subsidy schemes which exist in Egypt, Pakistan, and a number of other developing countries (Brown, 1978). But given the fact that the urban poor are probably only a minor partner in the coalition of urban interests that often manage to secure the adoption of "cheap food policies" at the expense of a country's farm population, it seems doubtful whether a shift from the implicit price subsidies to urban consumers which now exist to a food stamp plan limited to the urban poor could command sufficient political support to be adopted.

A narrow preoccupation with a problem such as malnutrition can lead to advocacy of other policies which would, on balance, have adverse effects on the wellbeing of the poor. There is, for example, an understandable tendency for nutritionists to condemn "cash crop agriculture". Given their concern with the serious nutritional problems in developing countries, it is not surprising that they sometimes argue that malnutrition is aggravated because farm land is being used to produce coffee, tea, or other export crops rather than food crops. Thus the Report of the Expert Committee on Maternal and Child Health that was discussed above includes an assertion that the commercialization of agriculture has

.....worsened the health situation in rural areas. Subsistence-style farming, for instance, has been largely replaced by cash crop agriculture geared to external markets rather than to the needs of the rural population. This has contributed significantly to changed nutritional habits and in many cases has severely impaired the ability of rural people to satisfy their own nutritional needs. (WHO, 1976a, p. 13).

Here again there are situations in which the viewpoint has some validity. When production of export crops is concentrated on plantations or estates, the profitability of export enterprises

may accentuate the other forces that lead to a dualistic agricultural structure and to a concentration of farm land in large-scale units, thereby intensifying the poverty of the bulk of the farm population that derives from their limited access to resources. In Jamaica, for example, plantations producing sugar occupy a large percentage of the level, fertile land, and the country's smallholders mainly depend on cultivation of the hillsides where productivity is low as a result of soil erosion and related problems. It is also worth noting, however, that in Kenya the only convincing evidence of a correlation between cash cropping and malnutrition pertains to two sugar-producing areas. In only one of those areas was the correlation statistically significant, and in that locality sugar cane was being grown on such a small fraction of the land of the households affected that competition for available resources of land and labor could hardly be the explanation. The plausible hypothesis that is offered in this analysis is that the increased availability of sugar cane in the area had encouraged consumption of sugar by small children as a substitute for maize and other more nutritious food, thus giving rise to a higher incidence of protein-calorie malnutrition (Kenya, forthcoming, Section II.3).

The concentration of land and other resources in plantations and other large-scale farm units that is characteristic of a dualistic agricultural economy often accentuates the nutritional and other problems faced by the great majority of the rural population because of their limited access to productive resources. More generally, modifications of traditional patterns of subsistence production undoubtedly increase the importance of nutrition education. But a general condemnation of export crops is based on a misleading, partial analysis of the situation. It ignores the fact that in many developing countries expanded production of such crops has made possible a very significant increase in cash and total income among small farmers, thus making an important contribution to the wellbeing of the rural population as well as earning foreign exchange which is one of the scarcest resources in most developing countries. Imposing restrictions on production of export crops (or the "luxury foods" condemned by Joy and Payne) would clearly reduce the welfare of farm households by preventing them

from using their land and other resources so as to maximize their net income. The fundamental requirement is to increase productivity so as to enable farm households to expand their production of food for home consumption and their commercial production. Subsistence agriculture is inevitably condemned to a low level of productivity. Achieving the increases in farm productivity and output required to support economic and social development requires a transition from a traditional "resource-based" to a more productive "science-based" agriculture which in turn requires a gradual expansion in the use of new, purchased inputs such as fertilizers and seed for high yielding, fertilizer-responsive varieties (Hayami and Ruttan, 1971; Johnston, 1978). Probably the most valid criticism of emphasis on export crops is that the priority given to those crops may well have contributed to the neglect of research on food crops. (See, for example, Anthony et al., 1979, Ch 8.)

Some of the extreme recommendations concerning the orientation of agricultural research toward the needs of small farmers fall into the same trap of partial analysis. By and large, "zero input" technologies (i.e., those involving no requirements for purchased inputs) simply will not yield the increases in farm productivity and output that are required (Oram, 1978). But it is possible to orient agricultural research so as to take account of the relative abundance of labor and the purchasing power constraint which characterize low-income developing countries where the bulk of the population is still dependent on agriculture. In fact, an emphasis on divisible, yield-increasing inputs that are labor-using and capital-saving, rather than lumpy inputs such as tractors that are mainly labor-saving, has important economic as well as social advantages (Binswanger and Ryan, 1977; Binswanger and Ruttan, 1978; Barker, 1978; Johnston and Kilby, 1975).

Clearly, the appropriate balance between capital-saving, labor-using innovations and capital-using, labor-saving innovations depends on the characteristics of individual countries. Particularly high priority is merited by biological and chemical innovations such as improved seed-fertilizer combinations and investments in irrigation and drainage which permit more intensive

use of land through multiple cropping. This is especially true in countries where the bulk of the labor force still depends on agriculture for its livelihood and where a substantial fraction of large annual additions to the workforce must be absorbed in agriculture. Schuh's criticism of "employment-oriented" agricultural strategies ignores the fact that a substantial increase in the farm labor force is inevitable in low-income developing countries such as India, Bangladesh, or Kenya. He emphasizes that "the one universal law relative to agriculture is that the agricultural labor force has to decline as development proceeds". And he goes on to assert that it is misguided to believe that the choice of production technology should be influenced by the relative abundance of labor in agriculture. In his view "efforts to increase employment in agriculture rather than to attack the fundamental problems causing low labor absorption in the industrial sector" is "to deal with symptoms rather than fundamental causes" (Schuh, 1978, p. 321). Schuh's general conclusion (p. 322) is that:

...policies for alleviating rural poverty must be directed to giving rural workers the skills they need for alternative employment, to promoting more efficient labor markets, and to removing the antiemployment bias of development policy by reducing the factor-price distortions in the economy at large.

Schuh's diagnosis and policy prescriptions have a great deal of validity in the context of American agriculture, where as early as 1950 only 12 percent of the labor force was engaged in agriculture. They probably also have considerable validity in relation to a middle-income semi-industrialized country such as Brazil where agriculture's share in the total labor force had declined to 46 percent by 1970, although the acute problems in the Northeast represent a special case. But they are of very limited relevance to the low-income developing countries because of the structural and demographic constraints that we examined in Chapter II.

Nonetheless, it is important to emphasize that in most developing countries factor-price distortions--notably overvalued exchange rates, under-pricing of capital, and over-pricing of labor

(in the modern industrial sector)--do aggravate problems of under- and unemployment. And there is also a great deal of validity in Schuh's observation that

Efforts to decentralize the industrialization process can also play an important role in producing more efficient factor markets (Schuh, 1978, p. 322).

In fact, an important advantage of a broadly based strategy of rural development is that it generates a pattern of rural demand that fosters a more decentralized pattern of industrialization and more rapid growth of nonfarm output and employment than does a dualistic pattern of agricultural development (Johnston and Kilby, 1975, especially Chs. 4, 7, and 8). However, Schuh ignores the fact that in many cases factor price distortions have reinforced other factors that have encouraged premature mechanization in agriculture and a dualistic pattern of agricultural development. This has led to a concentration of resources in a "modern" large-scale, inappropriately capital-intensive subsector and consequently has accentuated the problems of poverty among the great majority of rural households.

A critical problem in designing effective rural development strategies is to establish and maintain an effective balance among the various policies and programs that constitute the strategy. It should be readily apparent from the foregoing review of controversial issues that determining an effective balance among activities such as agricultural research and extension, investments in infrastructure, outlays for rural education, nutrition, health, family planning, and expenditures related to various other components of a rural development strategy is not an optimization problem in the formal sense. In fact, one of the reasons that it is especially difficult to reach a consensus with respect to the choice of measures to promote rural development is that cost-benefit analysis and other conventional investment criteria are of only limited value in providing guidance with respect to such decisions. In the following Chapter an approach is outlined which, it is believed, can be of value in making informed judgments about the composition and balance among components of a strategy for promoting rural development.

IV. THE DESIGN OF DEVELOPMENT STRATEGIES

It was suggested in the preceding Chapter that there is an emerging consensus that two components of rural development strategies merit high priority: (i) a broadly based agricultural development strategy that is capable of accelerating the growth of output while simultaneously fostering widespread participation in gains in productivity and income, and (ii) rural health programs that emphasize low-cost preventive activities so as to achieve broad coverage in promoting improvements in nutritional status and health and a reduction in fertility. At the same time it was recognized that various alternative views have been advocated which suggest a very different ordering of priorities.

The problem of striking a satisfactory balance among various production- and consumption-oriented policies and programs is especially critical in the low-income developing countries because of their severe resource constraints. However admirable in intent, programs which cannot be given sufficient support for effective implementation benefit no one. And undertaking low-priority programs, even those that may be highly desirable when considered in isolation, has a high "opportunity cost" because the commitment of resources which they require is likely to be at the expense of higher priority activities.

Decisions about the priority to be given to various production- and consumption-oriented activities of a development strategy are by their nature political decisions. This is especially apparent when it is recognized that in designing development strategies attention should be given to the composition and distribution of the goods and services that are produced as well as to the rate of growth of average per capita income. In spite of the economist's reluctance to make interpersonal comparisons, it is important to recognize that a given rate of growth in average GNP has quite different implications depending on whether it is concentrated in the top or the bottom deciles of the income distribution. This is particularly apparent in the case of fulfilling "basic needs" for goods or services that make it possible to alleviate the most serious deprivations associated with poverty.

An increase in food intake and nutrition-related health services which eliminate or reduce Protein-Energy Malnutrition among poorer segments of a country's population clearly represents a greater gain in social welfare than a further increase in food intake among those already consuming a nutritionally adequate diet. But even if there is general agreement concerning that value judgment, there are still serious difficulties in reaching a consensus concerning the measures that are most appropriate for reducing nutritional and other deprivations.

Decisions that affect resource allocation, the distribution of income, and social services are bound to be influenced by numerous and conflicting interest groups and by the political and economic power of those groups. It seems too simplistic, however, to conclude that failure to adopt and implement policies and programs which serve the broader national interest is simply a consequence of the power of resistance of groups opposed to changes that might affect their interests adversely. Clearly, the various viewpoints reviewed in Chapter III as examples of continuing controversy are not motivated by vested interests. Rather, they reflect different perceptions of what is possible and desirable in the national interest.

Because of the political nature of development decisions, because of the substantive disagreement as to which decisions will be most effective in attaining given development goals, a continuing debate over the design of development strategies is both inevitable and proper.

The proper goal of economic or policy analysis is not to replace that debate. It is to help make the debate more focussed, more realistic, and more productive. The passage quoted earlier from M. Granger Morgan (1978) bears reiteration in this context. "Good policy analysis recognizes that physical truth may be poorly or incompletely known. Its objective is to evaluate, order, and structure incomplete knowledge so as to allow decisions to be made with as complete an understanding as possible of the current state of knowledge, its limitations, and its implications." In this view, policy analysis is as much concerned with designing effective procedures for presenting and debating evidence as it is with

advocating particular viewpoints and substantive recommendations. We believe that good policy analysis has much to offer the continuing debate over development strategies. In this Chapter, we begin by reviewing some of the salient past experience with policy analysis in the development literature and elsewhere. In response to the shortcomings of purely formal approaches, we propose in the second section a less ambitious but more eclectic alternative, better suited to the realities of development strategy design in the low-income countries. In line with this view of policy analysis, we then discuss the basic interrelationships and trade-offs which constrain realistic strategies before proposing our own specific suggestions in Chapters V and VI.

Policy Analysis and the Development Debate

A major difficulty in designing procedures for exploring differences in judgment and objectives relates to the assessment, measurement, and comparison of outcomes from alternative development activities. The allocation of resources for agricultural research, for example, is inevitably subject to a large margin of uncertainty with respect to the profitability of the technological innovations that will be generated. There are further uncertainties concerning the response of farmers and the distributional effects of differential adoption of new technologies by small and large farmers. This example illustrates the general problems that arise both because of uncertainty and because alternative policies and programs will have differential effects on different groups. Hence, decision makers are "forced to make painful, vexing, interpersonal and intergroup trade-offs" (Bell, Keeney, and Raiffa, 1977 p. 4). These difficulties are further aggravated by the intractable problem of assessing benefits. Is there, for example, a satisfactory way to quantify the benefits, "human" as well as "economic", associated with avoiding blindness by the prevention of xerophthalmia caused by vitamin A deficiency? Improved nutrition and immunization programs can be expected to have beneficial effects on productivity, but those economic effects are difficult to measure. Moreover, they are probably less significant than the positive contributions to individual well being resulting from

improved health and vigor and reduced pain and suffering, including the psychological costs of excessively high rates of infant and child mortality. For reasons discussed later, poor prospects for child survival probably also have a high social cost as a source of resistance to the acceptance of family planning.

Most efforts to improve procedures for development decisions have concentrated on devising more sophisticated techniques of project analysis in order to achieve more rational investment choices.* Conventional benefit-cost analysis is of very little value in guiding the debate over, for example, the choice between a unimodal and a bimodal agricultural strategy, or over the priority that should be given to an integrated nutrition, health, and family planning program as a component of a country's strategy for rural development. But even in the evaluation of irrigation and drainage projects, for which direct costs and benefits can be quantified with relative ease, a useful evaluation must take account of important trade-offs between investing in physical structures and allocating resources for training and for creating institutional arrangements to promote efficient control and use of available water supplies at the farm level (Takase and Wickham, 1978; Levine 1971).

The elaboration of a variety of macro and sector models has been the principal response of economists and other policy analysts to the need to supplement benefit-cost analysis in order to provide more general guidance in designing development strategies. It has been argued that, because of the complex interactions among variables and the importance of indirect as well as direct effects, "we need more complex analytical techniques--models which incorporate as many of the relevant relationships as possible are more likely to give useful insights and guidelines for policy than are simpler approaches" (Rodgers, 1977, p. 24).

Evidence to date with large-scale, "black-box" models has, however, not been very encouraging for two reasons. In the first place, most of the models constructed to date have been flawed by

* The pioneering contribution to that literature was Little and Mirrlees (1969). See also Little and Mirrlees, 1974; Joshi, 1972; Das Gupta and Pearce, 1972; Gittinger, 1972.

technical deficiencies and by questionable assumptions. Beyond that, however, it is doubtful whether these large-scale models can be useful even with the removal of deficiencies of that nature. The various TEMPO models, ILO's BACHUE model for the Philippines, and the Adelman-Robinson model for South Korea illustrate the sorts of problems which have arisen. In an insightful analysis of the TEMPO and other models for evaluation of population and development policy, Arthur and McNicoll (1975) point out that a mantle of false complexity often cloaks essentially simplistic structural assumptions. They cite a TEMPO conclusion that for 19 different countries "slower population growth, produced by declining fertility, translates directly into a more rapid growth of GNP per capita. This conclusion is extremely robust... under widely differing parameter values for the key equations in the models" (Brown, 1974, p. 25). But this conclusion and its remarkable robustness derive directly from the model's single central assumption of a Cobb-Douglas production function: "a function that enjoys the property that, no matter what the parameters, the derivative of per capita output with respect to labor is always negative. An increase in population can therefore never pay its way" (Arthur and McNicoll, 1975, p. 257; see also Sanderson, 1978, pp. 20, 72-94). Family planning may indeed increase GNP growth, and Cobb-Douglas production may be a useful assumption on which to base some aspects of a development policy debate. But the role of models and other forms of analysis should be to clarify the relationship between such assumptions and their policy implications, not to obscure them.

As a further example, both the BACHUE and Adelman-Robinson models purport to demonstrate that slowing population growth has beneficial effects only after 30 years. Prior to that, it is alleged, "there is a slight tendency for population policies to lead to a deteriorating income distribution and increasing poverty..." (Adelman, et al., 1976, p. 46). But again, this is mainly a result of assumptions built into the model which insure that a slower rate of population growth will mean a worsening of agriculture's terms of trade because of the slower growth in demand for food. And since the bulk of poverty is located in rural areas, the welfare gain of the urban poor from lower food prices is more than

offset by the reduction in income for rural households. That implicit assumption of the model is in sharp contrast with the view of Mellor (1976) and others that governments' concern about the possibility of a rapid rise in urban food prices has often deterred them from pursuing employment-oriented development policies. Again, either assumption may be argued, and indeed the implications of both should be explored as part of the policy debate. But modeling approaches which obscure rather than highlight the assumptions from which their conclusions derive are likely to be counterproductive. This is particularly true when, as in the BACHUE case, there are serious conceptual and technical errors (Sanderson, 1978, p. 71), coupled with a disregard of elementary validation criteria.*

The more general deficiencies of large-scale simulations for population and development planning are described by Arthur and McNicoll (1975). An early infatuation with big model systems analysis has been a common phenomenon which has now been outgrown in a number of more mature fields. Military planning in the 1950s, water resource planning in the 1960s, urban and environmental planning in the 1970s--each of these fields initially developed large-scale simulation approaches to cope with the complex problems. And, in each field, practical experience with the actual results of these initial efforts has now led to a remarkable convergence of opinion which recognizes the strengths and limitations of model analyses, and--most importantly--their relationship to the overall process of policy design, implementation, and improvement.**

*Blandy (1975, p. 47) explicitly argues that validation criteria are of minimal importance.

**See especially Cline (1961) and Quade (1964) for the military experience, Fiering (1976) and Ackerman et al., (1974) for water resources, Brewer (1973) and Lee (1973) for urban and regional planning, and Holcomb Research Institute (1976) and Holling (1978) for ecological and environmental applications. More general synthetic treatments of the practical pitfalls and potential of systems analysis in a policy context are given by Quade (1975) and Majone and Quade (forthcoming).

Particularly relevant lessons learned in the course of this convergence are typified by those recently obtained in practical evaluations of various modeling-based approaches to environmental policy design, conducted under the auspices of the International Institute for Applied Systems Analysis (IIASA) by C. S. Holling and his co-workers.* The dominant and recurring theme in this work is the need for simplification at all stages of the modeling and analysis effort. Such simplifications are essential "to encapsulate understanding and help intuition play its central role in the analysis" and "to facilitate communication" (Clark, Jones, and Holling, 1977, p. 38). Models or any other analytical approach to assist in policy design are of little value unless they contribute to constructive interaction between policy analysts, managers, and decision makers.

The IIASA group stresses that the problems it addressed "are comprised of an immense array of interacting variables, conflicting objectives and competing actions". They conclude, however, that even in the relatively well researched and experimentally accessible world of environmental and resource systems

.....attempts to comprehensively model such complexities are futile. At best they produce models as intricate and unfathomable as the real world. More likely, they founder in a limbo of unending data requirements, impossible 'debugging' problems, and general ineffectiveness (Clark, Jones, and Holling, 1977, p. 19).

In place of a spurious "comprehensiveness", they argue for models which are

.....as ruthlessly parsimonious and economical as possible while still retaining responsiveness to the management objectives and actions for the problem. The variables selected for system description must be the minimum that will capture the system's essential qualitative behavior in time and space (Clark, Jones, and Holling, 1977, p. 15).

*The IIASA work reflected contributions from an international team of ecologists and resource managers, and in particular the Ecology Policy Group, Institute of Resource Ecology, University of British Columbia, Vancouver, Canada. See especially, Clark, Jones and Holling, 1977, and Holling, ed. 1978.

The resulting models are often initially cast as simulations in order to avoid prematurely sacrificing realism for mathematical tractability. But the simulations are in turn simplified through rigorous qualitative analysis, mathematical programming, and, above all, graphical presentation of key assumptions and consequences. Such analytic simplifications can be technically difficult, requiring substantive advances in the state of the analytic art. They inevitably require that initial model formulation be sparing of extraneous detail. And they are the single factor which the IIASA group judged most responsible for its occasional practical successes in improving ongoing policy debate.

Significantly, it is just such an approach to simplified, transparent, and rigorously analyzed models which Arthur and McNicoll (1975) urge in their review of population development. There are, of course, examples in the development field of models which strive to meet these criteria and are therefore of considerable value for policy analysis. For example, current efforts to modify the Kelley-Williamson-Cheetham model (1972) so as to achieve greater policy relevance seem very promising (Kelley and Williamson, 1979). And the linear programming models developed by Gotsch et al., (1975) provide a good example of the use of formal, quantitative techniques to illuminate certain issues of agricultural policy.

As compared to the complexity and uncertainty that must be confronted in designing strategies and sub-strategies to further the multiple goals of rural development, many of the environmental and other policy analyses referred to earlier constitute relatively well structured problems. But, it has been argued with great cogency that diffuse *ill-structured* problems, such as those that arise in the design of agricultural development or rural health and population strategies, call for a very different balance of analytic approaches.* For these problems, the serious

*This discussion of "ill-structured problems" is based to a considerable extent on seminar presentations on that topic presented at IIASA in April 1979 by Brian Arthur and Herbert Simon. See also Simon (1977). We acknowledge our gratitude without implicating them in this attempt to summarize and apply their insights.

disadvantage of large-scale models are magnified because they are too opaque to be well understood. It is therefore virtually impossible to use them as a tool for learning and the errors that are inevitable will go undetected. But small, carefully analyzed models can be useful. In fact, if skillfully used they can facilitate the important task of "planning to learn" which is emphasized in the final section of Chapter VI.

A well structured problem, such as designing inventory control or solving a transportation problem, has a well-defined objective--arriving at an answer or procedure for managing an inventory or for the time and space allocation of vehicles. In contrast, for an ill-structured problem, there is no well-defined "problem" but rather what Ackoff (1974) has termed as a "mess": a concern to change the functioning of a complex, dynamic system in order to make progress in attaining multiple objectives. Obviously, in rural development messes a great many interacting variables are involved, and many of the behavioral relationships and even some of the technical input-output coefficients are poorly understood. Moreover, a major objective of policy design is to modify key "parameters" of the problem, including the characteristics of major crop varieties and levels of mortality and fertility.

The purpose of policy analysis related to an ill-structured problem such as rural development may be to provide policy advice to decision makers. But equally the purpose may be to gain better understanding, to derive new insights, or to clarify the issues and identify those that are most critical. Indeed, a great deal of policy advice is of little value or even harmful because insufficient attention is given to the prior need to understand the underlying logical structure of the problem.

When problems are messes and ideas concerning "solutions" are vague the limitations of formal modeling exercises are intensified. In such cases the real concern is to achieve satisfactory, implementable outcomes in relation to multiple goals. These considerations underscore the importance of two other lessons derived from the IIASA evaluations of strengths, weaknesses, and complementarities of various approaches to policy design.

The IIASA group labels the common notion that "the goal of policy design is the design of optimal policy" as an outmoded myth. Especially in the case of ill-structured problems, attempts to determine what is "optimal" are inane. In fact, "the first responsibility of policy design is to generate and explore a strategic range of alternative approaches to the management problem" and thus to be concerned from the outset with "enriching the decision environment" from which the choices must be made (Clark, Jones, and Holling, 1977, pp. 47-48). Decisions will be shaped by local constraints, by particular institutions and organizational structures and procedures, and by unique personalities.* Therefore, continuing heuristic modifications of an initial policy design that draw upon additional information and insights are of great importance. We pursue this adaptive, re-design aspect of development strategies at some length in Chapter VI. In addition, however, it is essential to recognize that development choices, whenever made, are based on what is *perceived* to be technically feasible and politically implementable at the time.** In a very real sense, a policy analysis is therefore shaping the decision maker's preferences by arguing what can and cannot be obtained. In such a view, most efforts to quantify trade-offs, utilities, and indifference functions, to choose the policy "best reflecting the decision maker's preferences" are premature and counterproductive.

In conclusion, it appears that much of what is being done in the way of elaborate and arcane ventures in modeling simply does not need doing in the development context. The results are irrelevant to policy choices and design problems faced by developing countries. Benefit-cost analysis of specific projects clearly has a role to play as a guide to decision making. But especially in the rural development context, the recent tendency to impose elaborate appraisal procedures encourages a pseudo-sophistication that places excessive demands on the limited planning and administrative capacity available, thereby causing delays and a shortage of good

*Allison's (1971) analysis of the Cuban missile crisis provides a forceful example.

**Lindblom (1965) argues this view convincingly.

projects (Chambers, 1977). More fundamental, to rely on the resulting project-oriented evaluations and formal appraisals without serious consideration of other types of evidence leads inevitably to "sub-optimization" because of the fact that strategic options and variables that are of critical importance but difficult or impossible to quantify will be ignored. A more mature--and more modest--approach to policy analysis and design is needed which incorporates some of the hard lessons learned in a number of more experienced fields. Many such approaches are doubtless possible, but it seems certain that any effective one will necessarily devote explicit attention to its limitations and place in the overall process of development strategy design. In the next section, we develop one such approach which we believe can be responsive to the specific problems and choices faced in the low-income countries.

Processes for Development Design

The considerations raised in the previous section pose a dilemma for the design of rural development strategies. The limitations of formal analytic approaches mean that judgment and intuition should always have a major role to play in the design and evaluation of alternatives. It would be foolish, however, not to recognize that judgment and intuition are often wrong. Moreover, they never offer the sort of hard "evidence" on which the dialogue of policy design can most productively focus.

The difficulty is especially clear in the case of decisions about the allocation of resources for social services. It has been argued, for example, that priorities with respect to health programs should be determined on the basis of criteria such as the "magnitude, severity, and social consequences of the health problem; feasibility, cost and effectiveness of the health action; and demands for care and acceptance of services by the community" (WHO, 1976a, p. 32; Bengoa, 1973). Judgment is obviously called for here; but judgment without tightly reasoned cost-effectiveness calculations to back it up will probably not count for much with those who judge differently. The element of judgment is also prominent in determining the level and orientation of agricultural

research programs and in other undeniably technical matters which have a decisive influence on the rate and pattern of agricultural development. The risk is great, however, that the "strategy by default" resulting from a sequence of ad hoc, judgmental decisions will be unsatisfactory. The inevitable waste of resources is always regrettable, and in the context of low-income countries it is tragic indeed. Even the staunchest advocates for an "incrementalist" or "muddling through" view of decision making have never been ecstatic about its results (see especially Hirschman and Lindblom, 1962).

A market defined price system is, of course, one of the alternative "planning" approaches most often suggested in response to the need for managing a complex system via noncomprehensive, judgmental decisions. The strengths and shortcomings of this outlook have been debated at length. For example, proponents of basic needs strategies sometimes condemn the allocation of resources based on a system of market prices because the effective demand which interacts with supply to determine relative prices is a function of the existing income distribution which is often highly unequal. Although it is true that market-determined prices are vulnerable to that criticism, it does not follow that substituting a system of government-administered prices will improve the situation in practice. Whatever its shortcomings, a price system is a very economical mechanism for transmitting information to guide the decisions of individual producers and consumers, thereby performing a critical function in harmonizing those decentralized decisions. Even in developed economies, the information that can be handled by the communication channels that are available or which could be created without excessive cost are limited (Arrow, 1974, Ch. 4). Decentralized decision making by individual producers has especially significant advantages in the agricultural sector. Agricultural production is a biological process characterized by great variability, and the operations to be performed are separated in space and in time. It is for those reasons that "on-the-spot supervisory decisions" are of such great importance (Brewster, 1950). Efforts to centralize management and decision making lead to inefficiency and reliance on capital-intensive technologies. This is

because of the difficulty of supervising a large farm workforce; and the problems of "shirking" and poor performance which tend to arise when agricultural workers do not have a direct interest in the outcome of the farm enterprise encourage "premature mechanization".

A major limitation of the prices-and-markets view of the strategy design process derives from the fact that most critical government decisions affecting rural development are those which involve the provision of "public goods"--agricultural research, farmer training programs, rural education, irrigation and other investments in infrastructure, and rural health services. Such decisions have pervasive impacts on the growth of output and on the distribution of the benefits of growth. The production-oriented programs that constitute an agricultural strategy are major determinants of the rate of expansion of agricultural output because they influence the production possibilities available to farmers by modifying their technological, economic, and institutional environment. And in conjunction with price policies and the policies and programs that influence the size distribution of farm operational units, they largely determine which farmers have access to improved technologies as well as the rate of technical progress. Thus they have a powerful influence on the pattern of agricultural development and on the extent to which the bulk of the rural population benefits from gains in productivity and output. Similarly, rural education and health programs affect human capital formation and thereby influence both the rate of economic progress and the ability of various socioeconomic groups and individuals to share in the development process.

To some extent, decisions by policy makers, managers, and research workers affecting the supply of public goods will indeed be influenced by relative prices. In fact, Hayami and Ruttan (1971) have advanced an "induced innovation hypothesis" which suggests that relative factor prices will exert a major influence not only on farmers and firms supplying inputs but also on agricultural administrators and scientists. That is, they hypothesize that the decisions that determine the nature of technological and institutional innovations will be responsive to relative factor prices

and changes in those price relationships in such a way as to economize on a country's scarce factors of production. And they suggest that the contrasting patterns of technical change in Japan and in the U.S. are to be explained as appropriate responses to the very different factor availabilities and prices in the two countries. An important implication of their hypothesis is that factor and product prices which accurately reflect social opportunity costs may be even more important in influencing the orientation of agricultural research and therefore the nature of technical change than in their efforts on short-run allocative efficiency. The mechanism which they postulate, and analyze on the basis of the agricultural development patterns in Japan and in the U.S., is a dynamic process of factor substitution in response to trends in relative factor prices.

In our judgment that view of "induced innovation" considerably overstates the role of relative prices in shaping government decisions about agricultural research and other programs for supplying "public goods". In a recent essay, Ruttan and Binswanger assert that "The most powerful force that man can command to alter the direction of technical or institutional change is the capacity for innovation". They go on to suggest

If he is to deploy his innovative effort effectively, man must learn as much as he can about the complex matrix within which technical and institutional change interact with each other and with the physical and cultural endowments of a particular society (Binswanger and Ruttan, 1978, p. 4).

But this admonition that "man must learn as much as he can" provides little guidance as to how that is to be reduced to a manageable task. We are, therefore, back to the difficulties of the formalist-comprehensive analysis discussed in the last section. Due to the problems of communication and information processing noted there, an inherently difficult problem arises in extracting from the mass of information that is in some degree relevant to the design of a rural development strategy, only that information which is essential to rational decision making. Unless policy analysts are as "ruthlessly parsimonious and economical as possible"

in selecting pertinent evidence to guide decision making, the information will be of little value. Hence arises the need for an analytical framework and "models" to assist in developing the essential evidence which determines the critical issues that should find a place on a government's decision making agenda.

In an earlier attempt to come to grips with this problem, Johnston has argued that "formal analytical techniques obviously have an important role to play. But they need to be supplemented by 'reasoned methods of explanation and prediction' that take account of many types of evidence". (Johnston and Kilby, 1975, p. 131).^{*} This essentially eclectic approach takes account of intuitive and judgmental information and emphasizes certain significant implications of the structural features and sectoral interrelationships that characterize low-income countries (Johnston and Kilby, 1975, Ch. 4; Johnston, 1977). Very much in the spirit of the IIASA and other policy analysis experience reviewed in the previous section, it emphasizes simultaneous consideration of the *objectives* of a rural development strategy and the *means* (policies and programs) by which those objectives are to be obtained. In particular, it stresses that "it is also essential for the choice of objectives and of means to be guided by explicit recognition of certain *constraints* that can only be gradually eliminated, especially those imposed by the structural and demographic situation" in low-income developing countries (Johnston and Kilby, 1975, p. 132). Within that framework, the anticipated benefits and costs of alternative policies and programs need to be interpreted broadly. In particular, the advantages and disadvantages of alternative strategies and substrategies or components should be assessed in terms of their contributions to attaining the interrelated objectives of rural development. Furthermore, and of great importance, this type of analysis needs to be guided by insights and evidence derived from past historical experience. To cite just one important example, there is no *a priori* reason to suppose that the development and diffusion of divisible biological-chemical innovations epitomized by high-yielding, fertilizer-responsive crop

^{*}The quoted phrase is from an interesting essay by Helmer and Rescher (1959) *On the Epistemology of the Inexact Sciences*.

varieties could play a crucial role in achieving rapid and widespread increases in farm productivity and output. However there is now a wealth of historical evidence which confirms the special importance of such innovations in low-income countries where the bulk of the population still depends on agriculture for a livelihood. In fact, it is noted in Chapter V that countries with environmental conditions which limit the scope for yield increases based mainly on improved seed-fertilizer combinations face special problems.

Differences among countries in their development objectives, in their resource endowments and opportunities, and in the constraints that they face will obviously influence the choice of policies and programs that merit priority in their rural development strategies. But because of certain characteristics which they have in common and because they all face severe financial and manpower constraints, it may be possible to reach a consensus with regard to a few general propositions concerning development priorities in the low-income countries.

First of all, the severity of the constraints which they face rules out the major resource transfers that would be required to reduce significantly the deprivations which persist among the large fraction of their populations subject to poverty. This pervasiveness of poverty underscores the importance of increasing the output of goods and services; but it also underscores the need to consider the *means* by which output is increased, especially the distributional implications of the production-oriented policies and programs that are adopted.

A second and related proposition derives from the dominance of agriculture in total employment and GNP in the late-developing countries. Because of that structural feature, both the rate and pattern of agricultural development have decisive direct effects on the wellbeing of the large fraction of the population dependent on agriculture and also significant indirect effects on the growth of output and employment in the nonfarm sectors.

Both of those propositions point to the need to design rural development strategies with explicit attention to their effects on attaining the multiple objectives of development. It has been

suggested that as a minimum those objectives should include (i) achieving self-sustaining, cumulative economic growth; (ii) expanding opportunities for productive employment (including self-employment in agriculture); (iii) reducing poverty (with emphasis on malnutrition and excessive mortality and morbidity); and (iv) slowing population growth. Because resources are so limited, it is obviously necessary to consider the trade-offs that arise in allocating resources between production- and consumption-oriented programs and their allocation to specific activities within those broad categories. It is also important, however, to recognize that there are significant complementary as well as competitive relationships. In the remainder of this Chapter we therefore examine the interrelationships among the major components of a country's rural development strategy. Then, in Chapter V, we consider the implications of these interrelationships for striking a balance between the consumption-oriented and production-oriented activities undertaken in support of low-income countries' rural development.

Interrelationships Among the Determinants of Rural Wellbeing

The highly simplified portrayal of the determinants of rural wellbeing in Figure 4 stresses the way in which various production- and consumption-oriented activities separately and jointly impinge upon the wellbeing of the rural population. It is assumed that the final outcome is a function of the growth, distribution, and composition of the per capita consumption of goods and services. That outcome is influenced directly by the two sets of activities and also by their interacting effects on the rate of natural increase of the rural population, migration flows, and human capital formation.

The top of the diagram directs attention to the effect of production-oriented policies and programs on the rate and pattern of rural development which in turn will determine employment opportunities, the income derived from wage employment, net income derived from the sale of farm products, and the income in kind represented by production for subsistence consumption. The monetary component of those income flows will be divided between consumption expenditures and investment outlays. Farm cash income

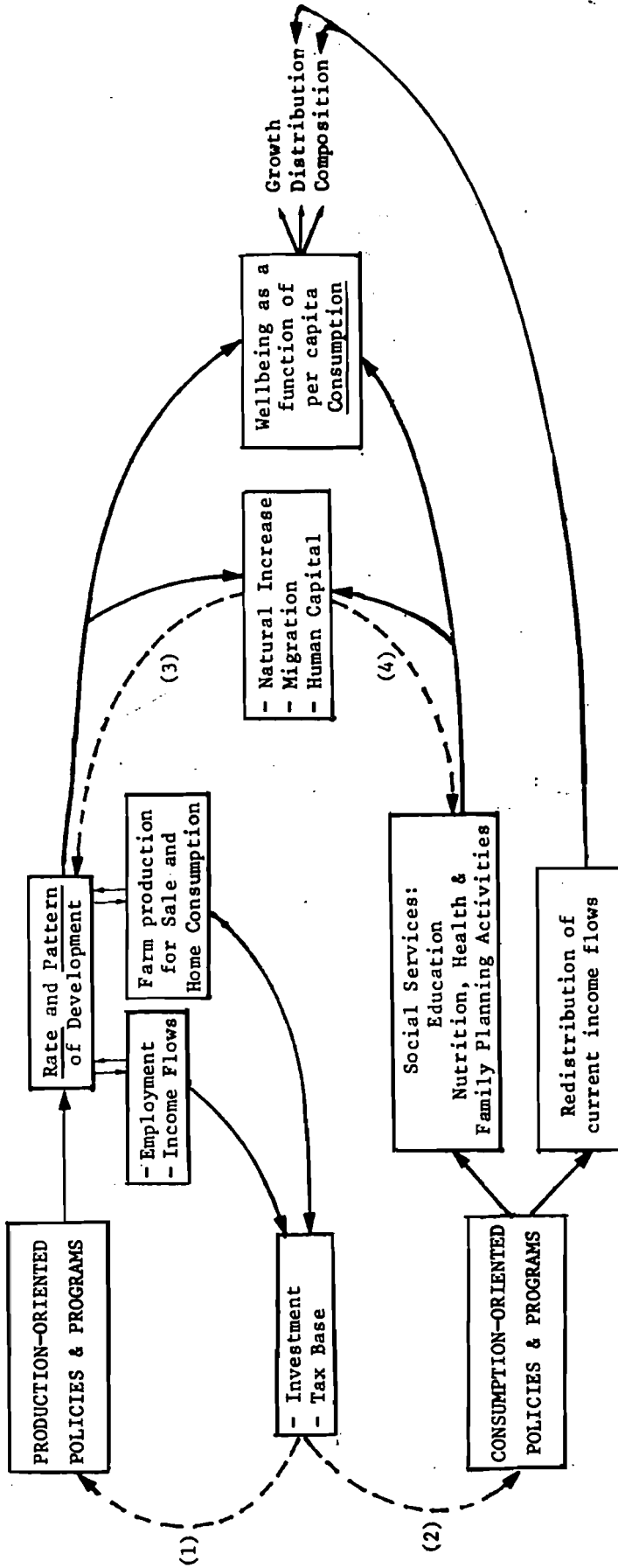


Figure 4. A Systems View of the Determinants of Rural Wellbeing.

Note: Solid black lines denote important causal linkages.
Dotted lines indicate major feedback loops.

is also a major source of government tax revenues in these predominantly agrarian economies. The feedback loops (1) and (2) emphasize that the level and allocation of these investment funds and tax revenues will affect future production and also the future level of consumption-oriented programs.

It is to be noted that the causal linkages associated with the rate and pattern of development are not limited to the direct effects on the growth, distribution, and consumption of per capita consumption. The diagram emphasizes that the rate and pattern of development will also influence the rate of natural increase, migration flows, and human capital formation. It is suggested later that the pattern of agricultural development may have quite a significant influence on the rate of change in fertility among rural families. Rural migration flows, will, of course, be influenced by the rate of natural increase of the rural population and by various other factors that determine the relative attractiveness of the income-earning opportunities available in rural and urban localities.* The rate of growth of the total population of working age in combination with the level of outmigration from agriculture will, as was noted in Chapter II, determine the rate of change of the rural labor force and the time required to reach the turning point when it will begin to decline in absolute size.

The lower portion of the diagram calls attention to the fact that consumption-oriented activities include two broad categories: the provision of education and other "public goods" as social services, and measures to redistribute current income flows, e.g., schemes for free or subsidized distribution of food. The causal linkages shown by the solid lines reflect the view that education and health services can be expected to have significant demographic and other indirect effects in addition to influencing wellbeing through changes in the availability of those social services. The effects on the rate of natural increase and on human capital formation are especially significant and are considered in some detail

*The major influence of the rate of population growth and the relative attractiveness of income-earning opportunities in rural and urban areas is emphasized in a major study of urban and rural population growth by the UN Population Division (UN, forthcoming). See also Mundlak, 1979, Ch. 2.

in Chapter V. On the other hand, it is assumed, plausibly we believe, that measures to redistribute current income influence rural wellbeing only through their effects on the distribution and composition of per capita consumption. Redistribution of productive assets, notably through a land reform program, would also affect the growth of output. That possibility receives attention later in the discussion of alternative strategies for agricultural development.

The feedback loops (3) and (4) emphasize that the rate of natural increase of the rural population, migration flows, and human capital formation have significant effects in future periods on the total and especially the per capita output available to rural households and also on the availability of social services. If the rapid growth of population and labor force which now characterizes the low-income countries persists, they will face either increasingly serious problems of "rural overpopulation" or "hyperurbanization", depending on the rate of outmigration from the rural sector. As previously noted, a pattern of rural development which fosters a relatively decentralized pattern of industrial development can lessen the concentration of the urban population in a few major cities.

In some of the low-income countries the problems of rural overpopulation are already severe. In Bangladesh, to cite an extreme example, landless labor households rose from an estimated 22 percent of all agricultural households in 1961 to 38 percent in 1973. This was a consequence of the acute shortage of arable land compounded by the inability of the country's very small industrial sector to absorb more than a small fraction of the annual additions to the labor force.* For similar reasons, the problem of rural overpopulation is also acute in Java where it is estimated that the landless and near landless account for more than a quarter of all rural households. And because of the progressive subdivision of land holdings, the average farm size is exceedingly small. In the Jogjakarta Region of Central Java, population

*According to estimates for the former East Pakistan, the nonagricultural sectors absorbed less than 10 percent of a 4.6 million increase in the country's labor force between 1951 and 1961 (Johnston and Kilby, 1975, App. Table V).

density rose from 492 persons per square kilometer in 1930 to 784 in 1970. According to a survey carried out in the early 1970s in a village in one of the most densely populated areas, 164 families had access to only 29.5 hectares, equivalent to 2350 persons per square kilometer. Nearly one-fifth of the families had no land at all, and the average holding for those with land was less than one quarter of a hectare (Singarimbun, 1973).

The increase in the size of the landless workforce has also been striking in India. It is estimated that between 1961 and 1971 the number of cultivators in India increased by 4 percent whereas the number of landless agricultural laborers increased by 80 percent (ADB, 1978, p. 55). Particularly in the Punjab and other areas of India where there has been considerable expansion of tractor cultivation, eviction of tenants by landowners has accounted for some of the increase in landlessness. But analyses of the process by Vyas (1976, 1979) suggest that rural population growth has been the major factor.

Rapid growth of the rural population also compounds the difficulty of extending the coverage and improving the quality of education and health services in rural areas. In India, for example, a rather impressive 61 percent increase in the number of literates in the 10-14 year-old age group increased the literacy rate from 42 to 50 percent between 1961 and 1971. But nevertheless, the absolute number of illiterates in that age group increased from approximately 28 to 34 million, and most of the illiterate population is located in rural areas. The substantial growth of the country's rural population has, of course, also compounded the difficulty of improving access to health services. The average per capita expenditure on medical and public health services by the Central and State governments averaged only 7.7 Rupees in 1973-74. That represented a 21 percent increase in per capita expenditure compared to 1971-72; but in real terms per capita expenditures for health services probably declined because the rate of inflation averaged 9 percent between 1970 and 1976 (UNICEF, 1977, pp. 87, 105; World Bank, 1978, p. 76; Cassen, 1978b, p. 198).

A highly significant positive interaction embedded in the feedback loops (3) and (4) is related to human capital formation.

Improvements in the quality of human resources resulting from investments in education and in improved health clearly have favorable effects on the growth of output. Moreover, this improvement in the quality of human resources has a favorable impact on output in the nonfarm sectors as well as in agriculture and other rural activities because of the substantial net outflow of migrants from the rural sector. It is also worth mentioning that the favorable feedback effects of human capital formation on the strengthening of social services applies not only to its effect in expanding the supply of teachers and health professionals and technicians required for rural schools and health programs but also through its effects on those served by social service programs. This is most obvious in the case of improved performance on the part of school children whose physical and cognitive development is not impaired by malnutrition or excessive morbidity. However, for the reasons that were noted in Chapter II, improvement in the health of mothers also enhances the results that can be obtained from the preventive and promotive activities that should be emphasized by rural health programs.

Being limited to the rural sector, Figure 4 ignores most of the interrelationships between the rural and urban sectors which are such an important feature of the development process. Some part of the investible funds originating in savings in agriculture is commonly invested in nonfarm enterprises, and analyses of those intersectoral flows indicate that the net transfer of resources out of agriculture is often substantial.* Likewise, the government

*These intersectoral resource flows have been well documented for Taiwan where the net outflow has been very large--20 to 25 percent of the net value of agricultural output (marketed and non-marketed) during the 1920s and 1930s and still nearly 15 percent of a greatly increased level of agricultural output during the 1966-69 period (Lee, 1971a and 1971b). During the latter period, the "invisible" outflow associated with a worsening of the terms of trade between agriculture and non-agriculture accounted for a large fraction of the net outflow. A recent study by Mundlak (1979) suggests that in Japan the net outflow of labor from agriculture was considerably more significant than the outflow of capital. However, he qualifies that conclusion by noting that the rate of technical change, which had a major influence on growth, was no doubt influenced by the rate of investment and therefore by the flow of savings from agriculture to nonagriculture. Presumably the outmigration of labor from agriculture was also influenced considerably by the level of investment in the nonagricultural sectors.

tax revenues collected from the rural sector may exceed the government expenditures for agricultural supporting services and for infrastructure investments and social services in rural areas. Finally, the level of wellbeing of the rural population is affected significantly by changes in the domestic and international terms of trade as determined by price changes affecting the commodities produced and purchased by rural households.

It was noted in Chapter III that highly protectionist import substitution strategies and other policies that distort relative prices can have serious adverse effects on rural welfare and can also frustrate overall development by blunting the incentives needed to achieve satisfactory rates of growth in farm productivity and output. But efforts to raise rural incomes by maintaining agricultural prices at artificially high levels can also be counterproductive. Long-term improvements in the wellbeing of the rural population require a transformation of the overwhelmingly agricultural structure of their economies and the growth in productivity, output, and employment within and outside agriculture made possible by the increased specialization and sectoral interdependence that are associated with that transformation. The substantial net migration of labor and population out of the rural sector is, of course, a consequence of the fact that economic development is characterized by relatively rapid growth of manufacturing and other nonagricultural sectors. Those issues, which have been examined in detail elsewhere, receive very little attention in this monograph. (See Johnston and Kilby, 1975, especially Chapters 2, 3, 7, and 8.) It cannot be emphasized too strongly, however, that the dynamic interactions between agriculture and the nonfarm sectors are of crucial importance in achieving the nation-wide increases in productivity and output required for self-sustaining, cumulative growth and for the elimination of poverty. Policies and programs that concentrate on improving the wellbeing of farm households which continue to rely mainly on subsistence production are doomed to a familiar kind of failure. This important lesson of history is emphasized just as strongly by China's recent experience of socialist transformation as by the experience of market economies such as Japan and Taiwan. (See, for example, Perkins et al., 1977.)

Trade-offs Among the Components of a
Rural Development Strategy

The foregoing review of the interrelationships among the components of a rural development strategy has called attention to a number of significant complementarities between production- and consumption-oriented activities. The existence of those complementarities, however, does not alter the fact that in low-income countries the financial, manpower, and other resources required to attain their economic and social development objectives are exceedingly limited relative to the range of activities that it would be desirable to undertake.

The most obvious competition for available resources is between production- and consumption-oriented activities. The resource requirements for expanding agricultural production to satisfy the growth of demand for food resulting from population growth and rising per capita incomes will be very great, especially if success is achieved in raising the incomes and purchasing power of the low-income households with inadequate levels of food intake and a high income elasticity of demand for food. Among the consumption-oriented activities, there are highly significant trade-offs between the allocation of resources for expanding and strengthening social services versus measures for redistribution of current income.

It is important for governments to face up to the hard choices involved in striking a balance between production- and consumption-oriented activities and among the components of each. It is usually the poor, and especially the rural poor, who suffer most as a result of unrealistic policies that fail to take account of the financial, administrative, and political constraints that limit what is feasible at any particular time. There is, however, a common tendency to ignore or gloss over the implications of those constraints.

Government decisions which lead to a commitment to costly programs for subsidized distribution of food to urban consumers provide an obvious example of this phenomenon. The resource requirements for such programs are substantial: in 1975 food subsidies in Egypt amounted to over 11 percent of the country's Gross Domestic

Product. Moreover, once such commitments are made they are difficult to reverse because of strong and highly visible political protests which, as in Egypt in January 1977, make it difficult or impossible to terminate or even significantly curtail such a program (L. Taylor, 1977, pp. 35-6). From a short-run, Basic Needs perspective it could perhaps be argued that allocating 11 percent of the country's Gross Domestic Product to a food subsidy program represented a satisfactory balance between production- and consumption-oriented activities and within the latter category. The availability of food aid from the U.S. substantially reduced the fiscal burden on the Egyptian government. The welfare benefits of the program for the urban poor were considerable because food purchases bulk so large in their total expenditure. Taylor asserts that termination of the program would have also had adverse effects on the rural poor, although it is not clear to what extent rural households benefit from the subsidy program. But given the fundamental importance of tasks such as increasing the country's productive capacity, expanding employment opportunities, raising farm productivity and incomes, achieving better coverage by rural health services, and slowing population growth, it needs to at least be recognized that such costly programs have a high opportunity cost.

Some of the more heady calls for viewing development choices in terms of redistribution suffer from the same wishful disregard of trade-off and feasibility issues. The Joint Committee Report on *Food and Nutrition Strategies in National Development* includes the questionable statement that in considering the costs and benefits of measures to reduce nutritional deprivation, "costs, if any, should be seen as the reduction of some people's consumption, and benefits should be seen as the increments of consumption by those whose situation is improved" (FAO/WHO, 1976, p. 54). For middle-income developing countries that view of the problem may have some validity. The political constraints to improving the wellbeing of the poor may be more significant than the economic constraints, and it can be argued that programs for supplementary distribution of food to the poor will be more acceptable, and therefore more likely to be implemented, than monetary income transfers. However,

even in the middle-income countries, large outlays for food subsidies are likely to result in a reduction in investment and in expenditures for research, education, and other development services, and such trade-offs should not be ignored. For the low-income countries, however, the basic structural and demographic features summarized in Chapter II mean that transfer-based approaches to improving general rural wellbeing can be, at best, grossly insufficient. And even programs focussed on selected target groups face absolute resource constraints due to the pervasiveness of poverty and its concentration in rural areas.

External aid can and should supplement the financial and manpower resources available within the low-income countries. In an abstract sense the statement quoted earlier, that "costs, if any, should be seen as the reduction of some people's consumption", would seem to apply at least as much to the large numbers of affluent consumers in developed countries as to the relatively small number of wealthy households within a developing country. But given the problems of inflation and the current climate of opinion in the developed countries, there is a danger of being overly optimistic about the extent to which foreign economic and technical assistance are likely to be expanded. It is sometimes asserted that developed countries would increase substantially the level of foreign assistance made available if they could be assured that aid flows would mainly benefit the poorest segments of the population in developing countries. But just as there are trade-offs in the allocation of domestic resources, there are undoubtedly trade-offs between the allocation of aid resources for programs to directly raise consumption levels and allocations for activities directed at raising a country's own productive capacity and at expanding social services for education and health.

The following statement in a WHO report is so relevant to this issue of reliance on foreign aid that it bears quoting at length even though the days of expecting a "miracle" from foreign aid are long past:

The greatest error in matters of health development, or indeed of any development, is to overestimate the possibilities and scope of international assistance. Progress will be illusory as long as countries continue to expect

some kind of miracle from aid. The multiplicity of sources of foreign assistance and the lack of coordination between them result in a dispersion of effort. Not only are too many projects started, but they are also often ineffective because the minimum requirements for success were not observed at the beginning... All too often projects, however interesting in themselves, bear little relation to the real situation and needs of the countries concerned, and sometimes they do not even conform to the aims of national socioeconomic development programmes. (Quoted in Davidson and Passmore, 1969, p. 751.)

The general problems that arise because of preoccupation with piecemeal programs which have only limited impact and which result from the distortions that can be introduced by foreign aid are illustrated by school feeding programs. A large number of school lunch programs have been initiated in developing countries, often as a fairly direct response to the inducement of foreign aid provided by donor agencies familiar with this type of intervention through experience in their home countries. Although school feeding programs are highly desirable, there are clearly other measures that warrant a higher priority. Reaching infants and small children is more difficult administratively, but their nutritional and health problems are more critical and can be influenced more significantly by the preventive and education measures included in integrated programs.

The recent emphasis in the U.S. on a Basic Human Needs approach to foreign assistance raises some important issues because of the country's major, though declining share, in foreign aid programs. U.S. foreign assistance in 1965 was equivalent to 0.5 percent of the country's GNP and represented 58 percent of the Official Development Assistance of the OECD countries. By 1976, however, the aid granted by the U.S. amounted to only 0.25 percent of GNP and accounted for less than one-third of the Official Development Assistance of the OECD countries (World Bank, 1978, pp. 98-9). Although it has been argued that orienting U.S. aid programs toward the objective of meeting Basic Human Needs will make it easier to reverse that trend, there is a danger that a narrow preoccupation with programs aimed directly at satisfying Basic Human Needs will make the task more difficult. Thus there

has been a reluctance in recent years to support major investments in irrigation and other rural infrastructure projects on the grounds that such activities would not directly benefit the poor. It is not surprising that some representatives of less developed countries have offered a cynical interpretation of the recent emphasis in the U.S. on Basic Human Needs as a ploy to give lip service to a humanitarian concern with the plight of poor families while stinting on support for costly investments in infrastructure and for the long-run institution-building activities that are indispensable requirements for increasing food production and expanding opportunities for productive employment. It is a false dichotomy to suggest that the relevant choice is between a Basic Human Needs strategy and a return to a "trickle down" approach to development. On the contrary, as far as rural development is concerned there is a need for a strong and explicit emphasis on agricultural development strategies capable of accelerating the growth of food production while simultaneously insuring broad participation in the development process. We turn to those issues in the following Chapter. Beyond that, there is a need for a substantial effort to redress the balance between urban and rural areas in the provision of social services. In the second section of Chapter V we examine the reasons why there now appears to be a special need to support efforts aimed at the design and implementation of integrated programs to promote improvements in nutrition and health and to foster the spread of family planning among rural households.

V. THE BALANCE BETWEEN PRODUCTION-ORIENTED AND CONSUMPTION-ORIENTED ACTIVITIES

The analysis in Chapter IV of interrelationships among the determinants of rural wellbeing and of trade-offs among components of a development strategy has highlighted the central importance of a country's agricultural strategy. In the first section of this chapter we examine some of the key issues related to the design and implementation of strategies for agricultural development.

Unfortunately, there is an acute lack of consensus concerning the consumption-oriented policies and programs that merit priority. Because the resource requirements for agricultural development are massive and the availability of financial and manpower resources is so limited in the low-income countries, the need to make difficult choices is apparent. In an excellent analysis of rural development programs in Africa, Lele (1975, p.123) has emphasized that "the substantial allocation of central resources to social services frequently occurs at the cost of more immediately productive investments in rural areas and, therefore, may prove self-defeating in the long run". The analysis of the preceding chapters emphasizes, however, that failure to give serious attention to the health and population aspects of the development problems confronting low-income countries is also likely to be self-defeating. The second section of this chapter summarizes our conclusions with respect to the nutrition, health, and population policies and programs that should be given priority in the development strategies of low-income countries. Those conclusions are necessarily tentative because evidence concerning the feasibility and effectiveness of the integrated approach that we emphasize is still limited.

We contend, however, that there is little room to doubt the fundamental importance of the interrelated objectives of improving the nutritional status and health of rural households and of fostering the spread of family planning. It was noted earlier that some 70 million tons of the projected food grain deficit of 120 to 145 million tons in the Developing Market Economies studied

by IFPRI is a consequence of population growth between 1975 and 1990. Because of the awesome power of compound interest, the exacerbation of the food problem related to rapid population growth will be much greater in subsequent decades unless the low-income countries find effective means to re-establish a balance between fertility and mortality. Reverting to high death rates is clearly not an acceptable means of re-establishing that balance. Achieving further progress in reducing mortality, especially among infants and small children, is an important objective but one which, in our view, needs to be linked effectively with efforts to lower fertility.

The Rate and Pattern of Agricultural Development

There is now increased awareness of the need to give a higher priority to rural development. However, the magnitude of the resource requirements for simply expanding food production are often not appreciated. We return to that point at the end of this section. There also is insufficient recognition of the difficulty of designing and implementing agricultural strategies which insure widespread participation in the benefits of growth as well as accelerating the growth of output.

The enhanced awareness of the central importance of rural development is often coupled with a recognition of the adverse effects of the myopic view of industrialization which has led to reliance on highly protectionist import substitution strategies. Those strategies have given rise to price distortions and related policies which have induced an inappropriately capital-intensive pattern of development within a modern enclave. This has received a disproportionate share of investment while contributing little to the expansion of job opportunities or to the pervasive process of modernization that is required for a more equitable sharing of the benefits of economic progress (Little, Scitovsky, and Scott, 1970; Healey, 1972; Morawetz, 1974). In India those tendencies were reinforced by a development strategy that assigned a high priority to capital-intensive investments in steel and other basic industries and which emphasized import quotas, investment licensing, and other direct controls. These policies have stifled

the growth of smaller and more decentralized manufacturing firms. Because such firms utilize less capital-intensive technologies, they are capable of generating a more rapid and widespread growth of nonfarm employment, and a more rapid growth in demand for food. This in turn both permits and requires more rapid growth of agricultural output (Mellor, 1976; Bhagwati and Desai, 1970). It is also noteworthy that there is now increased awareness that the "urban bias" that has characterized development policies and programs in many countries has had adverse effects on overall growth as well as contributing to the perpetuation of widespread poverty among the rural population (Lipton, 1977).

Fortunately, a considerable consensus has emerged during the past decade concerning both the feasibility and the desirability of emphasizing a broadly based pattern of agricultural development (World Bank, 1975, 1978; India, 1978, Ch. 9; ADB, 1978). There are, of course, extremely difficult problems to be overcome in translating intentions into effective policies and programs, even where there is a commitment to a broadly based and employment-oriented strategy. Furthermore, there is still insufficient recognition of the extent to which "unimodal" and "bimodal" (or dualistic) strategies represent mutually exclusive alternatives because of the structural-demographic characteristics of the low-income developing countries that were examined in Chapter II.

In countries where the population of working age is growing rapidly and the economic structure is overwhelmingly agricultural, it is simply not feasible to achieve success in simultaneously pursuing unimodal and bimodal strategies. A concentration of resources in a large-scale, relatively capital-intensive subsector that accounts for most of the increase in commercialized production will in large measure preclude the possibility of successfully pursuing a unimodal strategy leading to widespread increases in productivity and income. The existence of a trade-off between those two alternatives is obvious in land-scarce countries. If most of a country's arable land is cultivated by the large-scale subsector, the average farm size of the great majority of farm households will be even smaller than necessitated by the fact that the number of farm households is very large relative to the land area suitable for cultivation.

Because of the structural and demographic characteristics of low-income countries, pursuit of a bimodal strategy also tends to foreclose the opportunity for effectively implementing a unimodal strategy, even in countries where land is relatively abundant. This is a consequence of the cash income constraint that limits the purchasing power of the average farm unit. When some 60 to 80 percent of a country's population is still dependent on agriculture, the domestic commercial demand for farm products is very small in relation to the number of farm households. An important reason for the common emphasis on promoting production of export crops in developing countries is the fact that the expansion of farm cash income based on production for export is not limited by the size of the internal commercial market.*

The trade-offs associated with a choice between a unimodal or bimodal strategy are also related to the orientation of agricultural research and other supporting services. This is perhaps most apparent in connection with R & D activities pertaining to mechanical innovations, a topic to which we return shortly. It should also be noted that this choice between unimodal and bimodal patterns of agricultural development is an issue that arises in socialist as well as market economies. The term "bimodal" was first used in the context of agricultural development to describe the contrast between the large-scale, capital-intensive technologies employed on collective farms in the Soviet Union and the extremely labor-intensive technologies used on the tiny private plots of the members of a collective farm (T.W. Schultz, 1964, p. 123). The original blueprint for China's rural communes seemed to suggest an intention to move rapidly toward large-scale operational units. However, policies were soon modified and the major emphasis has been on a much more decentralized approach to decision-making. The critical operational unit seems to be the production team consisting of some 10 to 30 families, a unit that is

* It may be socially as well as privately profitable to promote large-scale, mechanized production of export crops if there is ample land available for expanding a country's cultivated area and if foreign markets can be expected to absorb a large increase in exports of the product in question without a substantial reduction in export prices. It appears that few countries have that combination of favorable circumstances.

apparently small enough to maintain worker incentives while applying capital-saving, labor-using technologies. On the other hand, the report of a recent ILO employment advisory mission to the Government of Tanzania expresses concern that a heavy emphasis on large, capital-intensive state farms may jeopardize the prospects for successfully implementing a broadly based agricultural strategy capable of raising the productivity and incomes of the "village sector" on which the great bulk of population depends for its livelihood (ILO, 1978, pp. 77-79)

Because the cash income constraint on expanded use of purchased inputs can be eased only gradually by the process of structural transformation, there are cogent economic as well as social reasons for pursuing a unimodal strategy that involves the progressive modernization of the great majority of a country's farm units. Given the structural and demographic characteristics of the low-income countries, the typical farm unit is inevitably small. And in many of these countries, the average farm size can be expected to decline considerably before the turning point is reached when the absolute size of their farm population and labor force finally begin to decline. It is worth recalling that according to the four hypothetical scenarios considered in Chapter II, the increase in the farm workforce over a 50-year period would range from a minimum of 75 percent, assuming a rapid decline in fertility and a very large increase in the rate of rural-urban migration, to a maximum of 475 percent with fertility and migration unchanged. Even more convincing is the historical fact that in Taiwan, where the rapid decline in mortality and acceleration in population growth began in the 1920s, the size of the average farm unit declined from about two hectares in 1930 to only one hectare in 1960. It was not until the late 1960s that a structural transformation turning point was reached. The farm population and workforce then began to decline in absolute size and the declining trend in farm size was reversed.

In brief, because of the constraints imposed by these characteristics of the low-income countries, agricultural development strategies must be oriented toward the needs of small farmers in order to have significant impact in alleviating the existing

problems of underemployment and poverty. To rely on measures for the redistribution of current income flows is simply not a viable alternative.

Land is the principal productive asset in the agricultural economy of a low-income country. When the political climate is favorable, land redistribution can make an important contribution toward narrowing the inequality in income distribution and insuring that the expansion of agricultural production is based on capital-saving, labor-using technologies which are appropriate to the factor proportions that prevail. There is substantial evidence of an inverse correlation between farm size and output per hectare, and the proposition that the technologies adopted by small operational units are labor-intensive is well established (Berry and Cline, 1976; Bardhan, 1973; Lau and Yotopoulos, 1971; Johnston and Kilby, 1975). Thus it can be asserted with considerable confidence that redistributive land reform programs are likely to have significant economic as well as social advantages although they may entail some adverse effects on output during a transitional period.*

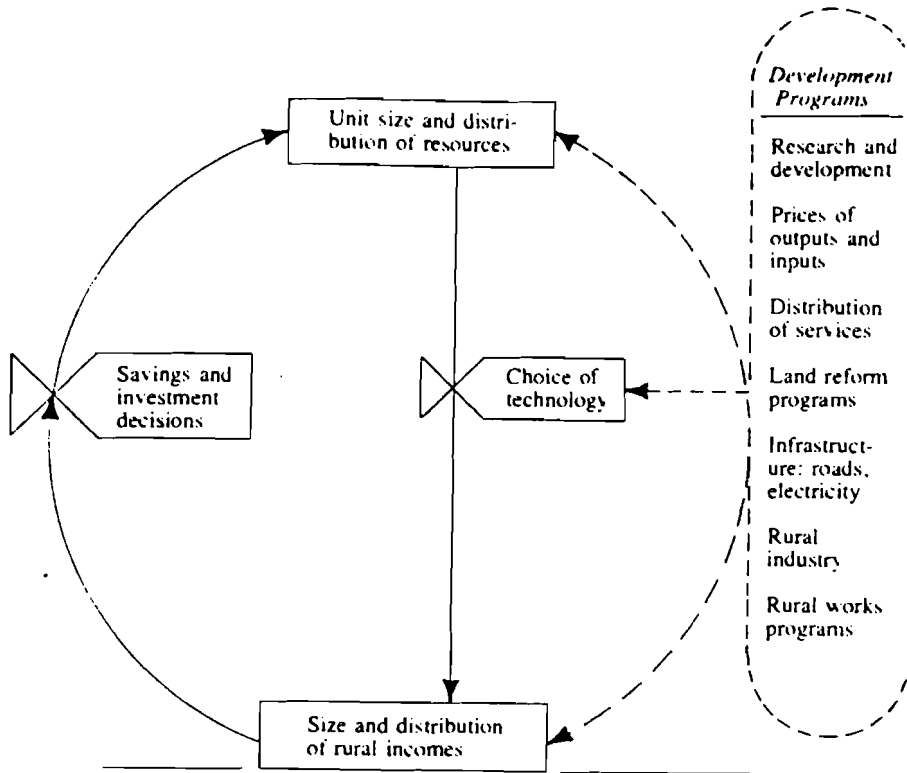
The difficult questions concerning redistributive land reform programs relate to their political feasibility. One knowledgeable observer who is sympathetic to land reform programs and fully aware of their potential advantages, has recently asserted that "an all out effort to implement land reform in India would undoubtedly fail at this point and would only serve to further exacerbate an already chaotic political situation" (Gotsch, 1979, p. 8). Many observers of the Indian scene would endorse that judgment, and in greater or lesser degree it probably applies to many

* In a paper discussed earlier, Schuh (1978) cites the Chilean land reform under Allende as an example of a policy distortion that had serious adverse effects on agricultural production. However, the economic structure of Chile with, for example, only 24 percent of its total labor force in agriculture, differs greatly from the circumstances in most of the low-income developing countries. For these countries, a "unimodal" pattern in which the size of most farm units does not differ very much from the inevitably small average size, continues to offer significant advantages. Moreover, the feature of the Chilean land reform which so adversely affected production seems to have been the weakening of incentives because farmers who received land were required to organize their production in collective units (Valdes, 1974, pp. 410-13).

other low-income developing countries. It is, however, hazardous to generalize about prospects for land reform because of differences between countries. In addition, dramatic changes in political climate can occur within countries even without the drastic change in regime that led to redistribution of land in China or the special circumstances of the post-World War II period that made it possible to effectively implement redistributive land reforms in Japan and Taiwan. Furthermore, even if the amount of land that can be made available for redistribution is limited, it may be possible to provide landless laborers with "house-plots" large enough to support a kitchen garden and a cow or a buffalo. This has been done on a fairly substantial scale in India with significant nutritional benefits, and Bell and Duloy (1977, p. 122) make the point that such plots can "go a considerable way toward reducing the dependent status of landless laborers."

Carl Gotsch's characterization of the Rural Production System shown in Figure 5 emphasizes that land reform is only one of a number of policies and programs that influence the distribution of land and other resources among farm units of various sizes (Gotsch, 1974, p. 137). He rightly emphasizes the central importance of technology and the fact that the choice of technology will be affected by the level and orientation of research, price policies, the distribution of credit and other support services as well as by land reform programs. Gotsch's analysis also stresses the importance of feedback effects which are likely to bring about changes in the distribution of land and other resources.

The feedback loops shown in Figure 5 call attention to the way in which an initial size distribution of land and other resources will be affected by the size and distribution of rural incomes in subsequent periods. This is primarily because of the powerful influence of income flows on savings and investment decisions which in turn are likely to lead to interrelated changes in the size distribution of farm units and in the technology applied. One of the more disturbing consequences of the Green Revolution in India and still more in Pakistan has been the way in which a rapid increase in incomes among large landowners, in combination with policies and institutional factors such as an overvalued exchange rate and preferential access to institutional



Source: Gotsch (1974), p. 137.

Figure 5. The Rural Production System.

credit, have encouraged premature tractor mechanization. It has sometimes been argued that those tendencies toward an increasingly dualistic pattern of development are an inevitable consequence of the technical innovations underlying the so-called Green Revolution. And the vagueness of the term Green Revolution lends itself to such an interpretation.

In fact, however, the high-yielding seed-fertilizer combinations that are the core technology of the Green Revolution are highly divisible. Experience in other countries, most notably Japan and Taiwan, demonstrates that in a more appropriate institutional and policy environment those innovations can lead to widespread increases in productivity and income among small-scale farmers. Moreover, the broadly based pattern of agricultural development which characterized Japan and Taiwan was established long before the land reforms of the post-World War II period created an egalitarian distribution of land ownership. The combination of strong research programs which generated divisible, yield-increasing

innovations suited to the needs of small farmers, plus substantial investments in irrigation and other forms of infrastructure, plus policies which enabled small farmers to have access to credit, fertilizer, and other inputs on the same terms as large farmers, led to the progressive modernization of the existing small-scale farm units.

This expansion path for the agricultural sector was economically efficient because the gradually enlarged expenditures for purchased inputs were concentrated on fertilizer and other yield-increasing inputs that enhanced the productivity of the on-farm resources of labor and land. The economic efficiency of a well designed "unimodal" pattern of agricultural development, so well illustrated by the experience of Japan and Taiwan, is demonstrated clearly by the fact that large increases in total factor productivity, i.e., increases in output per unit of total inputs, accounted for such a substantial fraction of the increases in farm output (Hayami and Ruttan, 1971, Chs. 6 and 7; Johnston and Kilby, 1975, Chs. 5 and 6). Furthermore, their pattern of agricultural development facilitated overall economic growth and structural transformation in many ways. In the period prior to the postwar land reform which led to an egalitarian distribution of land ownership, a large share of the gains in productivity and income accrued to landowners. But to a very considerable extent those large rental incomes were invested in rural nonfarm industries rather than being used to create large and inappropriately capital-intensive farm units.

Numerous factors contribute to the strength of the polarizing factors that account for the more dualistic patterns of agricultural development existing or emerging in many of today's low-income developing countries. The direct effects of economic policies and price distortions that lead to underpricing and preferential access to capital and foreign exchange are obvious. Tractors and tractor-drawn implements have often been available at prices well below their social opportunity cost. Moreover, the effects of such policies in impeding the growth of small- and medium-scale, rural-based manufacturing firms have contributed to a tendency for landowners to concentrate on maximizing their wealth,

power, and status within a "closed loop" in which farming is the only economic option that receives serious attention. That tendency has been reinforced in India and Pakistan by the large scope that existed for import substitution and by the fact that the major impact of the seed-fertilizer innovations was confined to limited areas such as the Punjab which already had well-controlled water supplies. As a result, the enormous increases in productivity and output in those areas had relatively little impact on agricultural prices; wheat growers in those vanguard areas were simply replacing American farmers in provisioning India's cities. Success in fostering more widespread technical progress, with the investments in irrigation and other infrastructure required to create environmental conditions favorable to the high-yielding varieties, will result in a growth of output which can be expected to put pressure on grain prices. It should also have more pervasive effects on the demand for labor because of the higher labor requirements associated with the new varieties, even without the increase in multiple cropping which they facilitate through their shorter growth period.* In the resulting situation of declining grain prices, the more alert and more aggressive landowners can be expected to turn to new and more rewarding areas of entrepreneurial activity. These tendencies will, of course, be strengthened to the extent that economic policies are modified in the direction of encouraging a more decentralized pattern of industrial development. Under those conditions, an increasing fraction of the rural elite will no longer concentrate on maximizing wealth and power within farming and will no longer be motivated to stubbornly resist changes aimed at improving the income-earning opportunities of small-scale farmers. In fact, there may even be a growing perception of the extent to which rapid, self-sustaining growth of the non-agricultural sectors requires widespread increases in income and purchasing power among the mass of the rural population.

*For a more detailed analysis which reaches analogous conclusions see Binswanger and Ryan (1977).

Those considerations underscore the importance of viewing policy design for agricultural development as a dynamic, adaptive process. To argue in terms of "absolute priorities" and to assert that a redistributive land reform is a "pre-requisite" for achieving a broadly based pattern of agricultural development is likely to be counterproductive. The important need is rather to "think in terms of sequences in the course of which a forward step in one direction will induce others..." (Hirschman, 1971, pp. 19-20). Leys (1971, p. 133) carries the idea a step further when he emphasizes that it is essential to assess realistically

....what changes--social and political, as well as economic--are within the politicians' 'means', and what are not; and what patterns or sequences of change, among those that are practical, will carry the process of development farthest and fastest at the least cost in the politicians' resources.

Although a redistributive land reform program that is effectively implemented can make a notable contribution to the task of achieving broadly based agricultural development, this is not sufficient to insure its feasibility. The rhetoric of land reform without effective implementation can easily have adverse effects. That outcome seems especially likely when land tenure reform aimed at fixing rental ceilings to prevent "rack renting" is advocated as a substitute for redistributive land reform. The political resistance to enacting legislation to limit rental rates is generally less determined than the opposition to legislation to redistribute land in excess of an acreage ceiling. But that is no doubt a consequence of the relative ease with which rental ceilings can be evaded. In situations in which the farm workforce is increasing rapidly and there is an acute lack of alternative income-earning opportunities, tenants or those seeking to become tenants have a strong interest in colluding with landlords in ignoring rental ceilings. What is probably more serious in its effects on the income-earning opportunities of the landless or near landless is the tendency for landlords to convert large ownership units cultivated by a number of tenants into large operational units. Because of the characteristics of the agricultural production

process that were emphasized earlier, this creation of large units is likely to induce farm operators to adopt tractors and related capital-intensive, labor-displacing technologies. Thus there is a real danger that land tenure reforms adopted to enhance the welfare of poor rural families will have the effect of exacerbating the problems of underemployment and meager incomes by strengthening the forces that lead to a bimodal pattern of agricultural development.

Land reform is only one of many issues that need to be confronted in the design and implementation of agricultural strategies capable of accelerating the growth of output by means that lead to widespread participation of the rural population in improved income-earning opportunities. The policies and programs that are needed in individual countries are to a large extent location-specific because of the great variation among countries and among farming regions within individual countries. Especially important are the variations in environmental conditions and in socioeconomic and historical factors that determine opportunities and constraints.

It is fortunate that a methodology of proven effectiveness exists for developing "biological-chemical" innovations for conditions of controlled water supply. The research activities carried out at IRRI (the International Rice Research Institute in the Philippines) and at CIMMYT (the International Center for Maize and Wheat Improvement in Mexico) have contributed greatly to the development of the high-yielding, fertilizer-responsive varieties of rice and wheat which have been the basis for the Green Revolution. The internal rate of return of the research at IRRI has been estimated at an astounding 84 percent. Even more significant than its direct impact, however, has been its indirect contribution in making national research programs more productive. It has been estimated that the internal rate of return on investments in national research programs rose from some 39 percent to 74 percent during the 1965-75 period and accounted for the bulk of the shift in supply functions attributable to rice research programs (Evenson, 1978, p. 238). The impressive achievements of agricultural research in a number of countries has led to a substantial

increase in the allocation of resources for agricultural research, and there has been a rapid expansion in the level of support provided for the network of international agricultural research centers. But unfortunately there are indications that the substantial increase in financial and technical support for the international centers has been in part a substitution for external support previously provided for strengthening research programs in individual countries. In any event, given the extremely high returns obtained from agricultural research and the limited allocations of funds for research in most developing countries, there is a strong presumption that there is still serious underinvestment in this activity (Evenson, 1978, pp. 242-43).

One of the urgent needs is for research to narrow the "yield gap" between the levels of yield that are technically and economically possible and those that are actually realized by the great majority of farmers. The existence of that yield gap points to the need for farm-level surveys to obtain better understanding of the major constraints faced by farmers. It also directs attention to the importance of training programs and improved institutional arrangements to achieve better management and utilization of water and of methodologies such as the so-called "Benor approach" in order to increase the effectiveness of agricultural extension activities.*

Another urgent need in many countries is for huge investments in irrigation and drainage facilities. Such investments are needed not only to extend the area capable of benefitting fully from high-yielding varieties but also to permit increased multiple cropping which expands the opportunities for productive employment in agriculture as well as increasing production. Unfortunately, the costs of extending the area under irrigation have been rising

*For an excellent discussion of these issues, see the "Second Asian Agricultural Survey" carried out under the auspices of the Asian Development Bank (ADB, 1978, pp. 65-101, 242-55). The recent *World Development Report, 1978* prepared by the World Bank (1978, Chs. 4 and 5) contains a very concise review of the priority problems of increasing agricultural productivity and output in Asia and in sub-Saharan Africa. (The highly structured approach to extension sometimes referred to as the Benor approach is described in more detail in Benor and Harrison, 1977.)

sharply because so many of the areas best suited to the construction of dams and gravity-flow irrigations systems have already been utilized. It has been estimated, for example, that in Asia the average cost (per hectare served) of constructing an irrigation system has more or less doubled during the past decade (Herdt, Te, and Barker, 1977, p. 194). Furthermore, in a number of areas, the depletion of ground water supplies in aquifers is beginning to limit the scope for further expansion of irrigation based on tubewells.

Another priority is related to the need to develop more productive technologies adapted to rainfed conditions. Because of both technical and economic constraints on extending the area under irrigation, a large fraction of the agricultural land in developing countries will continue to depend on rainfed production. In some instances very substantial increases in yield and output have already been achieved under rainfed conditions. The rapid spread of hybrid maize in Kenya is a notable example of success in achieving rapid diffusion of high-yielding varieties of hybrid maize among small-scale farmers (Gerhardt, 1975).

In many areas, however, the level, variability, and seasonal distribution of rainfall limit the yield increases that can be obtained simply by the introduction of improved seed-fertilizer combinations. In such areas, and this is especially true of semi-arid regions as illustrated by the "medium potential" area in Kenya discussed in Chapter II, there appears to be a need to supplement biological and chemical innovations by equipment and tillage innovations to improve land and water management (Johnston, 1978, 1979). Unfortunately, the research efforts devoted to such problems have been so limited that the research base for increasing productivity and output in those areas is grossly inadequate. The capital-intensive tractor-based technologies that have been developed in the U.S., Australia, and other developed countries are highly productive. But they are ill suited to socioeconomic environments in which a large farm workforce constitutes a relatively abundant resource whereas capital and foreign exchange are scarce and have a high opportunity cost because they are indispensable for industrial development.

The establishment of ICRISAT (the International Crop Research Institute for the Semi-Arid Tropics) with responsibility to intensify research on this range of problems is an important addition to the network of international agricultural research centers. But the need to stress location-specific national and sub-regional research programs is especially urgent in the semi-arid and other rainfed farming regions because of the great heterogeneity of their environmental and socioeconomic conditions. This consideration seems to apply with particular force to efforts to generate locally adapted equipment and tillage innovations. Research already carried out by ICRISAT demonstrates that improved systems of land and water management utilizing animal draft power and a well-designed tool carrier can lead to large increases in output and in net farm income. The results obtained vary greatly, however, depending on the type of soil (Ryan et al., 1979).

Considerable research aimed at the testing and design of improved animal-drawn implements and other simple, inexpensive items of farm equipment has been carried out in a number of countries. The most substantial program of that nature has been carried out at IRRI, and it appears to have had a considerable impact in fostering local manufacture and expanded use by farmers of items such as hand-pushed rotary weeders and a simplified version of the power tillers that spread rapidly in Japan beginning in the mid-1950s and in Taiwan some 10 to 15 years later. The work at IRRI has benefitted considerably from the long experience in Japan and Taiwan in developing a widening range of farm implements suited to the needs of small-scale farmers. However, the relevance of the work at IRRI, as of the earlier experience in Japan and Taiwan, is pretty much limited to irrigated rice production. (For a brief account of Taiwan's experience and comparative analysis of experience in India and Pakistan, see Johnston and Kilby, 1975, Ch. 8.)

By and large the R & D activity on inexpensive farm equipment adapted to upland conditions has had only limited impact on farming in developing countries. The principal exceptions appear to be certain areas in India and the francophone areas of West Africa (Johnston, 1978). (Mazubuka District in Zambia is also an interesting example of an area where there has been widespread adoption

by small farmers of a considerable range of improved animal drawn equipment, including mouldboard plows, interrow cultivators, and carts.)

At least in the countries of tropical Africa, the lack of success to date appears to be related to three principal factors. First, there has been a common tendency among agricultural administrators in those countries and foreign technical advisers to emphasize tractors which are viewed as a symbol of a "modern" agriculture. Subsidized tractor hire services (and in Tanzania, heavily subsidized distribution of tractors to selected "ujaama" villages) have diverted serious attention from the potential contribution of animal draft power in overcoming the labor bottlenecks resulting from continued reliance on human muscle and the hoe. A second factor has been the very limited availability of financial and manpower resources for all kinds of agricultural research. In fact, there appears to be an especially great need to strengthen agricultural research in tropical Africa. Even though food production estimates are subject to a considerable margin of error, it seems clear that the rate of growth in output in recent years has been especially unsatisfactory in tropical Africa. And several recent studies have stressed the fundamental importance of deficiencies in the research base and in the availability of profitable and feasible innovations (Anthony et. al., 1978; Lele, 1975).

A third factor has been the lack of an effective methodology for undertaking R & D activities to generate mechanical and tillage innovations. In most countries efforts have been concentrated on the development and testing of equipment by agricultural engineers. However, the need is for improved implements that will fit into improved farming systems, and it is not surprising that engineers working on their own have not had much impact. This seems to be an obvious case in which there is a need for a "systems approach" by engineers, agronomists, and other scientists which takes account of the interacting effects on crop yields of equipment design, tillage methods, soil characteristics, moisture conditions, and varietal improvement and fertilizer use (Johnston, 1979).

Another neglected area that calls for increased attention concerns the role of women in rural households. In many developing countries, and especially in tropical Africa, women play a major role in crop production and other agricultural activities. It is difficult to generalize about the sexual division of labor in African agriculture because it is highly variable in different regions and among different ethnic groups, and evidence from many areas suggests that there is increasing flexibility and even a breaking down of the traditional sexually based division of labor. However, women are commonly responsible for the production of food crops and for lighter tasks such as weeding, and they typically devote considerably more time than men to agricultural activities. Moreover, women often play a major role as decision makers and managers. In fact, a large percentage of rural households are headed by women--45 and 35 percent respectively according to estimates made for Kenya and Malawi. Nevertheless, most agricultural extension agents are men, and farmer training and extension programs have given relatively little attention to reaching women. It has therefore been emphasized that "the neglect of women's role in agriculture may act as a drag on economic growth and contribute to imbalances in the distribution of the benefits of the growth that does occur" (Lele, 1975, p. 77).

The agricultural work carried out by women is almost always superimposed on their household activities. For many village women those household activities include the time-consuming drudgery of hauling water and firewood long distances in addition to the usual household tasks of preparing food and rearing children. Moreover, the preparation of food includes such activities as the shelling of maize, hand pounding of grain, and other processing activities as well as cooking.

When extension programs have been concerned with women, they have frequently been oriented exclusively toward domestic science, and the care of children. Too often the foreign advisers who have influenced these programs have tended to ignore the significant involvement of women in subsistence production and in cash income-earning activities, and in some cases the practices demonstrated have been ludicrously beyond the reach of women in a typical African village.

Beyond the need to put more emphasis on the dissemination of information about agricultural innovations to women, the most promising possibilities seem to lie in fostering wider use of various types of improved equipment at the household or village level. The two innovations which have probably had the most widespread impact to date are hand gristmills or small motorized mills for grinding maize, other cereals, and dried cassava and schemes for supplying water at the village level. In some areas simple dug wells have provided a more convenient source of water, but it is often necessary to resort to schemes for bringing piped water from a river or spring. This entails substantial capital and recurrent costs, especially if a motorized pump is required. However, low-cost methods of storing water also offer promise. Catchment tanks are not uncommon in relatively prosperous areas where metal roofs have been introduced. And the use of wheel barrows for hauling water has often been advocated.* Wheel barrows, hand carts, and animal drawn carts can, of course, also reduce the labor time for many other hauling activities, including the hauling of manure to fields, a practice which often increases yields considerably because of its favorable effect on the water-holding capacity of the soil as well as in providing additional nutrients.

Hand-operated maize shellers and groundnut (peanut) decorticators are additional examples of inexpensive items that permit a considerable saving of labor time. Community development programs in India as well as Africa have sometimes promoted stoves of improved design as a means of reducing requirements for firewood or dung for fuel, although it is reported that an "improved" stove introduced in Sierra Leone reduced the amount of smoke inside the house but used more firewood (Carr, 1979, p. 26). For many years there has been considerable interest in methane generators using manure and other types of organic matter. These generators can provide gas for cooking without reducing the nutrient value of the residue which is then used for fertilizer. The spread of biogas generators has been rather slow in India, but an even simpler and

*According to an estimate by D.J. Vail, the introduction of a \$10 wheel barrow would reduce the time required for hauling water in Tanzania villages from an average of over 300 hours per family per year to about 100 hours (Lele, 1975, p. 27n).

cheaper design that has reportedly been spreading rapidly in parts of China has aroused new hope (Dosik and Falcon, 1978).

Understanding of the range of problems related to the role of women in rural areas and of the most promising means of reducing drudgery and increasing their productivity and status is still inadequate. Expanded local manufacture and use of various items of improved household equipment appears to be quite limited. This is no doubt in part a reflection of the severe cash income constraint faced by rural households in low-income countries, but it is probably also influenced to a considerable extent by a failure to recognize that women's time has a high opportunity cost and that welfare of the family, not only the wellbeing of women, suffers from viewing their time as a "free good".

One observer who has been studying the role of women in African rural households has asserted that

Schemes which aim at improving conditions by teaching rural women better nutrition and primary health care constantly fail because the women at whom they are aimed are just too busy to attend classes on a regular basis or put the fruits of their learning into practice (Carr, 1979, p. 9).

It is difficult to assess the validity of that generalization on the basis of evidence now available. But clearly in designing rural health schemes it is important to be conscious of the competing demands on the time of women. It also seems pertinent that success in promoting better child spacing and smaller families can help reduce the time burden associated with the care and feeding of small children as well as having direct beneficial effects on the health of mothers and their children.

Several attempts have been made to estimate the investment requirements associated with expanding food production in developing countries. According to recent estimates by IFPRI (1978, p.3), more than \$60 billion in additional investment will be required by 1990 to close the food gap for 36 food-deficit, low-income nations that contain about one-third of the world's population. Additional investments for irrigation alone account for \$45 billion of

that total. Such estimates require many assumptions and approximations, but the figures are broadly consistent with earlier estimates by FAO, by the Consultative Group on Food Production and Investment, and by a Japanese team that carried out a study on behalf of the Trilateral Commission.

A recent study of prospects for Asian rice production carried out by economists at IRRI is also of interest. Their projections are limited to investment requirements for expanding rice production in Asia for the period 1974-85. The implications of their projections are "sobering". They

....imply that in the absence of technological change, it will be impossible for production to grow fast enough to match population growth even with a level of annual investment twice as high as that of the past decade (Herdt, Te, and Barker, 1977, p. 201).

The need to foster technological progress in order to increase the productivity of conventional inputs such as irrigation and fertilizer underscores the critical importance of measures to strengthen agricultural research, extension, and other training and institution-building activities. The need to increase the efficiency as well as the level of investment has also been noted by IFPRI (1978, p. 3) which has emphasized the need for improvement in human capital, including a very large expansion of scientific, technical, and managerial skills. Successful implementation of strategies to accelerate agricultural development will depend as much on meeting those institutional and manpower requirements as on mobilizing the funds required for greatly increased levels of investment.

It was noted earlier that the IRRI projections of investment requirements for expanding rice production take account of an approximate doubling of the cost per hectare for expanding irrigation due to the fact that most of the lower cost sites for irrigation schemes have already been developed. Their analysis also directs attention to the fact that the scope for future increases in Asian rice production related to increased use of fertilizer will be more limited than during the past decade and

a half. During the five-year period from 1963 to 1967, an annual rate of increase in fertilizer use of 18.5 percent made a very significant contribution to the expansion of rice output in Asia. Because the initial levels of fertilizer use were so low, the effect on rice yields during that period is probably fairly well approximated by a linear response function using the "rule of thumb" that one kg of fertilizer yields 10 kgs of additional paddy output. The IRRI projections for 1974-85, however, take account of the influence of the type of rice variety (modern, fertilizer-responsive vs. traditional), whether production is under irrigated or rainfed conditions, and the projected levels of fertilizer application and rice yields are related to those factors. Of particular relevance for future prospects for expansion of rice and other cereals is the fact that the response to additional fertilizer diminishes as the level of use increases. The IRRI projection models assume that fertilizer use will continue to expand rapidly during the 1974-85 period; in all cases except one at an initial rate of 12 percent in 1974 declining gradually to 8 percent per year by 1985. However, a projection which assumed a more gradual decline so that the expansion of fertilizer use was still at a 9.5 percent rate in 1985 would reduce the grain to fertilizer response ratio to a point that a very large fertilizer price subsidy would be required to induce farmers to apply that level of fertilizer.

Those IRRI projections are, of course, subject to the usual qualifications of being dependent on various assumptions. However, the general implications of the analysis are valid and important. Of particular relevance to the population issue examined in the next section is the implication that future expansion of rice production will tend to become more costly because of the onset of diminishing returns to increased fertilizer use and the rising costs of expanding the area under irrigation.

Nutrition, Health, and Population in Rural Development Strategies

The difficulty of striking an effective balance between production- and consumption-oriented/policies and programs are

matched or perhaps exceeded by the difficult issues that arise in determining priorities within the category of consumption-oriented activities. In our examination of the interrelationships among the various determinants of rural well-being we suggested that there is a presumption that social services, notably rural education and health services, merit a higher priority than measures to redistribute current income flows. There is general agreement concerning the need to give a high priority to education because it is recognized that expenditures on education are an "investment" which contributes to economic growth in addition to yielding benefits for those receiving education. It is also widely accepted that education, especially of women, is one of the strongest influences contributing to the changes in attitudes and behavior required for a reduction in population growth rates. We are persuaded that there are equally cogent reasons for believing that rural health programs designed to foster a reduction of fertility together with improvements in the nutritional status and health of the most vulnerable groups--infants, small children, and mothers--have significant indirect effects on human capital formation, the rate of natural increase, and migration flows in addition to the direct effects on the wellbeing of the recipients of health services.

Views with respect to measures to directly alleviate poverty by redistribution of income through such programs as free or subsidized distribution of food appear to be especially prone to ad hoc arguments which emphasize the desirability of the objective but gloss over the opportunity cost of allocating scarce resources for those activities. Thus a recent IFPRI report (1978, p. 6) notes "that widely admired food distribution programs such as Sri Lanka's are expensive, particularly with respect to public sector resources". The somewhat surprising conclusion, however, is that "Nevertheless, it appears that broad food subsidy programs are, despite the high costs, a promising means of improving the welfare of large numbers of poor people". The conclusion is especially surprising in this context because the main thrust of this brief report on IFPRI's research program is to emphasize the fundamental importance of expanding food production and

income-earning opportunities and to stress the enormous resource requirements for achieving rates of increase sufficient to meet the growth in effective demand that will occur by 1990. It is noted that in India the poorest 20 percent of the population devote as much as 50 percent or more of increments in income to increasing their consumption of foodgrains (IFPRI, 1978, p. 5). In low-income countries where poverty and inadequate or marginal levels of food intake are pervasive phenomena, inflationary increases in food prices resulting from a failure of food supplies to match the growth in effective demand are bound to have especially adverse effects on families in the bottom deciles of the income distribution. This follows directly from the fact that such families devote such a large fraction of their income to food, and in addition they have very little scope for maintaining the level of energy intake by shifting to cheaper sources of calories. There are indeed cogent reasons for emphasizing the need for a major effort to prevent a disastrous increase in food deficits between now and 1990. But curiously, this report, and the earlier IFPRI report on *Food Needs of Developing Countries* (1977b) fail to note that the rapid population growth which must be expected to continue in virtually all of the low-income countries will have greater effects on the growth of effective demand for food in the post-1990 period.

There are several reasons for our focusing in this section on the issues relevant to determining the priority to be given to programs to enable the rural population to have access to a "composite package" of nutrition, health, and family planning services. The fundamental reason for this emphasis is, of course, that we are persuaded that such programs are feasible and highly desirable because of the potential that they have for making important direct and indirect contributions to the multiple goals of a rural development strategy. At the same time we recognize that the design and effective implementation of rural health programs confronts formidable problems so that the prospects for success are not good unless there is considerable agreement that integrated programs merit a high priority and determined efforts are made to overcome the problems that are sure to arise in such a difficult undertaking.

It was emphasized in Chapter III that there seems to be an emerging consensus about including integrated nutrition, health, and family planning programs as a component of strategies for rural development. And that consensus is not confined to those with a special interest in health problems. The UN Economic and Social Commission for Asia and the Pacific has organized a Regional Seminar to examine those issues.* The Aide-Memoire outlining the background for that seminar notes that "it is being increasingly recognized that it is essential to adopt an integrated approach by efficiently linking" activities related to family planning, nutrition, and health. In recent discussions of agricultural and rural development policies at the Asian Development Bank there has been considerable acceptance of the idea that, especially for the poorer countries, the Bank should be prepared to provide support for basic public services and especially for health, nutrition, and family planning activities combined in an integrated approach (Hsieh, 1979). It is not surprising that a chapter on the effects of nutrition and health on fertility in a recent symposium on *Population and Development* summarizes a number of arguments that have been advanced for pursuing an integrated approach to the delivery of health, nutrition, and family planning services (Butz and Habicht, 1976, p. 226). It is noteworthy, however, that chapters in that volume dealing with the sociological and economic aspects of the relationships between education and fertility endorse the proposition that reducing infant and child mortality is likely to be one of the most promising interventions for lowering fertility (Holsinger and Kasarda, 1976, p. 163; DeTray, 1976, p. 207).

Nevertheless, there is still a great deal of controversy concerning the advantages and disadvantages of an integrated approach to the delivery of nutrition, health, and family planning services. As was noted in Chapter III, many population and nutrition specialists are either opposed to integrated programs or only give lip service to that approach. Although this can no

*This Regional Seminar is to be held in Bangkok from the 24th to the 31st of July, 1979.

doubt be explained in part by the normal bureaucratic concern for one's own specific program, there are also more serious reasons. Thus it is sometimes argued that single-service programs are less likely to encounter the problems of "channel overload" that arise when a village-level health worker is concerned with a set of activities embracing nutrition, health, and family planning. In addition doubts are often expressed about the implementation capacity of the Ministry of Health in many developing countries. Finally, some population specialists are concerned about a possible diversion of funds and efforts away from a concentrated effort to slow population growth (Ness, forthcoming).

Recent papers by John Mellor, the Director of IFPRI, imply quite different reasons for dismissing integrated health programs as a component of a rural development strategy. Basically, he argues that achieving more rapid agricultural growth and wide participation in improved employment and income opportunities is both a necessary and sufficient condition for reducing birth rates to levels consistent with sharply reduced mortality rates. Thus he states:

The relevant question is not whether demographic change will occur, but when it will occur. The sooner broad-based development policies leading to demographic transition are implemented, the sooner the transition will be completed and the smaller the final population number will be. (Mellor, 1978, p. 17)

Mellor acknowledges that further improvements in contraceptive technology and programs to improve access to contraceptives can facilitate the transition. But he emphasizes that family planning programs are inexpensive "compared to the costs of development necessary to create the desire for a small family ..." (Mellor, 1978, p. 19). Reference to the potential contribution of nutrition and health programs is limited to a remarkably offhand interpretation of China's experience. He asserts that "improving diets for the mass of people has done wonders for health in China", but the role of the county's rural health activities is

dismissed by the comment that "the Chinese seem now to have more questions than answers about the system of slightly trained, part-time barefoot doctors" (Mellor, 1978, p. 8).

Continuing controversy about the so-called "child survival hypothesis" has also been a source of resistance to the concept of an integrated approach to health, nutrition, and family planning. Some of the earlier statements advocating a higher priority for programs to improve nutrition and health made extravagant claims about the more or less automatic reduction in fertility that would result from reducing infant and child mortality. The argument was that there was not only a high risk that children would not survive to maturity but also great uncertainty about the survival prospects of children in a particular family so that parents would "overcompensate". This controversy has given rise to a huge literature. The not very surprising conclusion is that reduced child mortality will not "automatically change child-bearing attitudes or levels of fertility" and that the rate of natural increase will rise because "the fertility reduction will be smaller in magnitude than the mortality reduction" (Madigan, 1975, p. 278; Preston, 1975, p. 191). The rapid rates of population growth that were examined in Chapter II are, of course, a result of the slow and limited declines in fertility that have been associated with rapid declines in mortality levels. However, the reductions in mortality that have occurred cannot be ignored. In very general terms the relevant question is: How best to complete the half-completed demographic transition?

Attention was given in Chapter II to a dozen low- and middle-income countries which have clearly entered the second phase of the demographic transition with fertility declining a good deal more rapidly than mortality. Brief attention was given to a few of the many attempts to identify the determinants of fertility decline. Of the two variables that determine a country's rate of natural increase, this is obviously the only one that is amenable to purposive action by governments. In spite of an enormous increase in research on this question, attempts to explain fertility differentials and changes in fertility remain highly tentative.

In our judgment an attempt by Easterlin (1975, 1977) to provide a synthesis of "the economics and sociology" of fertility is the most valuable analytical framework for clarifying our understanding of the interactions between socioeconomic factors and changes in fertility and for assessing the probable effects of possible interventions. His framework focuses on three sets of variables which influence family size: (1) demand which he defines as "the number of surviving children parents would want if fertility regulations were costless"; (2) supply, which is defined as "the number of surviving children parents would have if they did not deliberately limit fertility"; and (3) the costs of fertility regulation, defined to include subjective or psychic costs as well as objective costs (Easterlin, 1975, p. 55).

Whether parents are motivated to restrict family size is determined by the relationship between the potential supply and the demand for children. Particularly pertinent to the demographic situation in the low-income countries is that before a country has begun the demographic transition there is no "problem" of unwanted children. That is, because of high infant and child mortality the "potential supply" of children falls short of the number that is desired. Traditional practices such as an intercourse taboo during lactation may hold expressed fertility well below the biological maximum, but there is no conscious desire or action to limit fertility. In fact, traditional values and attitudes, such as the importance of child-bearing as a source of status for women, serve to reinforce a large-family norm in the premodern situation that exists prior to the demographic transition.

As child-survival prospects are improved, however, a threshold is reached as parents become aware of a new situation in which the potential supply exceeds the desired number of children. Reaching that threshold marks the transition from premodern to modern fertility determination, the latter being characterized by a situation in which it is usual for family size to depend on conscious decisions by individual parents. The emergence of an "excess supply" situation will, of course, be influenced by

changes that reduce the desired number of children, such as the change in perceptions concerning the economic benefits and costs of rearing children which occur as child labor is reduced and more children attend school. That is an aspect of a more general change in attitudes which occurs as parents come to attach greater weight to the "quality" than the "quantity" of children.

Various aspects of "development" or "modernization" will have important effects in determining how soon that "fertility threshold" will be reached. Urbanization, which has historically been a key factor in the process, will be considerably less significant for the contemporary low-income countries because of their structural-demographic characteristics which make it inevitable that the rural population will continue to weigh heavily in their total population for several decades at least. Other aspects of modernization such as increases in per capita income, expansion of education, and exposure to mass media will have positive as well as negative effects so there is no simple linear relationship between those variables and changes in fertility.

There is a fair amount of evidence, as was noted in Chapter II, which suggests that increases in per capita income are likely to induce a substantial decline in fertility when income distribution is relatively equal. The extremely rapid declines in fertility in Japan and Taiwan appear to have been facilitated by their unimodal agricultural strategies which enabled the great mass of their rural populations to participate in processes of economic, technical, and social change. A detailed study of fertility change among rural households in Taiwan by Mueller (1971, pp. 37-38) led to the conclusion that "where agricultural improvement is confined to a minority of cultivators... the expansion of economic horizons will be more limited than in Taiwan. Only a minority will then experience the rising aspirations that in Taiwan seem to be contributing so importantly to acceptance of family planning in rural areas."

Easterlin's analytical framework seems especially relevant to understanding the relationship between changes in child-survival prospects and reductions in fertility. Although the automatic and immediate links between reduced child mortality and lowering of the birth rate are probably not terribly strong, there is now a great deal of evidence which suggests that attaining a certain threshold in the reduction of infant and child mortality, together with an awareness of that change, can exert a strong influence on achieving the more general threshold that marks the transition from premodern to modern fertility determination.

A particularly attractive feature of integrated nutrition, health, and family planning programs is that they have the potential for achieving further reduction in infant and child mortality and also for promoting increased awareness that the risk of child loss has been reduced significantly. Furthermore, the general attitudinal changes associated with improved health and a less fatalistic view can be reinforced by establishing routines for integrated programs whereby family planning information is introduced at strategic "entry points" when parents are likely to be receptive to the idea of family planning. Thus there are cogent reasons to expect that integrated health, nutrition, and family planning programs are likely to be more effective than single-service programs in bringing about the changes in attitudes and behavior required for a reduction of birth rates.

In Easterlin's analytical framework, the actual decisions which determine family size depend on the relationship between the strength of the motivation (if any) to restrict births and the psychological and objective costs of fertility regulation. Family planning programs that achieve broad coverage of the rural population can be very effective in sharply reducing the objective cost of regulating fertility by providing convenient and inexpensive access to reliable methods of contraception.

Such programs often attempt to use "field motivators", and sometimes incentive payments as well, to motivate parents to accept the practice of family planning. Experience with integrated programs, however, seems to confirm the a priori expectation that the introduction of family planning as part of a comprehensive program concerned with family health and welfare increases the credibility of field workers and tends to strengthen the motivation of both clients and field staff.*

There are additional reasons for the emerging consensus concerning the high priority that should be given to integrated delivery systems which emphasize a "package" of health, nutrition, and family planning services with a focus on mothers, infants, and small children. It has been seen that the problems of malnutrition and of unnecessarily high mortality and morbidity are concentrated among those vulnerable groups. In addition, the seriousness of those problems is usually a consequence of the two-way interactions between nutritional status and the prevalence of infections and parasitic diseases. The death rate for measles, for example, is often more than 200 times as high in low-income developing nations as in developed countries, and acute cases

*Some of the evidence is briefly reviewed in Johnston and Meyer, 1977, pp. 13-16. It is suggested there (p. 15) that "the frequent and timely discussion of family planning by a field worker associated with broad health objectives has an appreciable motivational advantage over its potentially more haphazard and less salient discussion by a worker associated solely with birth prevention in the typical nonintegrated family planning program". In support of that view, Johnston and Meyer quote the following observation from an evaluation report on Kenya's Special Rural Development Programme: "There is a strong local feeling [in Kakamega District where an intensive family planning project was underway], which is perfectly understandable, that family planning facilities should not be considered a priority in an area in which basic medical facilities are still lacking. This may itself engender a negative attitude toward family planning" (IDS, 1975, p. 17). Social learning theory and a considerable body of experimental evidence also provides support for the view that the presentation of a package of interrelated innovations such that the adoption of one implies the subsequent adoption of others is an effective strategy for bringing about behavioral change.

of malnutrition are often caused by diarrhea and reduction of food intake because of loss of appetite and mothers withholding food. In addition, a mother's nutrition, especially during the gestation period, affects a child's birthweight and prospects for survival.

Moreover, there is substantial evidence concerning the efficacy of MCH programs in sharply reducing infant and child mortality. Probably the strongest evidence is provided by the large reductions in infant and child mortality in countries such as Taiwan, China, Sri Lanka, and Costa Rica where health programs have achieved broad coverage of rural areas. According to fairly recent estimates, only about 3.6 percent of children born in Taiwan die before reaching the age of 5, which is just one percentage point higher than the U.S., whereas in India and Pakistan the corresponding figure is roughly 30 percent (Berg, 1973, p. 222).

Pilot health projects in a number of countries which have included nutrition and health education, vaccinations, and simple treatment of illness by local health workers, provide additional evidence that such programs can reduce child mortality substantially, rapidly, and at low cost. Such a program in Nigeria, for example, led to a reduction of infant mortality from 295 to 72 per thousand in five years and a reduction of close to 40 percent in the death rate among children in the 1-4 age group. Measles accounted for 37 percent of deaths in that age group. Therefore, an even greater reduction would be possible now that an effective measles vaccine is available (David Morley in Maurice King, ed., 1966).

In summary, there appear to be four principal reasons for believing that the potential advantages of integrated health, nutrition, and family planning programs warrant a high priority. It has already been emphasized that a major advantage of an integrated approach is the desirability of undertaking a program of action that can make a significant contribution to achieving the multiple objectives of slowing population growth and of

achieving widespread improvements in the nutritional status and health of a country's population, including poor families in rural as well as urban areas.

A second important reason relates to the feasibility of this approach. It has been emphasized repeatedly in this monograph that however desirable a program might appear to be in terms of its aims, it does not warrant serious consideration unless it is also feasible. Although the evidence is still rather limited, it appears that an integrated approach to the delivery of health services is financially, administratively, and politically feasible even in low-income developing countries.

The third reason for assigning a high priority to integrated programs is that there are strong a priori reasons and some evidence in support of the proposition that they are more cost-effective than the available alternatives for achieving improvements in nutritional status and health and for lowering birth rates.

Finally, there appear to be cogent economic as well as social reasons for opting for programs which embrace health and nutritional as well as population objectives rather than concentrating on the "inexpensive" alternative of a "conventional" family planning program. For the reasons noted above, we are skeptical whether a nonintegrated approach can be as cost-effective as an integrated program in achieving the substantial reductions in birthrates that are needed to re-establish equilibrium with the reduced mortality rates that have already been attained in most of the low-income countries. We would attach greater importance, however, to the fact that the additional costs incurred in achieving the health and nutritional objectives of integrated programs represent an investment in human capital formation that is likely to have a very high rate of return for society as well as for the individuals benefitted by such programs. The economic benefits to society are almost as difficult to quantify as the gains in individual wellbeing. It can hardly be seriously questioned that reducing malnutrition and excessive morbidity among infants and small children in these low-income countries will improve their performance in school and their productivity as workers.

Given the long-run benefits, even intergenerational benefits, to be expected from improved physical and cognitive development of children, there is a strong presumption that the rate of return from fairly modest investments in integrated health programs can be very large indeed.

It bears emphasis that these are all potential advantages of an integrated approach to the delivery of health, nutrition, and family planning services. A decision to adopt such a program is, of course, only a first step in the challenging task of designing and implementing an effective program. We return to that point in the following chapter, but it should be stressed here that a considerable body of knowledge and experience has been acquired concerning the design and management of such programs. In brief, there is considerable understanding of a "methodology" for such programs even though it is by no means as well established as, for example, the methodology for crop improvement programs directed at breeding high-yielding, fertilizer-responsive plant varieties adapted to conditions where moisture availability is not a major problem. There seems to be wide agreement among medical and public health specialists that great advances have been made in devising more effective methods for training primary health care personnel (WHO, 1976a, 1979). Furthermore, informed judgement is in agreement concerning the efficacy of relatively simple and inexpensive procedures for preventing and curing a large percentage of the most common causes of illness and death among children and mothers. Relatively inexpensive and safe vaccines are now available against measles, diphtheria, whooping cough, tetanus, smallpox, tuberculosis, cholera, and typhoid. Diarrheal diseases, which are not preventable by vaccine, are a major cause of morbidity and mortality that call for different and more difficult measures. The interlinked problems of lack of an adequate water supply and deficient hygienic and sanitation practices appear to be the major factors responsible for these gastro-intestinal diseases that are so common and serious. But much can be done at a relatively small cost to reduce the incidence of disease and also to improve the treatment of infants suffering from diarrhea and dehydration.

Hence, an exclusive focus on problems of availability and access to food will not be nearly as effective in improving the health of small children as a more balanced strategy. Programs which emphasize a practical approach to nutrition and health education, other preventive and promotive activities, including family planning, and simple curative techniques such as oral rehydration can yield large short-run returns in improving the health of children. Moreover, by lowering fertility they can help to make the longer term development problems more manageable. Some of the opportunities and problems that have been highlighted by India's Rural Health Scheme are reviewed in the following chapter.

VI. CONCLUDING REMARKS ON POLICY ANALYSIS AND RURAL DEVELOPMENT PRIORITIES

This paper has sought to make a contribution to the difficult task of identifying the components of a rural development strategy which merit priority in low-income developing countries. Needless to say, priorities will and should be influenced by specific circumstances in individual countries. Nevertheless, the severe resource constraints, the overwhelming importance of agriculture, the pervasiveness of poverty and its concentration in rural areas, and the difficulty of slowing population growth represent significant common features of the low-income developing countries which account for nearly one-third of the world's population. Moreover, a number of the "lower-middle-income" countries such as Nigeria, the Philippines, and Honduras have similar characteristics and pose similar problems.

Our attempt to make a useful contribution to the debate on these issues has been at two levels. At one level we have put forward a number of suggestions as to how the process of policy design might be approached so as to improve the quality of decision making and to enhance the prospects for effective implementation of the policies and programs that are adopted. Our concentration on the low-income countries as a comparatively homogeneous subset of Third World developing countries is a first step toward defining a typology to assist in focusing the debate about development policies and thereby make the issues somewhat more tractable.

At a more specific level, we have set forth our reasons for believing that two of the greatest challenges confronting the low-income developing countries concern the need to design and effectively implement broadly based agricultural strategies and health programs capable of achieving wide coverage of their rural populations. Progress in the area of health has been especially limited although that is not too surprising. The concept of an integrated approach to the delivery of nutrition, health, and family planning services is recent. Papers presented by Asok Mitra and Carl Taylor at the 1971 MIT Conference on Nutrition, National Development and Planning appear to have been the first statements of the advantages of an integrated approach that reached a large audience

(Berg, et al., ed., 1973). The first integrated program aimed at achieving nationwide coverage in a low-income developing country with a mixed economy was India's Rural Health Scheme launched in October 1977 (India, 1978, Ch. 15).

Converging and Diverging Views:
Political Feasibility Revisited

The range of viewpoints represented by the community of "nutrition advocates" is especially interesting in relation to the problem of achieving the degree of consensus required for effective action in response to those challenges. It might be supposed that individuals and groups especially concerned with the seriousness of nutritional deprivation in developing countries would be an important part of the coalition of interest groups providing support both for broadly based strategies for agricultural development and for nutrition, health, and family planning programs. It is therefore somewhat surprising as well as disappointing that a 1977 "International Study Symposium on Policy Making and Planning to Reduce Malnutrition" held at the University of California almost entirely ignored the potential contribution of a two-pronged approach directed simultaneously at increasing food production and purchasing power *and* at direct action to improve nutrition and health and slow population growth through integrated health programs.

A retrospective evaluation of the Conference attributes the failure to advance toward a consensus to the existence of three conflicting viewpoints which are characterized as 'holistic planning', 'revolution', and 'intervention'. According to Joy (1978, p. 141):

Some reconciliation is occurring in the recognition by some of the need for both intervention and overall planning to reduce malnutrition. There seems, however, still to be a split between the revolutionaries ('the social system has to be fundamentally changed') and the rest.

A statement on "The Politics of Food and Nutrition Planning" prepared and presented at the Conference as an expression of the radical view characterized the "limitations of current approaches" as follows:

The food and nutrition planning approach presented in this conference has a political content, as have all other food and nutrition planning approaches. However, this political content is not explicitly spelled out. As nutrition planning influences the political and economic development of a country, the nutrition planner must be aware of his political role. The presentation of nutrition planning as a technical tool tends to hide this important issue. Sometimes the complexity of the real nutrition problem is deliberately exaggerated to rationalize a purely technical approach. This emphasis on the technical approach also serves to justify the need for western-trained experts. (Jonsson and Brun, 1978, p. 128.)

It is fairly obvious that nutrition planning and still more the design of a rural development strategy depend on decisions that are essentially political. What distinguishes the Jonsson-Brun statement is the view that unless a country's government "represents the underprivileged" and is "committed to social equality," it is to be expected that even if policies and programs are adopted which improve the income and nutritional status of the poor this will probably "increase the degree of exploitation to which they are exposed" (Jonsson and Brun, 1978, pp.128, 129).

It seems unduly pessimistic as well as historically inaccurate, however, to suggest that only governments installed by a revolution can achieve genuine progress in improving the wellbeing of a country's rural population and of the poor in general. There are invariably conflicts of interest between the general social welfare and private interests. Large farmers and other employers generally tend to maximize their private profits and are not deterred from adopting capital-intensive technologies and reducing their workforce because of the social costs of under- and unemployment.

The social problem then is to find policies which will induce employers to act in the public interest, i.e., policies which will make it profitable for them to offer productive work to more of the labor force by encouraging them to economize in their use of capital. (Edwards, 1974, p. 6.)

Edwards goes on to note that in the absence of constructive policies of that sort, growing public concern with unemployment may result in policies which

.....force employers, both public and private, to employ more labor even in unproductive circumstances. There is a tradeoff--not because political will is lacking, but because economic policies are not up to the task at hand.

We share his view that the "analytically interesting and politically challenging situation" is one in which there is a possibility of achieving progress toward national development objectives by "improved technical and economic policies and greater political commitment to the general welfare" (Edwards, 1974, p. 7).

Those considerations underscore the need to be concerned with the political feasibility of alternative measures and therefore sensitive to the priorities of the various groups that wield political power. Jyotirindra Das Gupta has stressed that the political systems in less developed countries are "underdeveloped" and that "the political capability of such central governments tends to be extremely limited". Hence it is necessary to take account of "sources of action beyond the formal central government" including "state and local government and the extragovernmental, informal political authorities..." Finally, Das Gupta stresses that "Both revolutionary and non-revolutionary regimes have the capacity to learn if they are so motivated, or if they are pressed to do so" (Das Gupta, 1978, p. 68). The design of development strategies should therefore take account of the willingness and the ability of the political authorities to shift gradually from their old support structure in order to secure a new basis of support for the actual implementation as well as the design of strategies that are more effective in reducing poverty and improving the well-being of their rural and urban populations. "This is a tall order

for any political regime," Das Gupta notes, but in fact "we have been giving tall orders to most of the underdeveloped countries without realizing how fragile their political authority is in these initial stages of development".

In Chapter III, the FAO Report on food and nutrition planning by Joy and Payne (1975a) was cited as an example of an approach that is likely to be counterproductive. The fundamental defect in that approach, in our judgment, is not so much that it exaggerates "the complexity of the real nutrition problem" as that the approach is politically infeasible and administratively unworkable. Moreover, it seems to encourage a misleading view of a dichotomy between "macro" and "micro" approaches or between "general planning" and "planning for nutrition objectives" (Joy, 1978, p. 137). This is a false dichotomy in the context of rural development strategies that simultaneously emphasize production-oriented activities to shape the rate and pattern of development, and consumption-oriented measures which give a high priority to integrated nutrition, health, and family planning programs. Both "prongs" of that two-pronged approach have important macro and micro aspects.

There is clearly a need for general planning to strengthen agricultural research, to expand the rural infrastructure, and to create a more favorable policy environment for a broadly based agricultural strategy. Likewise there is a need for planning at the regional and district level, particularly in relation to investments in infrastructure and action to strengthen the links between agricultural research and extension and to increase the effectiveness of those activities. Uma Lele's insightful book, *The Design of Rural Development: Lessons from Africa*, gives major attention to the importance of mobilizing popular support for agricultural extension activities, although she also stresses that the feasibility and profitability of innovations is of paramount importance in determining their acceptance by farmers. She presents a valuable analysis of the administrative problems of implementing rural development strategies including the problems of decentralization and coordination (Lele, 1975, pp. 73-6, ch. IX). Lele and others (for example Hildebrand, 1976) have also stressed the importance of surveys

carried out by interdisciplinary teams. Better understanding of both agrotechnical and socioeconomic factors at the farm level can enhance the relevance and value of research and extension activities. The need to combine central planning and coordinating functions with substantial devolution of responsibility to local field staff is in fact one of the reasons why developing administrative capability for promoting rural development is such a challenging task (Hunter, 1978, p. 27).

There is also a need at the local level for an active role by farmers grouped in either formal or informal organizations. The danger of trying to impose a standard formula is stressed in the following summary statement by Hunter (1978, p. 40) of why some grouping of farmers for development action is desirable:

First, it is convenient for official delivery of services and supervision, and in theory a benefit to farmers, since full services could not be delivered officially direct to every individual. Second, group formation can be a prime method of eliciting dynamic motivation among farmers themselves to take an active and increasing share in the design and management of their own development process. These two reasons can conflict: excessive emphasis on convenience and supervision may strangle local participation, by imposing a group system on all farmers, many of whom find it useless or unwelcome.

There has been relatively little research and analysis of the problems that arise in designing and implementing integrated nutrition, health, and family planning programs.* It is clear nonetheless, that the design and implementation of such programs also depends critically on macro and micro factors. There is general agreement that active support and participation by the local community is an essential ingredient of success. In fact, one of the significant advantages of an integrated approach over single-service programs is the greater likelihood that a local community and its leaders will lend active support to a comprehensive family health plan as compared to a program concerned only with a specific nutritional intervention or the promotion of family planning.

*Part Eight on "Integrated Intervention" in Austin et al., (1978) seems to be the most comprehensive review currently available. It also includes an extensive bibliography, but see also C. Taylor (1977); McCord (1977); and Johnston and Meyer (1977).

It is equally apparent, however, that there is a need for general planning and for financial and technical support from central, regional, and district health organizations. The locally recruited village-level health workers cannot be expected to carry out their functions satisfactorily unless they receive initial and in-service training and continuing technical support and supervision from medical and paramedical staff. India's Ministry of Health and Family Welfare and the State Governments are performing a key role in organizing training programs for medical and paramedical staff and for the village level Community Health Workers (CHWs), some 50,000 of whom have already been recruited and given initial training. The preparation of a *Manual* for CHWs, that is available in 15 Indian languages, has been another important contribution by the central government (India, 1977). The *Manual* illustrates, however, one of the difficult and as yet unresolved problems in designing and implementing low-cost health delivery systems.

Twelve chapters in the *Manual* outline a host of activities to be carried out by the village-level Community Health Workers, including tasks related to the identification of malaria and assistance in mosquito control, detection of smallpox and other communicable diseases, promotion of environmental sanitation and personal hygiene, immunization, family planning, maternal and child health, nutrition, and "treatment of minor ailments". Five additional chapters discuss various types of traditional medicine, one of which may be utilized in a particular area. An appendix provides a guide for the use and administration of drugs. It certainly seems doubtful whether part-time village-level workers can be expected to carry out such a broad range of activities. Hence there is a strong possibility that many CHWs will tend to neglect the preventive and promotive activities that are potentially so cost-effective in reducing mortality and morbidity among the most vulnerable segments of the population and opt for a more passive role such as dispensing drugs in response to requests. Thus there appears to be an urgent need for a protocol, probably location-specific specifying the limited set of activities that should be given priority. For example, the *Manual* includes diarrhea among a number

of "minor ailments" in Chapter 11, whereas there is considerable evidence which suggests that diarrhea and dehydration, interacting with malnutrition, are typically major causes of the high rates of mortality and morbidity among infants and small children in developing countries. The simple and inexpensive technique of "oral rehydration" is therefore one of the activities which would appear to merit a high priority in integrated programs. But the quantity and quality of water available, environmental sanitation, and personal and food hygiene are also highly important because of their influence on the incidence of gastro-intestinal infection.

Even within the context of an integrated health program difficult choices must be made concerning the activities to be given priority in the initial and subsequent phases of the program. But the decisions that will determine the balance between the production- and consumption-oriented activities to be included within their rural development strategies are more difficult. There is a risk that objectives, policies, and programs will be too narrowly focused on growth. There is perhaps an even greater risk of initiating a wide range of activities which exceed the financial and administrative resources available with the result that plans and pilot projects are multiplied but with little positive impact in improving the wellbeing of the rural population.

Learning to Plan--and Planning to Learn*

A major thesis of this monograph has been the need for serious and explicit attention to policy analysis in order to improve the process of policy design. We are moderately confident that the approach to the design of rural development strategies outlined in Chapter IV can be helpful. There is, however, only one proposition which we can enunciate with complete confidence: whatever the approach to policy design and to the planning of implementation, many of the decisions that are made will be wrong and many of the programs that are adopted will fail.

*The title of this section is taken from a provocative book by D.N. Michael (1973).

Failure of development strategies is inevitable due to the pervasiveness of uncertainty. All the research and analysis we ever do will not eliminate this uncertainty, or even make a large dent in its magnitude. Little wonder that Hirschman (1971, p.133) has stressed how counterproductive an emphasis on "uniquely correct policies" and "absolute priorities" can be, and that he argues instead for thinking "in terms of sequences in the course of which a forward step in one direction will induce others...".

The realistic goal of policy design is not to eliminate uncertainty, but to accommodate it more effectively. In practical terms this means using the best analysis and knowledge that we can muster to help decision makers see a little further ahead, to comprehend a few more interactions, to avoid some of the truly disastrous and irreversible mistakes to which development is so prone. It means recognizing that we will make mistakes anyway--big, costly ones. It means viewing these failures as a form of unavoidable, dearly paid for, but potentially invaluable experience which can be our single greatest asset in a continuing, adaptive effort to design and implement development strategies.

We have commented frequently on the practical problems associated with the current proliferation of "development options", all clamoring for the undivided attention of researchers, funding agencies, and development administrators. Even if all these "options" were well thought out, carefully costed and analyzed, and represented feasible actions which a real world decision maker might take, their sheer number would pose difficult problems of choice. In fact, most of them are nothing of the kind. Rather, they reflect a perspective, a conclusion, a vision of people concerned with helping to resolve development problems. Many are in fact invaluable ideas which constitute proper starting points for analysis. But as Majone (1977, p. 16) has emphasized, good "analysis should be done in two stages: a first stage to find out what one wants to recommend, and a second stage to make the recommendations convincing 'even to a hostile and disbelieving, but intelligent audience'".^{*} In the present development literature,

^{*}The quoted phrase is from Kahn and Mann (1956).

it seems to us that these two stages have too often been compressed to one. As a result, the single stage of the debate is overfull of advocates (including ourselves), each presenting his ideas in a manner most likely to make them "convincing even to a hostile and disbelieving" audience. Inevitably, the nuances, the reservations, the disadvantages are deemphasized in the emerging adversary forum. As a result, the prospects for mutual interaction and learning which are so critical to progress in a field as multifaceted and difficult as development are lost. Prosaic as it may sound, we believe that there is room for careful, scholarly research, as well as forceful advocacy, in development analysis. One of the prime goals of this research would be to gently distinguish some of the more solid from some of the more ethereal "options" presently crowding the literature and seeking a place on decision makers' agenda.

To be sure, research related to development has been a flourishing growth industry during the past two decades. But a great deal of this research has been of little value to decision makers and administrators in developing countries. This is hardly surprising, given the extent to which the research is oriented to the academic and disciplinary concerns of the researchers. For example, Butz and Habicht (1976, pp. 229-30) offer the following set of recommendations for research relevant to the effects of nutrition and health on fertility:

The following research subjects focus, in our opinion, on the crucial links in the supply and demand networks that determine the level and distribution among persons and families of stocks of nutrition and health and the effects of these stocks on fertility outcomes:

- Determinants of the earnings and agricultural productivity effects of investments in the health and nutrition of children. This basic quantitative knowledge... is necessary for estimating family demand for health and nutrition inputs and for studying parental tradeoffs between numbers of children and "quality" of children.....
- Economic and social determinants of intrafamily patterns of food distribution... Descriptive data on these patterns are needed to investigate the explanatory power of the approach suggested earlier.

- Determinants of the income and price elasticities of demand for preventative and curative health among disadvantaged groups... Knowing their magnitude permits prediction of the effects on health care of changing prices and family income...

- Determinants of the income and price elasticities of demand for nutritious foods among disadvantaged groups ...

- Determinants of patterns of parental substitution between numbers of children and "high-quality" children of superior health and nutritional status. This knowledge... is important for understanding parents' fertility responses to changing incentives for health care and nutrition.

- Economic and social determinants of the mothers' breast-feeding behavior...

T. P. Schultz sets his sights even higher in arguing that there is a need for "two advances in the social sciences" in order to compare the social returns from direct incentive payments to parents to avert births with the benefits of programs such as "promoting the health and nutrition of mothers and young children". "First, agreement must be reached", he declares, "on how to characterize a society's interpersonal and intergenerational goals and their trade-offs. Second, a much improved understanding will be required of how economic and demographic variables influence and are influenced by reproductive behaviour" (T.P. Schultz, 1976, p. 111).

As long as research objectives are defined in such ambitious and academic terms, the results can hardly be expected to be of much practical value to those concerned with the design and implementation of actual development strategies. It has been aptly observed that in the final analysis, "The only man who can solve a problem is the man who has the problem". Yet it is striking how little of the development literature discusses what "the problem" is perceived to be by the administrators and people in the developing countries who must be the ultimate problem solvers. An observation by a foreign adviser working with the UNICEF Village Technology Unit in Kenya is a refreshing exception (McDowell, 1978, p. 75):

Our approach to the generation of interest in technologies which may be appropriate for use at village level amongst very poor people, is based on the fact that we do not know what is, or is not, appropriate, and neither do our government counterparts. The only people who can really decide what is, or is not appropriate are the people, themselves.

One of the most painful lessons learned in the IIASA policy design studies reported earlier concerned the importance of determining what the man with the problem thought *he* needed from the researcher-analysts in order that *he* could better address his problem more effectively. If research and analysis do not establish contact with the needs and constraints as perceived by those directly concerned with coping with a problem, the chances for effective implementation--of actually changing the course of development--are very small indeed. It is for this reason that we put a high priority on decentralized, locally responsive agricultural and health programs as components of a rural development strategy. There is much to be learned about striking a satisfactory balance in specific situations between planning, coordination, and control at the national or regional level, and the exercise of initiative and authority by village councils and other local units. Given the nature of the local power structure in many developing countries, to achieve responsiveness to the needs of the poor often depends on initiatives of the central government and maintenance of a delicate balance between central and local responsibility and authority.

We believe that many of the shortcomings of the contemporary development debate can be mitigated to the extent that workers in the field begin to adopt a systems-conscious, policy analytic perspective on their subject. The more tentative attitudes which should accompany such a change would lead away from a focus on certainty and definitive answers, towards a learning process of adaptive policy design and redesign.

The focus on questions of feasibility and constraints which we have emphasized throughout this monograph is one small step in this direction. Such a focus can rapidly clear the field of

a number of the least realistic "options" proposed for consideration, leaving our wits and analyses less encumbered in attempts to cope with the remaining areas of controversy and uncertainty.

We believe, for example, that feasibility and constraint considerations rule out, as far as low-income developing countries are concerned, proposals to institute a system of old age pensions to overcome the security motive for farm families to have many children. The same applies to proposals to expand off-farm employment of women as an "intervention" for bringing about changes in attitudes and motivation with regard to family size. A broader, and more complicated example is provided by the currently fashionable concept of "integrated rural development". In recent years, governments in developing countries have frequently been exhorted to emphasize integrated rural development. But there has been remarkably little in the way of serious analysis of the concept which in fact is used in very different ways in various contributions to the literature.* Rarely, for example, is a distinction made between "integrated" planning of rural development strategies and "integrated" administration of rural development programs. We believe that the approach to policy design outlined in Chapter IV emphasizes the advantages of taking a comprehensive view of the components of a rural development strategy in making the decisions which determine the balance between production- and consumption-oriented policies and programs. But questions of feasibility clearly arise in attempts to administratively integrate a broad range of activities (Ruttan, 1975). It is our tentative judgment that the complementarities among nutrition, health, and family planning activities included in an integrated rural health program are so significant

*Two examples illustrate this point. In one of the more serious attempts to examine the concept of integrated rural development, Rondinelli and Ruddle (1978) emphasize the spatial aspects of "integrating" the various components of a rural development strategy. Although their chapter on "Stimulating the Rural Economy" includes a section on integrated rural development, the major emphasis of the book is on "spatially integrated development policies" and "the evaluation of integrated spatial development proposals..." (p.vi). On the other hand, Kötter (1978) equates "integrated rural development" with strategies for rural development which "integrate" the poorest segments of the rural population into the development process.

that it is both feasible and desirable to link that set of activities. But a critical evaluation of relevant experience might well reveal that in some of the low-income developing countries the spread of rural education and the availability of trained manpower are still so limited that conditions are not yet propitious for the successful implementation of such integrated rural health schemes. Much more important than any specific conclusions, however, is the need for analytic efforts to take more seriously the issue we raised in Chapter I: how to distinguish between the desirable and the feasible in development.

As we noted at the outset of this section, learning to plan is learning to fail. And planning to learn is planning to fail in a manner such that we both survive the experience and gain as much information as possible from it. There is a great deal of room for creative thinking on the issue of viewing different development strategies and programs implemented in different settings as experiments in development. This means developing performance criteria which can be effectively monitored to show which of the alternative strategies now in operation are more effective at meeting which of their objectives. If a resource-consuming explosion of proposals for monitoring is to be avoided, these performance criteria must be cleverly selected. An extensive literature in experimental design and statistical decision theory provides a conceptual starting point. But for sustained progress, a cooperative effort among data analysts and experienced field workers who really understand what can be measured, and what the measures mean, will be required. More generally, by analogy to other fields there is much that may be gained by explicitly designing new programs or program variants as experimental tests of conflicting theories or hypotheses. Such tests could probably do more to build a consensus on critical development issues than any amount of theory or argument that we are likely to muster over the foreseeable future, and the potential for accelerating development progress might be substantial.

Although the conceptual, technical, and organizational difficulties involved in conducting such a learning exercise are substantial, the greatest problem by far is an substantial one. Real

learning begins by saying "I have made a mistake". The barriers to learning are therefore tremendous.

The first step in overcoming these barriers is to admit that they are there. And they are there, at the political, professional, and personal level. Wherever we look, the most obvious trappings of power and competence involve appearing to be in control and appearing to be right. However illusory these appearances may be, maintenance of the illusion is accorded very high priority by governments, institutions, and our own personal psyches. What is needed to promote learning is an almost opposite orientation. Instead of trying to cover up or make excuses when things go wrong, we need to learn to view mistakes and shortcomings as priceless lessons, ignored at the peril of human wellbeing in the developing countries. Instead of associating competence with a well-manicured record of correct decisions, we need to view it as the ability to fail creatively, and to learn from the experience.

Such prescriptions are not pipe dreams. Even at the national political level, there are examples of a pragmatic, "learning by doing" approach. For example, reports on China's approach to rural development often emphasize a pragmatic willingness to recognize mistakes and modify policies. The policy shift in the early 1960s, following the initial setbacks associated with the Great Leap and the creation of the Rural Communes, is an important case in point. By reverting to the small production team as the principal unit of decision making, a workable solution was apparently found to the problems of farm management and incentives (Timmer, 1976). The decision of the administration of General Chiang Kaishek in Taiwan to implement an effective land reform program in the early 1950s is another interesting example. That regime had just gone through what John Brewster (1967) has aptly described as a "catastrophic learning experience" in their defeat by the Chinese Communists and expulsion from the Mainland. One of the key lessons learned by that painful experience was the importance of maintaining the support of the farm population. In principle at least, it should be considerably easier for international and bilateral aid agencies to give a high priority to learning from experience. And the World Bank's action in undertaking the

the African Rural Development Study reported on by Lele (1975) is a noteworthy example of such an initiative.

In our judgment there is an especially important need to learn from ongoing experience with integrated rural health programs. Fortunately, the Indian Government has commissioned a number of evaluation studies of the new Rural Health Scheme which are being carried out by research workers in universities and research and management institutes (see, for example, Bose, 1978). A critical but constructive analysis of the Hindi version of the Government's *Manual for Community Health Worker* (1978) carried out by the Linguistics Department at the University of Delhi represents an especially interesting and useful effort to learn from initial mistakes (Srivastava et al., 1978).

There also appears to be a need to give a high priority to comparative studies of pilot projects and national programs in order to maximize the process of learning from both mistakes and successes resulting from these early efforts. It seems obvious to us that such studies need to be carried out as a genuinely collaborative effort involving scientists, policy makers, and administrators in selected countries--probably a relatively small set of countries which face somewhat similar problems and constraints. The studies carried out within individual countries must, of course, be responsive to distinctive problems as perceived by those responsible for the national program. The opportunities for learning from comparative analysis of experience in a number of countries would, however, be facilitated if a measure of agreement could be reached concerning the broad outline of the design and focus of such studies. A certain amount of parallelism would facilitate learning as much as possible about key problems such as insuring and sustaining the motivation of village level workers, fostering participation at the village level in the planning and implementation of nutrition, health, and family planning activities, and devising methods of financing which include contributions from the local community. Studies at the national level combined with comparative analyses could, we believe, facilitate the learning process in individual countries and assist in the diffusion of the hard-earned knowledge and understanding that is being acquired.

Above all, however, it is essential to keep in mind the obvious but often neglected fact that the goal of development studies is the promotion of development. The needs are enormous. The constraints are extreme. The challenge is to narrow this gap between the desirable and the feasible without deluding ourselves into equating the two. It is often objected that the relevant "obstacles" could certainly be overcome if a country's leaders would simply muster the "will to develop". But constraints cannot be wished away. Beyond the complexity and uncertainty that characterize development issues, it is essential to recognize that the political and other resources available to leaders in developing countries are limited. A feasible approach must be sequential. The need, as so well expressed by Leys (1971, p. 133) in a passage quoted earlier, is to assess realistically what changes "are within the politicians' 'means', and...what patterns or sequences of change, among those that are practical, will carry the process of economic development farthest and fastest..."

We have argued that an explicit approach to policy analysis can assist in making such realistic assessments. Our own analysis assigns a very high priority to a two-pronged approach emphasizing broadly based agricultural development strategies and integrated rural health programs. More broadly, we stress the need to focus the debate on these and related issues through a typology which at the very least recognizes the distinctive characteristics of the low-income countries. In particular, the structural-demographic features and constraints that have been examined require recognition of the trade-offs that arise in the choice between the two-pronged approach just mentioned and attempts to alleviate poverty directly through redistribution of current income flows. Finally, we emphasize that decisions with respect to broad priorities represent only the starting point for a continuing, adaptive process of policy design, implementation, and revision.

REFERENCES

- Abel, M.E. (1978) Hard policy choices in improving incentives for farmers. Pages 171;184, in *Distortions in Agricultural Incentives*, edited by T.W. Schultz. Bloomington and London: Indiana University Press.
- Ackerman, B.A., S. Rose-Ackerman, J.W. Sawyer Jr., and D.W. Henderson (1974) *The Uncertain Search for Environmental Quality*. New York: Free Press.
- Ackoff, R.L. (1974) *Redesigning the Future: A System Approach to Societal Problems*. New York: Wiley-Interscience.
- ADB (Asian Development Bank) (1978) *Rural Asia: Challenge and Opportunity*. New York: Praeger.
- Afifi, A.A., et al. (1974) Some terminology revisited, in *Systems Aspects of Health Planning*, edited by N.T.J. Bailey and M. Thompson. Amsterdam: North-Holland Publishing Company.
- Allison, G.T. (1971) *Essence of Decision: The Cuban Missile Crisis*. Boston: Little, Brown, and Co.
- Anthony, K.R.M., B.F. Johnston, W.O. Jones, and V.C. Uchendu, (1979) *Agricultural Change in Tropical Africa*. Ithaca, New York: Cornell University Press.
- Arrow, K.J. (1974) *The Limits of Organization*. New York: Norton.
- Arthur, W.B., and G. McNicoll (1975) Large-scale simulation models in population and development: what use to planners? *Population and Development Review*, 1:251-265.

- Austin, J., et al. (1978) *Nutrition Intervention Assessment and Guidelines*. Cambridge, Massachusetts: A Report prepared by the Harvard Institute for International Development, and submitted to the U.N. Agency Coordinating Committees, Subcommittee on Nutrition.
- Bardhan, P.K., (1973) Size, productivity, and returns to scale: an analysis of farm-level data in Indian agriculture. *Journal of Political Economics*, 81(6):1370-86.
- Barker, R. (1978) Barriers to efficient capital investment in agriculture. In *Distortions of Agricultural Incentives*, edited by T.W. Schultz. Bloomington and London: Indiana University Press.
- Bell, D.E., J.H. Duloy (1974) Rural target groups. Pages 113-35. in Chenery, Hollis, et al. *Redistribution with Growth*. London: Oxford University Press.
- Bell, D.E., R.L. Keeney, and H. Raiffa, eds. (1977) Introduction and overview. In *Conflicting Objectives in Decisions*. Chichester, New York: Wiley and Sons.
- Bengoa, J.M. (1973) Significance of malnutrition and priorities for its prevention. In *Nutrition, National Development, Land Planning*, edited by A. Berg, N.S. Scrimshaw, and D. Call. Cambridge Massachusetts.
- Benor, D., and J.Q. Harrison (1977) *Agricultural Extension: The Training and Visit System*. Washington, D.C.: World Bank.
- Berg, A. (1973) *The Nutrition Factor*. Washington, D.C.: Brookings Institution.
- Berg, A., N.S. Scrimshaw, and D. Call, eds. *Nutrition, National Development and Planning*. Cambridge, Massachusetts: MIT Press.
- Berry, R.A., and W.R. Cline (1976) *Farm Size, Factor Productivity and Technical Change in Developing Countries*. Paper prepared for the ILO World Employment Programme. Geneva: International Labour Office.
- Bhagwati, J.N., and P. Desai (1970) *India: Planning for Industrialization*. London: Oxford University Press.
- Bhattacharyya, A.K. (1975) Income inequality and fertility: A comparative view. *Population Studies*, 29.
- Binswanger, H.P., and J.G. Ryan (1977) Efficiency and equity issues in Ex Anti allocation of research resources. *Indian Journal of Agricultural Economics*, July-September.
- Binswanger, H.P., and V.W. Ruttan, et al. (1978) *Induced Innovation*. Baltimore: Johns Hopkins University Press.

- Blandy, R. (1975) *Economic-Demographic Interaction in Model Building*. In the report on the FAO/UNPRA seminar on methodology, research, and country case studies on population, employment, and productivity. Rome: FAO.
- Bose, A., et al. (1978) *An Assessment of the New Rural Health Scheme and Suggestions for Improvement*. Delhi: Demographic Research Centre, Institute of Economic Growth, University of Delhi.
- Boyce, J. and R.E. Evenson (1975) *National and International Agricultural Research and Extension Programs*. New York: Agricultural Development Council.
- Brewer, G. (1973) *The Politician, the Bureaucrat, and the Consultant*. New York: Basic Books.
- Brewster, J.M. (1950) The machine process in agriculture and industry. *Journal of Farm Economics*, 32(1).
- Brewster, J.M. (1967) Traditional social structures as barriers to change. In *Agricultural Development and Economic Growth*, edited by H.M. Southworth and B.F. Johnston. Ithaca, New York: Cornell University Press.
- Brown, G.T. (1978) Agricultural pricing policies in developing countries. In *Distortions of Agricultural Incentives*, edited by T.W. Schultz. Bloomington and London: Indiana University Press.
- Brown, R.A. (1974) *Survey of TEMPO Economic-Demographic Studies*. Washington, D.C.: General Electric Co. - TEMPO.
- Butz, W.P., and J.P. Habicht (1976) The effects of nutrition and health on fertility: hypotheses, evidence, and interventions. In *Population and Development: The Search for Selective Interventions*, edited by R.G. Ridker. Baltimore, Maryland: Johns Hopkins University Press.
- Calloway, D.H. (1977) Proposal for research (working paper). PAG (Protein Advisory Group) Bulletin, September-December.
- Carr, M. (1979) *Technology and Rural Women in Africa*. Geneva: Draft paper prepared for the ILO Technology and Employment Programme, January.
- Cassen, R.H. (1978) Current trends in population change and their causes. *Population and Development Review*, 4(2).
- Cassen, R.H. (1978b) *India: Population, Economy, and Society*. London: Macmillan.
- Castle, E.N. (1978) Comment on E.G. Schuh's approaches to "basic needs" and to "equity" that distort incentives in agriculture. In *Distortions in Agricultural Incentives*, edited by T.W. Schultz. Bloomington and London: Indiana University Press.

- Chambers, R. (1977) Simple is practical: approaches and realities for project selection for poverty-focused rural development. Kuwait: Paper prepared for a seminar on the implications of the employment and income distribution objectives for project appraisal and identification, April.
- Chowdhury, A.K.M.A., and L.C. Chen (1977) The interaction of nutrition, infection, and mortality during recent food crises in Bangladesh. *Food Research Institute Studies*, XVI(2):47:62.
- Clark, W.C., D.D. Jones, and C.S. Holling (1977) Lessons for ecological policy design: a case study of ecosystem management. Vancouver, Canada: IRE R-10-B, Institute of Resource Ecology, University of British Columbia. (To appear in *Ecological Modeling*, 1979.)
- Cline, R. (1961) *A Survey and Summary of the Mathematical and Simulation Models as Applied to Weapons System Evaluation*. ASD: Technical Report 61-376.
- Cole, H., and R.A. Brown (1975) *The TEMPO Models As a Basis for Development Planning*. New York: Paper presented at the SEADAG seminar on the role of economic-demographic models in development planning, March. (Quoted in Arthur and McNicoll 1975).
- Das Gupta, J., and D.W. Pearch (1972) *Cost-Benefit Analysis: Theory and Practice*. London: Macmillan.
- Das Gupta, J. (1978) Comment on B.F. Johnston, Strategies for the reduction of malnutrition. In *Nutrition Planning: The State of the Art*, edited by L. Joy. London: IPC Science and Technology Press, Ltd. (Published for U.S. Agency for International Development.)
- Davidson, Sir S., and R. Passmore (1969) *Human Nutrition and Dietetics*, 4th edition. Edinburg and London.
- Demeny, P. (1979) *On the End of the Population Explosion* (working paper No.39). New York: Center for Policy Studies, Population Council.
- De Tray, D.N. (1976) Population growth and educational policies: an economic perspective. In *Population and Development: The Search for Selective Interventions*, edited by R.G. Ridker. Baltimore, Maryland: Johns Hopkins University Press.
- Dixon, R.B. (1978) On drawing policy conclusions from multiple regressions: some queries and dilemmas. In *Studies in Family Planning*. October-November.
- Dosik, R.S. and W.P. Falcon (1978) *Energy and Agriculture in Developing Countries*, draft ms. Stanford, California: Food Research Institute, Stanford University.

- Easterlin, R.A. (1975) *The economics and sociology of fertility: a synthesis*. In *Early Industrialization, Shifts in Fertility and Changes in Family Structure*, edited by Charles Tilly. Princeton, New Jersey: Princeton University Press.
- Edwards, E.O. (1974) *Employment in developing nations*. In *Employment in Developing Nations: A Ford Foundation Study*, edited by E.O. Edwards. New York: Columbia University Press.
- Evenson, R.E., and Y. Kisler, (1975) *Agricultural Research and Productivity*. New Haven: Yale University Press.
- Evenson, R.E. (1978) *The organization of research to improve crops and animals in low income countries*. In *Distortions in Agricultural Incentives*, edited by T.W. Schultz. Bloomington and London: Indiana University Press.
- FAO (1975) *Demography for Agricultural Planners*. Rome.
- FAO/WHO (1976) *Food and Nutrition Strategies in National Development*. Report of the 9th Session Joint FAO/WHO Expert Committee on Nutrition. FAO Nutrition Meetings Report Series No.56 and WHO Technical Report Series No.584. Rome: FAO; Geneva: WHO.
- FAO (1977) *The Fourth World Food Survey*. Rome.
- Farquhar, J.W. (1978) *The American Way of Life Need Not Be Hazardous to Your Health*. Stanford: The Portable Stanford, Stanford Alumni Assn.
- Fiering, M.B. (1976) *The role of systems analysis in water program development*. *Natural Resources Journal*, 16:759-771.
- Gerhardt, J. (1975) *The Diffusion of Hybrid Maize in Western Kenya*, abridged by Cimmyt. Mexico City: Centro Internacional de Majoramiento de Mais y Trigo.
- Gittinger, J.P. (1972) *Economic Analysis of Agricultural Projects*. Baltimore and London.
- Gonzalez-Vega, C. (1976) *On the Iron Law of Interest Rate Restrictions: Agricultural Credit Policies in Costa Rica and Other Less Developed Countries*. Ph.D. Dissertation, Stanford University.
- Gotsch, C.H. (1974) *Economics, institutions and employment generation in rural areas*. In *Employment in Developing Nations*, edited by E.O. Edwards. New York: Columbia University Press.
- Gotsch, C.H. (1979) Book review of "Rural Asia: Challenge and Opportunity", Asian Development Bank (New York: Praeger 1978). *Nutrition Planning*, 2(1):5-9.
- Harari, D.H. (1978) *Employment problems*. In *Planning for a Growing Population*, edited by Robert Cassen and Margaret Wolfson. Paris: OECD Development Centre.

- Hayami, Y., and V.W. Ruttan (1971) *Agricultural Development: An International Perspective*. Baltimore: Johns Hopkins University Press.
- Healey, D.T. (1972) Development policy: new thinking about an interpretation. *Journal of Economic Literature*, 10(3):757-97.
- Helmer, O., and N. Rescher (1959) On the epistemology of the inexact sciences. *Management Science*, 6(1).
- Herdt, R.W., A. Te, and R. Barker (1977) The prospects for Asian rice production. *Food Research Institute Studies*, XVI(3).
- Hertford, R., and A. Schmitz (1977) Measuring economic returns to agricultural research. In *Resource Allocation and Productivity in National and International Agricultural Research*, edited by T.M. Arndt et al. Minneapolis: University of Minn. Press.
- HIID (Harvard Institute for International Development) (1978) J. Austin, et al. *Nutrition Intervention Assessment and Guidelines*. Submitted to United Nations ACC (Agency Coordinating Committee) Sub Committee on Nutrition, June.
- Hildebrand, P.E. *Generando Tecnologia Para Agricultores Tradicionales: Una Metodologia Multidisciplinaria* (Generating Technology for Traditional Farmers: A Multi-Disciplinary Methodology). Guatemala: Socioeconomia Rural, Instituto de Ciencia y Tecnologia Agricolas, Sector Publico Agricola, Diciembre (this publication contains an English as well as a Spanish version).
- Hirschman, A.O., and C.E. Lindblom (1962) Economic development, research and development, policy making: some converging views. *Behavioral Science*, 7:211-222.
- Hirschman, A.O. (1971) *A Bias For Hope*. New Haven: Yale University Press.
- Holcomb Research Institute (1976) *Environmental Modeling and Decision Making*. New York: Praeger.
- Holling, C.S., ed. (1978) *Adaptive Environmental Assessment and Management*. Chichester, England: Wiley-Interscience.
- Holsinger, D.B., and J.D. Kasarda (1976) Education and human fertility: sociological perspectives. In *Population and Development: The Search for Selective Interventions*, edited by R.G. Ridker. Baltimore, Maryland: Johns Hopkins University Press.
- Hopper, W.D. (1968) Investment in agriculture: The essentials for payoff. In *Strategy for the Conquest of Hunger: Proceedings of a Symposium Convened by the Rockefeller Foundation*. New York: Rockefeller Foundation.

- Hopper, W.D. (1978) Distortions of agricultural development resulting from government prohibitions. In *Distortions of Agricultural Incentives*. Bloomington and London: Indiana University Press.
- Hsieh, S.C. (1979) Director, Agriculture and Rural Development Department, Asian Development Bank, personal communication, April 4.
- Hull, T.H., V.J. Hull, and M. Singariumbun (1977) Indonesia's family planning story: success and challenge. *Population Bulletin*, 32(6)
- Hunter, G. (1978) *Agricultural Development and the Rural Poor: Guidelines for Action*. London: Overseas Development Institute.
- IDS (Institute for Development Studies) (1975) *Second Overall Evaluation of the Special Rural Development Programme*. Occ. Paper No.12. Nairobi: University of Nairobi.
- IFPRI (International Food Policy Research Institute) (1977a) *Recent and Prospective Developments in Food Consumption: Some Policy Issues*. Research Report 2, rev. ed.
- IFPRI (1977b) *Food Needs of Developing Countries: Projections of Production and Consumption to 1990*. Research Report 3.
- IFPRI (1978) IFPRI Research Highlights 1978. Washington, D.C.
- ILO (International Labour Office) (1978) *Towards Self-Reliance: Development, Employment and Equity Issues in Tanzania*. Addis Abada: Jobs and Skills Programme for Africa.
- India (1977) *Government of India, Ministry of Health and Family Welfare: Health Care Services in Rural Areas, (draft plan)*. New Delhi.
- India (1978) *Government of India, Planning Commission: Draft Five Year Plan 1978-83*. New Delhi.
- Johnston, B.F. (1969) The Japanese 'model' of agricultural development: its relevance to developing nations. In *Agricultural and Economic Growth: Japan's Experience*, edited by K. Ohkawa et al. Tokyo: Tokyo University Press.
- Johnston, B.F. (1978) Agricultural production potentials and small farmer strategies in Sub-Saharan Africa. In *Two Studies of Development in Sub-Saharan Africa*. Washington, D.C.: World Bank Staff Working Paper No.300.
- Johnston, B.F. (1979) *Socio-Economic Aspects of Improved Animal-Drawn Implements and Mechanization in Semi-Arid East Africa*, paper prepared for the workshop on socio-economic constraints to development of semi arid tropical agriculture, ICRISAT, 19-23, February.
- Johnston, B.F. and Kilby (1975) *Agriculture and Structural Transformation: Economic Strategies in Late-Developing Countries*. New York: Oxford University Press.

- Johnston, B.F. and A.J. Meyer (1977) Nutrition, health, and population in strategies for rural development. *Economic Development and Cultural Change*, 26(1).
- Jonsson, U. and T. Brun (1978) The politics of food and nutrition planning. Pages 128-29, in *Nutrition Planning: the State of the Art*, edited by L. Joy. London: IPC Science and Technology Press Ltd., published for U.S. Agency for International Development.
- Joshi, V. (1972) The rationale and relevance of the Little-Mirrlees Criterion. *Bull. Oxford University Inst. Econ. Statist.*, 34(1):3-32, February.
- Joy, L. ed. (1978) The symposium in retrospect. Pages 137-42, in *Nutrition Planning: The State of The Art*. London: IPC Science and Technology Press Limited, published for US Agency for International Development.
- Joy, L. and P. Payne (1975a) Food and nutrition planning. *FAO Nutrition Consultants Reports Series*, No.35. Rome.
- Joy, L. and P. Payne (1975b) Nutrition and national development planning. *Food and Nutrition*, 1(4).
- Kahn, H. and I. Mann (1956) *Techniques of Systems Analysis*. Santa Monica, California: The Rand Corp., RM-1937.
- Kenya, Republic of, (1979) *Development Plan 1979-1983*. Nairobi.
- Kenya (forthcoming) *Child Nutrition in Rural Kenya: A Monograph on the First National Anthropometric Survey*. A Central Bureau of Statistics/UNIC sponsored report.
- Kocher, J.E. (1973) *Rural Development, Income Distribution, and Fertility Decline*. New York: Population Council.
- Kotter, H.R. (1978) Involvement of the rural poor - a key factor in development: the present and future role of institutions and organizations. In *Rural Asia: Challenge and Opportunity. Supplementary Papers, Vol. IV--Administration and Institutions in Agricultural and Rural Development*. Manila: Asian Development Bank.
- Lapham, R.J. and W.P. Mauldin (1972) National family planning programs: review and evaluation. *Studies in Family Planning*, 3(3).
- Lau, L.J. and P.A. Yotopoulos (1971) A test for relative efficiency and application to Indian agriculture. *Amer. Econ. Rev.* 61(1): 94-109.
- Lee, T.H. (1971) *Intersectoral Captial Flows in the Economic Development of Taiwan, 1895-1960*. Ithaca, New York.
- Lee, T.H. (1971) *Strategies for Transferring Agricultural Surplus Under Different Agricultural Situations in Taiwan*. Paper prepared for the Japan Economic Research Center conference on agriculture and economic development. Tokyo and Hakone.

- Lee, D.B. Jr. (1973) Requiem for large-scale models. *AIP Journal*, pages 163-178.
- Lele, U. (1975) *The Design of Rural Development Lessons From Africa*. Baltimore and London: Johns Hopkins University Press, published for the World Bank.
- Levine, G. (1971) The water environment and crop production. Pages 385-92, in *Some Issues Emerging From Recent Breakthroughs in Food Production*, edited by K.L. Turk. Binghamton, New York.
- Levitsky, D.A. (1976) Ill-nourished brains. *Natural History*, 85:6-11.
- Leys, C. (1971) Political perspectives, in *Development in a Divided World*, edited by D. Seers and L. Joy. Middelsex, England.
- Lindblom, C.E. (1965) *The Intelligence of Democracy*. New York: Free Press.
- Lipton, M. (1977) *Why Poor People Stay Poor: A Study of Urban Bias in World Development*. London: Temple Smith.
- Little, I.M.D. and J.A. Mirrlees (1969) *Manual of Industrial Project Analysis in Developing Countries*. Vol. II. *Social Cost Benefit Analysis*. Paris: OECD Development Centre.
- Little, I.M.D. and J.A. Mirrlees (1974) *Project Appraisal and Planning for Developing Countries*. New York: Basic Books.
- Little, I.M.D., T. Scitovsky, and M. Scott (1970) *Industry and Trade in Some Developing Countries*. London: Oxford University Press.
- Lynam, L. (1978) *An Analysis of Population Growth, Technical Change, and Risk in Peasant, Semi-Arid Farming Systems: A Case Study of Machakos District, Kenya*. Ph.D. Thesis, Stanford University.
- Madigan, F.C. (1975) Final report (summary of discussions). In *Seminar on Infant Mortality in Relation to the Level of Fertility*. Paris: Committee for International Coordination of National Research in Demography.
- Majone, G. (1975) The feasibility of social policies. *Policy Sciences*, 6:49-69.
- Majone, G. (1977) *Pitfalls of Analysis and the Analysis of Pitfalls*. RM-77-1. Laxenburg, Austria: International Institute for Applied Systems Analysis.
- Majone, G. and E.S. Quade, eds. (forthcoming) *Pitfalls of Analysis*. Chichester, England: Willey-Interscience.
- Mandami, A. (1972) *The Myth of Population Control*. New York: Monthly Review Press.

- Margen, S. (1978) Comment on Leonardo Mata "The Nature of the Nutrition Problem". Pages 103-104, in *Nutrition Planning: the State of the Art*. London: IPC Science and Technology Press Limited, published for US Agency for International Development.
- Martorell, R. (1979a) *Nutrition-Infection Interactions and Human Growth*. Paper presented at the annual meeting of the Human Biology Council. San Francisco, April 4.
- Martorell, R. (1979b) *Responses to Chronic Protein-Energy Malnutrition: Adaptation or Malady?* Paper presented at the 48th annual meeting of the American Assn. of Physical Anthropologists. San Francisco, April 4-7.
- Mata, L.J. (1978) *The Children of Santa Maria Cauque: A Prospective Field Study of Health and Growth*. Cambridge, Mass.: MIT Press.
- Mauldin, W.P. and B. Berelson (1978a) Conditions of fertility decline in developing countries, 1965-75. *Studies in Family Planning*, May.
- Mauldin, W.P. and B. Berelson (1978b) "Reply" to R.B. Dixon, *Studies in Family Planning*, October-November.
- McCord, C. (1977) Integration of health, nutrition, and family planning: the Companigani project in Bangladesh. *Food Research Institute Studies*, XVI(2).
- McDowell, J. (1978) Appropriate technologies for tackling malnourishment. In *Community Action-Family Nutrition Programmes*, edited by D.B. and E.F. Patrice Jelliffe. Proceedings of a joint IUNS/UNICEF/ICMR Working Conference, Hyderabad, India, October 17-21. New Delhi: UNICEF.
- McKay, H., et al. (1978) Improving cognitive ability in chronically deprived children. *Science*, 200:270-78.
- Mellor, J.W. (1973) Nutrition and economic growth. In *Nutrition, National Development and Planning*, edited by A. Berg, N.S. Scrimshaw and D.L. Call. Cambridge, Mass.: M.I.T. Press.
- Mellor, J.W. (1976) *The New Economies of Growth: A Strategy for India and the Developing World*. Ithaca, New York: Cornell University Press.
- Mellor, J.W. (1978) *Three Issues of Development Strategy - Food, Population, Trade*. Two conference papers; testimony presented to the U.S. House of Representatives Select Committee on Population. Washington, D.C.: International Food Policy Research Institute.
- Michael, D.N. (1973) *On Learning to Plan -- and Planning to Learn*. San Francisco: Jossey-Bass Publishers.
- Mitra, A. (1973) The nutrition movement in India. In *Nutrition, National Development, and Planning*, edited by A. Berg, et al. Cambridge, Mass.: M.I.T. Press.

- Morawetz, D. (1974) Employment implications of industrialisation in developing countries: a survey. *Econ. J.*, September, 335(84):491-542.
- Morgan, M.G. (1978) Bad science and good policy analysis. *Science*, 15 September, 201(4360).
- Morley, D. (1966) The under-fives clinic. In *Medical Care in Developing Countries*, edited by M. King. Nairobi: Oxford University Press.
- Mundlak, Y. (1979) *Intersectoral Factor Mobility and Agricultural Growth*. International Food Policy Research Institute, research report No.6., February.. Washington, D.C.
- Mueller, E. (1971) *Agricultural Change and Fertility Change: The Case of Taiwan*. Mimeograph. Ann Arbor, Michigan: University of Michigan.
- Nagel, J.S. (1978) Mexico's population policy turnaround. *Population Bulletin*, 33(5). Washington, D.C.: Pop. Ref. Bureau, Inc.
- NAS (National Academy of Sciences) (1977) Report of study team 4: resources for agriculture. *Supporting Papers: World Food and Nutrition Study*, Vol. II.
- Ness, G.D. (forthcoming) The political economy of integration in development strategies: comment on Johnston and Meyer. In *Economic Development and Cultural Change*.
- Oram, P.A. (1978) Comment on Sir Charles Pereira "The Changing Patterns of Constraints on Food Production in the Third World. In *Distortions of Agricultural Incentives*. Bloomington and London: Indiana University Press.
- Perkins, D. et al. (1977) *Rural Small-Scale Industry in the People's Republic of China*. Berkeley, California: University of California Press.
- Preston, S.H. (1975) Health programs and population growth. *Population Devel. Rev.*, 1(2):189-99.
- Preston, S.H. (1978) *Mortality, Morbidity, and Development*. Paper prepared for the Seminar on Population and Development in the ECWA Region. Population division of the UN, September.
- Puffer, R. and C. Serano (1973) *Patterns of Mortality in Childhood*. Washinton, D.C.: Pan American Health Organization, PAHO Sci. Pub. No.262.
- Quade, E.S., ed. (1964) *Analysis for Military Decisions*. Chicago: Rand McNally and Co.
- Quade, E.S. (1975) *Analysis for Public Decisions*. New York: Elsevier.

- Rao, D.C. (1974) Urban target groups. In *Redistribution with Growth*, edited by H.B. Chenery, et al. London: Oxford University Press.
- Reutlinger, S. and M. Selowsky (1976) *Magnitude and Policy Options*. Baltimore: Johns Hopkins University Press, published for the World Bank.
- Rogers, G.B. (1977) *Demography and Distribution*. Population and employment working paper No.49, February. Geneva: ILO.
- Rogers, G.B. (1978) Migration, urbanization, resources and development. In *Alternatives for Growth: The Engineering and Economics of Natural Resources Development*, edited by H.J. McMains and L. Wilcox. Cambridge, Mass.: Published for the National Bureau of Economic Research, Ballinger.
- Rondinelli, D.A. and K. Ruddle (1978) *Urbanization and Rural Development: A Spatial Policy for Equitable Growth*. New York: Praeger.
- Rush, H., P. Marstrand, and J. Gribbin (1978) World futures: growth with redistribution? *Food Policy*, 3(2).
- Ruttan, V.W. (1975) Integrated rural development programs: a skeptical perspective. *Int. Devel. Rev.*, 17(4):9-16.
- Ryan, J.G., et al. (1979) *Assessment of Prospective Soil, Water, and Crop-Management Technologies for the Semi-Arid Tropics of Peninsular India*. Paper prepared for the ICRISAT workshop in socioeconomic constraints to development of semi-arid tropical agriculture. Hyderabad, India. 19-23 February.
- Sanderson, W.C. (1978) *Economic-Demographic Simulation Models: A Review of Their Usefulness for Policy Analysis*. Memorandum No.218, Dept. of Economics, Stanford University. (Also available as FAO, technical paper 4, ES:DP/INT/73/PO2, Rome, 1978)
- Simon, H.A. (1977) *Models of Discovery and Other Topics in the Methods of Science*. Dordrecht: Reidel.
- Singarimbun, M. (1973) *Some Consequences of Population Growth in Java*. Mimeographed. Jogjakarta.
- Srinivasan, T.N. (1977) Development, poverty, and basic human needs: some issues. *Food Research Institute Studies*, XVI(2).
- Srivastva, R.N., et al. (1978) *Evaluating Communicability in Village Settings: Communicability and Comprehensibility of the Manual for CHWs*. Evaluation report, Department of Linguistics, University of Delhi and UNICEF, New Delhi.
- Streeten, P. and S.J. Burki (1978) Basic needs: some issues. *World Development*, 6(3):411-21.
- Sukhatme, P. (1977) *Nutrition and Poverty*. Ninth Lal Bahadur Shastri Memorial Lecture. New Delhi: Indian Agricultural Research Institute.

- Schuh, G.E. (1978) Approaches to 'Basic Needs' and to 'Equity' that distort incentives in agriculture. Pages 307-327, in *Distortions in Agricultural Incentives*, edited by T.W. Schultz. Bloomington and London: Indiana University Press.
- Schultz, T.P. (1976) Determinants of fertility: a micro-economic model of choice. Pages 89-124, in *Economic Factors in Population Growth: Proceedings of a Conference Held by the International Economic Association at Valescure, France*, edited by A.J. Coale. New York: Wiley.
- Schultz, T.W. (1964) *Transforming Traditional Agriculture*. New Haven, Conn.
- Schultz, T.W. (1979) *Investment in Population Quality Throughout Low Income Countries*. Chicago: University of Chicago, Human Capital Paper 79:1, January.
- Takase, K. and T. Wickham (1978) Irrigation management and agricultural development in Asia. *Foodcrop Agriculture in Asia*, Vol. 1, Supplementary papers to *Rural Asia: Challenge and Opportunity*. Asian Development Bank.
- Taylor, C.E. (1973) Nutrition and population. In *Nutrition, National Development, and Planning*, edited by A. Berg, et al. Cambridge, Mass.: M.I.T. Press.
- Taylor, C.E., et al. (1976) The child survival hypothesis. *Population Studies*, 30(2).
- Taylor, C.E. (1977) Nutrition and population in health sector planning. *Food Research Institute Studies*, XVI(2):79.
- Taylor, L. (1977) Research directions in income distribution, nutrition, and the economies of food. *Food Research Institute Studies*, XVI(2):29-46.
- Timmer, C.P. (1976) Food policy in China. *Food Research Institute Studies*, XV(1):53-69.
- Tsui, A.O. and D.J. Bogue (1978) Declining world fertility: trends, causes, implications. *Population Bulletin*, 33(4). Washington, D.C.: Population Reference Bureau, Inc.
- UNICEF (United Nations Children's Fund)-India (1977) *Scar, Statistical Profile of Children and Youth in India*. New Delhi.
- UN (forthcoming) *Patterns of Urban and Rural Population Growth*. New York: Population Division, United Nations.
- UN (1975) *Report of the World Food Conference Rome, 15-16 November, 1974*. New York.
- UN (United Nations) (1976) *Global Review of Human Settlements: A Support Paper for Habitat*, Vol. 2, Oxford Pergamon Press.

- Valdes, A. (1974) The transition to socialism: observations on the Chilean Agrarian Reform. In *Employment in Developing Nations*, edited by E.O. Edwards. New York: Columbia University Press.
- Vallin, J. (1976) World trends in infant mortality since 1950. *World Health Statistics Report*, 29(11). Geneva: WHO.
- Vyas, V.S. (1976) Structural change in agriculture and the small farm sector. *Economic and Political Weekly*, XI(1-2):29-36.
- Vyas, V.S. (1979) *Presidential Address, Indian Economic Association*. January.
- Welch, F. (1978) The role of investments in human capital in agriculture. Pages 259-81, in *Distortions in Agricultural Incentives*, edited by T.W. Schultz. Bloomington and London: Indiana University Press.
- Weisbrod, B.A., et al. (1973) *Disease and Economic Development: The Impact of Parasitic Diseases in St. Lucia*. Madison: University of Wisconsin Press.
- WHO (1976a) *New Trends and Approaches in the Delivery of Maternal and Child Care in Health Services*. Sixth report of the WHO Expert Committee on Maternal and Child Health, tech. report series 600, Geneva.
- WHO (1976b) *Application of Systems Analysis to Health Management*. Tech. report series 596, Geneva.
- WHO (1978) *WHO, Primary Health Care: Report of the International Conference on Primary Health Care, Alma Ata, USSR, 6-12 September*. Jointly sponsored by the World Health Organization and the United Nations Children's Fund, Geneva.
- WHO (1979) *WHO, Training and Utilization of Auxiliary Personnel for Rural Health Teams in Developing Countries*. Report of a WHO Expert Committee, tech. report series 633, Geneva.
- World Bank (1977) World Bank, development policy staff, *Prospects for Developing Countries 1978-85*. Washington, D.C.
- World Bank (1978) *World Development Report 1978*. Washington, D.C.
- Yotoupolos, P.A. The population problem and the development solution. *Food Research Institute Studies*, XVI(1).

PAPERS OF THE POPULATION, RESOURCES, AND GROWTH STUDY

1. Nathan Keyfitz, *Understanding World Models*. RM-77-18. Laxenburg, Austria: International Institute for Applied Systems Analysis. Published in *Sociological Methodology 1978* edited by K.F. Schuessler, pp. 1-19. San Francisco: Jossey-Bass Publishers.
2. Andrei Rogers, *Migration, Urbanization, Resources and Development*. RR-77-14. Laxenburg, Austria: International Institute for Applied Systems Analysis. Published in *Alternatives for Growth: The Engineering and Economics of Natural Resources Development* edited by H. McMains and L. Wilcox, pp. 149-217. New York: Wiley.
3. Roman Kulikowski, *Optimization of Rural-Urban Development and Migration*. RM-77-14. Laxenburg, Austria: International Institute for Applied Systems Analysis. Published in *Migration and Settlement: Selected Essays. Environment and Planning A 10(5):1978*.
4. Frans Willekens, *Spatial Population Growth in Developing Countries: With a Special Emphasis on the Impact of Agriculture*. WP-77-04. Laxenburg, Austria: International Institute for Applied Systems Analysis.
5. Andrei Rogers, *Urbanization, Agricultural Change, and Spatial Concentration in Open Dualistic Economic Development: Background Paper for the 1978 May Task Force Meeting and December Conference*. WP-78-5. Laxenburg, Austria: International Institute for Applied Systems Analysis.

6. Henry Rempel, *The Role of Rural-Urban Migration in the Urbanization and Economic Development Occurring in Kenya*. RM-78-12. Laxenburg, Austria: International Institute for Applied Systems Analysis.
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8. Tatiana Zaslavskaya, *Complex Systems Research on Socio-Economic Problems of the Rural Agricultural Sector in the Soviet Union*. WP-78-22. Laxenburg, Austria: International Institute for Applied Systems Analysis.
9. Donaldo Colosio, Luis J. Castro, and Andrei Rogers, *Migration, Urbanization and Development: A Case Study of Mexico*. WP-78-27. Laxenburg, Austria: International Institute for Applied Systems Analysis. Published in abridged form in *Memoria Cuarto Congreso Academia Nacional de Ingenieria, A.C.*, pp. 200-203.
10. Mahendra Shah and Frans Willekens, *Rural-Urban Population Projections for Kenya and Implications for Development*. RM-78-55. Laxenburg, Austria: International Institute for Applied Systems Analysis.
11. Jacques Ledent, *The Dynamics of Two Demographic Models of Urbanization*. RM-78-56. Laxenburg, Austria: International Institute for Applied Systems Analysis.
12. Jacques Ledent, *The Factors and Magnitude of Urbanization under Unchanged Natural Increase and Migration Patterns*. RM-78-57. Laxenburg, Austria: International Institute for Applied Systems Analysis.
13. Jacques Ledent, *The Forces of Urbanization and Varying Natural Increase and Migration Rates*. RM-78-58. Laxenburg, Austria: International Institute for Applied Systems Analysis.
14. Allen Kelley, and Jeffrey Williamson, *Urbanization, Distribution, and Economic Growth*. Unpublished manuscript. Laxenburg, Austria: International Institute for Applied Systems Analysis.
15. Zbigniew Pawlowski, *A Demoeconometric Model of Poland: DEMP 1*. WP-79-14. Laxenburg, Austria: International Institute for Applied Systems Analysis.
16. Donaldo Colosio, *Urbanization and Economic Development in Mexico*. WP-79-19. Laxenburg, Austria: International Institute for Applied Systems Analysis.
17. Bruce Johnston, and William C. Clark, *Food, Health, and Population Policy Analysis and Development Priorities in Low Income Countries*. WP-79-52, Laxenburg, Austria: International Institute for Applied Systems Analysis.

18. Bruce Johnston, *Socio-Economic Aspects of Improved Animal-Drawn Implements and Mechanization in Semi-Arid East Africa*. Forthcoming.
19. Zbigniew Pawlowski, *DEMP 1: Some Counterfactual Simulation Results*. WP-79-39. Laxenburg, Austria: International Institute for Applied Systems Analysis.
20. Clark Reynolds, *A Shift-Share Analysis of Regional and Sectoral Productivity Growth in Contemporary Mexico*. WP-79-41. Laxenburg, Austria: International Institute for Applied Systems Analysis.
21. Andrei Rogers, and Dimiter Philipov, *Multiregional Methods for Subnational Population Projections*. WP-79-40. Laxenburg, Austria: International Institute for Applied Systems Analysis.
22. Jacques Ledent, and Andrei Rogers, *Migration and Urbanization in the Asian Pacific*. WP-79-51. Laxenburg Austria: International Institute for Applied Systems