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KIRIT S. PARIKH

*Analysis of National and International Agricultural Policies for Sustainable Growth and Equity and Stability in an International Setting\**

INTRODUCTION

Food problems – efficient production or procurement of food and the appropriate distribution of food among members of family and society – are endemic problems of mankind. Yet the nature and dimensions of these problems have been changing over time. As economic systems have developed specialization has increased and this has led to increased interdependencies of rural and urban areas, of agricultural and nonagricultural sectors, and of nations. The importance of public policies in resolving these problems has grown with this growing interdependence of nations, reflected in increasing volumes of food trade, and this requires that the exploration of national policy alternatives be carried out in the context of international trade, aid and capital flows.

The objective of the Food Agriculture Programme (FAP) of the International Institute for Applied Systems Analysis (IIASA) is to find national and international policies that would help ensure adequate food for all in a sustainable way (Parikh and Rabar, 1981). Our primary emphasis is on policies with a five to twenty years perspective. But we recognize that the policy options available to individual nations are significantly affected by the policies of other nations. Policies have to be evaluated in the context of the objectives of national governments. Growth, equity, stability and sustainability may in general be considered to be the objectives of the governments' economic policies. Specific policy instruments, even policies relating to primarily agricultural issues, affect these objectives differently. This can be seen in Table 1 which summarizes the possible impacts of some important policies on those objectives in a large developing country such as India. Thus to evaluate policies we need to determine quantitatively the impact of policies on various objectives. This can be done satisfactorily only with a policy analysis model system. The model system we have

\* The paper describes the work of many people who constitute the FAP Network, to all of whom the credit for its substance goes. In writing this I have benefited from the help and comments of Gunther Fischer, Klaus Froberg and Douglas Maxwell.

constructed consists of price endogenous, descriptive, general equilibrium national policy models of 23 selected countries, or groups of countries, covering 80 per cent of the world's agricultural production, consumption, and trade, which explicitly incorporate governmental policies and which are linked through trade, aid and capital flow. The models are to be used in a year by year simulation mode. The FAP of IIASA has been working on this task since 1977 with the help of a large network of collaborating institutions around the world.

TABLE 1 *Some effects on objectives of various policy instruments*

Policy instrument	Objective			
	Growth	Equity	Stability	Sustainability
Investment level	↑	↑↓	↓	
Income tax	?	↑?		
Indirect tax	↑	↓	↓	
Irrigation	↑	↓	↑	↓
High yield varieties	↑	↓	↓?	↓
Fertilizers	↑	↑↓		↓
Mechanization	↑?	↓		
Land ceiling and redistribution	↑↓	↑		↑↓
Tenancy reforms	↑	↑		↑?↓
Public food distribution	↓	↑	↑	↑
Procurement of food grains	↓	↑		
Buffer stock operation	↓?		↑	↑
Food aid	↑↓?	↑	↑	↓

↑ Further objective.

↓ Adverse effect on objective.

? Questionable effect.

Source: Parikh, 1977.

Our model system differs from many past global models (FAO, 1971; Japanese MAFF, 1974; Takayama, et al., 1976; Rojko and Schwartz, 1976, and Lundborg, 1981) in that we distinguish nations. MOIRA (Linnemann, et al., 1977) distinguishes nations but only has one commodity and a restricted set of government policies.

Policy in our national models is directed to understanding structural change in terms of composition of output in agriculture and non-agriculture, of rural to urban populations and of changing comparative advantage of the nation. The linked system permits policy analysis within an environment in

which countries adapt their policies to each others' actions. The general equilibrium methodology at both the national and international level provides a rigorous tool to account for the interactions between different actors – producers, consumers, governments – and ensures balance not only at the commodity but also at the financial level of each of the actors. Government policies are restricted to specific instruments whose effectiveness is thus judged in the context of behavioural responses of economic agents.

The paper is organized as follows: in the next section the structure of a typical national model and their international linkages are described. A number of policy applications are then briefly presented. Finally our approach to incorporating objectives of long-term sustainability is indicated.

### A TYPICAL NATIONAL POLICY MODEL OF THE FOOD AND AGRICULTURE PROGRAMME

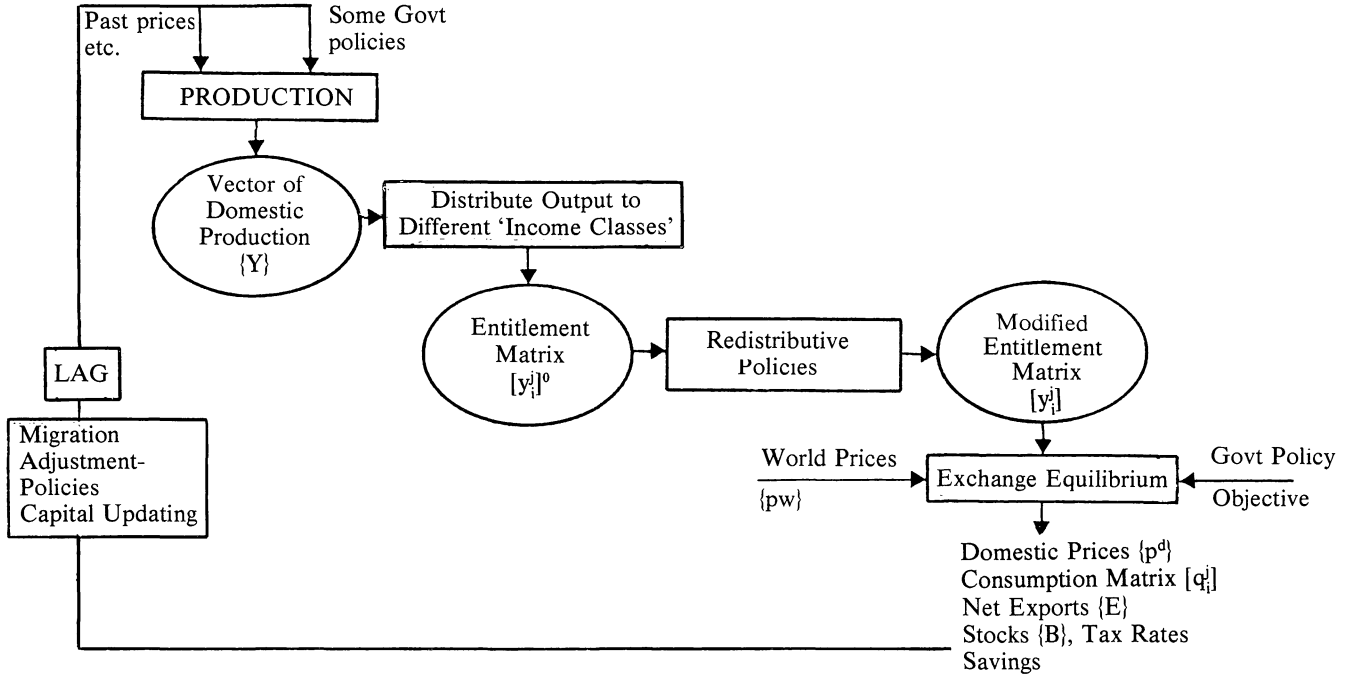
The basic elements of the model system of the FAP are the national policy models. A national model has to reflect the specific problems of interest to that particular nation. Thus the national models differ in their structure and in their descriptions of government policies. The model system of the FAP permits linking of such diverse models but requires that the models meet a few conditions. They have to have a common sector classification at the international trade level, nine agricultural and one nonagricultural sectors, and some fairly reasonable additional technical requirements. For example, net exports have to be independent of absolute level of world prices and continuous functions of them. Even though the national models differ from each other, the broad structure is common to most models. Each model covers the whole economy and together they cover the whole world. Thus there are no infinite sources or sinks in the system to absorb policy impacts and mask feedback and other secondary effects. Food supply and demand are distinguished by various income groups. A typical model is shown in Figure 1.

Past prices and government policies affect production decisions. The domestic production in the  $n$  sectors of the economy,<sup>2</sup>  $y_1, y_2, \dots, y_n$ , is determined by each of the various income groups – represented by superscript  $j$ . Thus for group  $j$ , its share of the national product is given by the vector  $y_1^j, y_2^j, y_3^j, \dots, y_n^j$ . The income this share amounts to is determined by the price that these products command. For example, a farmer who has grown two tons of wheat and one ton of rice would have an income of twice the price of a ton of wheat plus the price of a ton of rice, minus the cost of producing wheat and rice. The matrix  $[y_i^j]^0$  thus describes the initial entitlements of the different products for the various groups. Government policies may redistribute these entitlements to  $[y_i^j]$ .

Given these entitlements and world prices, the  $j = 1, \dots, J$  income groups trade among themselves under the influence of government policies, which include national market policies, (price, bufferstock, trade) public

FIGURE 1 *A typical national model*

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Source: Parikh and Rabar, 1981.

finance policies (balance of payments, public demand, direct tax) and international market and finance policies (agreements on price, bufferstock, trade, financing). The resulting exchange equilibrium determines the domestic prices, net exports, tax rates, and the consumption patterns of different income groups whose demand behaviour is characterized by a linear expenditure system and which clears the markets and meets the balance of trade constraint.

### THE INTERNATIONAL LINKAGE

The net exports of all the countries are thus calculated for a given set of world prices and market clearance is checked for each commodity. The world prices are revised and the new domestic equilibria giving new net exports are calculated once again for all countries. This process is repeated until the world markets are cleared in all commodities. It may be noted that at each stage of the interaction the domestic markets are in equilibrium. The procedure is shown schematically in Figure 2. It may be noted that any international agency – such as a bufferstock agency – can be represented as a country and the effectiveness of its policies can be evaluated within a framework in which country policies react to the policies of the agency.

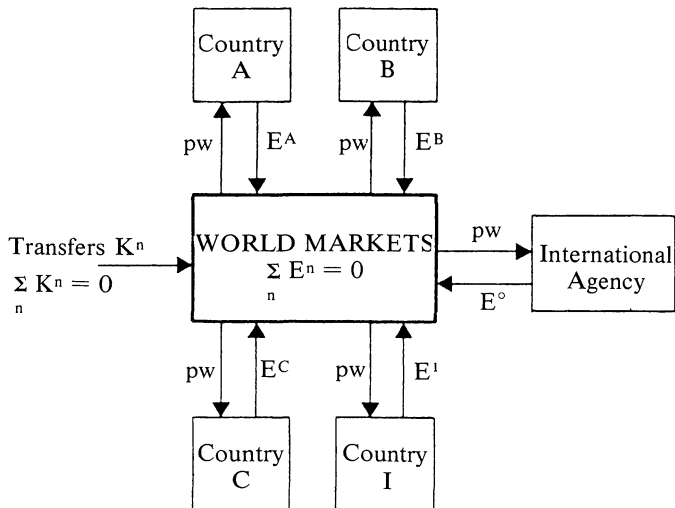


FIGURE 2 *International linkage*

Source: Parikh and Rabar, 1981

This process yields international prices as influenced by government policies. The outcome of this process is examined by governments who may change their policies for the next period.

Since we go through these steps period by period, we have a dynamic simulation that we use for a five-to fifteen-year period to predict the consequences of various policies, not only for individual countries but also for the entire system.

The approach of the FAP model system described briefly above is certainly ambitious but if the policy issues raised here are to be adequately explored, we believe that such a level of complexity is inescapable.

## IMPLEMENTATION – A NETWORK APPROACH

The countries selected and the status of the models are shown in Table 2. As can be seen, most of the detailed models are being developed with the help of collaborating institutions. The collaborating institutions bring knowledge of specific countries and through their expertise are able to make national models more realistic. Moreover, they provide contact with national decision makers, help disseminate findings and ensure that the work of the FAP will find real-life applications. The development of the methodology of linking the country models together, as well as the methodology of the computation of domestic equilibrium under the influence of government policies, was begun at IIASA and continued at the Centre of World Food Studies in Amsterdam, by M. Keyzer (1981).

TABLE 2 *Status of detailed national agricultural policy models, April 1982*

Some policy analysis made	Nearly ready	Well underway	Scheduled to start
*Hungary	*EEC	*Egypt	Australia
CMEA	Kenya	*Poland	New Zealand
*India	*US	*Japan	*Mexico
Brazil	*Finland	*Canada	Nigeria
*Sweden		China	Pakistan
*Austria			Argentina
*Thailand <sup>a</sup>		*Bangladesh <sup>a</sup>	*Indonesia <sup>a</sup>

\* Built with the help of collaborating institutions

<sup>a</sup> Co-ordinated by Centre for World Food Studies, Amsterdam

The FAP group also developed a number of detailed country models (Parikh, Narayana, 1981; Csaki, 1981), as well as a simplified system (Fischer, Frohberg, 1980) consisting of models of all the selected countries based on a data bank (Sichra, 1981) organized by IIASA around data obtained from international organizations. The simplified system of models demonstrated the feasibility of linking various national models, and established the computational efficiency of the algorithms developed. The simplified national models were further developed with the help of specialists from various countries into an intermediate version of models which constitute a system called the *basic linked system*.

## SCOPE OF ANALYSIS

Some of the more important policy questions that can be explored with the *basic linked system* and the detailed models are listed below:

### *National policies*

For growth:

What is the impact of price policies on production and consumption?

What are the impacts of fertilizer prices, irrigation and 'modernization' on production, food prices and consumption?

How does agricultural growth affect employment and migration patterns?

For equity:

Does a price increase in the cities benefit the farmers?

Is it better to ration food or to issue food stamps for public food distribution programmes?

What role can a food-for-work programme play in relieving rural poverty?

How do changes in landholding patterns and in tenancy structure affect production and consumption?

For stability:

Is price stabilization desirable for consumers?

What is an appropriate national bufferstock policy to stabilize prices?

How can stable incomes for farmers be ensured? What are the costs and benefits of alternative schemes of deficiency payments and set-asides?

For self-sufficiency:

How to realize an appropriate agricultural self-sufficiency level?

Should food aid be sought? What are effective ways of utilizing food aid?

What are appropriate trade policies of trade quotas, tariffs, and export incentives?

### *International policies*

What are the consequences of adoption of large-scale programmes for alcohol/energy plantations by energy-deficient countries with food surpluses?



- What is the most effective way to operate an international bufferstock agency that tries to ensure that prices for specific commodities either remain at a given level or remain within a prescribed range?
- What would be the economic consequences of an agreement to keep world market prices at given levels by adjusting internal prices, either for all nations or for a subset of nations?
- What would be the size of a bufferstock to withstand a shock such as might result from a series of crop failures?
- What levels of international food transfers are required to banish hunger within a prescribed time limit?

## EXAMPLES OF POLICY ANALYSIS

In a short paper one can only present a few selected examples of such analysis which give a flavour of the kind of analysis that is possible:

*If only the rich countries ate less and exported more*

What impact would it have on the hungry people of the poor countries if the rich countries were to eat less and export more, thereby lowering world prices and allowing the poor countries to import more than they do now?

This was explored by F. Rabar (1981). It was assumed that a hypothetical country enters the market with the firm intention of selling thirty million tons of wheat each year, at any price, to help poor importers. A series of adjustments start as soon as the first thirty million tons appear on the market. The international market response is immediate. Argentina, Australia, Canada, the US, Mexico and India reduce their export of wheat, and Austria, Japan, Brazil, Egypt, New Zealand, the EEC, Thailand, Kenya, Pakistan, Nigeria and the rest of the world increase their imports. The CMEA countries, China and Indonesia show no reaction. Yet the quantity is too high to be completely absorbed at prevailing prices. The wheat price drops and it stays depressed for the next ten years.

The second-level adjustment on the part of the exporting countries, after reducing their exports, is to reduce their production as well. This happens with different time lags, different speeds and different intensities. This is, though, the general response of all the exporters.

The second-level adjustment on the part of the importers, after increasing their imports and their home demand, is the reduction of their home supply. In other words, they substitute their home production with cheap imports. Of course, they reallocate their production capacities to other products: because of these substitutions the consumption of wheat increases only marginally and hungry people do not eat much more.

A slight improvement in the nourishment of the population can be observed in some developing countries, but not all. The real advantage seems to be in the beef market. In almost all countries there is an upward shift in feed consumption: either wheat is directly used as feed or producers substitute wheat with coarse grain production. Bovine production and

export figures in the exporting countries and imports in the importing countries go up and for some years after the shock an upswing in the beef market is created, until prices and production begin to adjust.

After all these adjustments we may ask the question: where are the additional thirty million tons of wheat, put on the market by an imaginary country? The answer is that it was absorbed in the system. Almost none of it reached the hungry people of the countries represented.

*Growth or redistribution, or both*

Per caput food production has grown in India at an annual rate of 1 per cent over 1950–80 and yet the percentage of rural population below poverty line with insufficient food has remained more or less constant. To test the effectiveness of redressing poverty and malnutrition what we call a ‘free food programme’, in which the government annually distributes freely to everyone 75 kg of food-grains, the model of India was used by Parikh and Narayana (1981).

The questions that arise are the following:

What would be the impact on poverty, on consumption and on income distribution?

What would be the impact on government budget, its budgetary surplus and public investment, and consequently the impact on the growth rate of the economy?

What would be the impact on domestic market prices of foodgrains and their impact on supply?

The simulation is carried out up to 1990 – where the policy changes are introduced in 1977. Four scenarios are generated to explore the issues. To eliminate the problem of domestic supply disturbances, we ensure in all scenarios the same prices to farmers – that is, the same incentives – through complete domestic price stabilization. The food distributed freely is purchased by the government on the market and is financed by reducing public investment which affects economic growth. The results of the runs are shown in Table 3. The two base scenarios of high and low growth are generated through change in savings rate.

TABLE 3 *Indian agricultural model results: annual growth rates 1971–90*  
(per cent)

	High growth		Low growth	
	Base	Free food	Base	Free food
Real GDP	5.40	4.77	4.60	3.86
GDP agriculture	2.59	2.59	2.59	2.59
GDP non-agriculture	6.95	6.07	5.78	4.70

Between the base and the free food scenarios a fall in growth rate of real GDP of about 0.7 per cent per year is observed. A major impact of the programme is in the distribution of consumption. Under the free food programme the number of people in absolute poverty drops to around 10 million in 1977 from its 1976 level of more than 160 million people in the rural areas. When we compare the two base scenarios we see no change in poverty levels. So growth alone is not enough to reduce poverty. It is clear that such a free food programme can be very effective in reducing poverty. Its cost is lowered growth. A reduction of 0.8 per cent in growth rate from the low and high growth base rates of 4.6 and 5.4 seems quite acceptable to us. But a reduction from an average annual growth rate of 3.5 per cent, as achieved by India over the past three decades, may not be so obviously acceptable. The growth rates in our base cases are higher than actual because of our assumption of reduced capital/output ratios in the non-agriculture sector. Thus, if growth is stepped up, redistribution becomes easier but it is still necessary to redress poverty.

*What if climate changes were to reduce yields of some foodgrains in the United States*

Climate changes such as disturbance of the ozone layer may reduce rates at which yields of soyabeans, maize and wheat increase in the United States. Such changes affect acreage allocations in the United States, its exports and world prices. The impact would be global. This was explored with our US model (Abkin, 1981) linked to our *basic linked system*.

The yields of soyabeans, maize and wheat grow by 1.83, 1.68, 2.06 per cent per year, respectively, in the base run. We assumed that climate disturbances would lower these rates to 0.93, 1.54 and 1.61, respectively, from 1982 onwards. The effects were predictable but the magnitudes somewhat surprising. Though the US yields in 1990 were lowered by 8.3, 0.82 and 4.1 per cent for soyabeans, maize and wheat, respectively, their US outputs reduce by 6.75, 1.87 and 2.56 per cent only, and the world production changes even less. It is interesting to note that the area under maize increases whereas areas under soyabeans and wheat decrease. The world prices of soyabeans are higher in all years from 1982 to 1990 but the prices of maize and wheat are lower in some years though higher in most years. The meat prices are also higher. These adjustments in production structures in the United States and the world somewhat soften the impact of such changes. The above runs can also be interpreted to show what would happen if the rates of technical progress were to slow down in soyabeans, maize and wheat yields in the United States.

*What if the United States were to raise the price of its grain exports*

A bill proposed to the US Congress would raise the price of exported wheat and maize to 'the cost of production' – a technical US agricultural term that is calculated on a generous basis. What would be the consequence of such a bill on prices, production and farmers' incomes? This will be explored with the help of our US model (Abkin, 1981) linked to our *basic linked system*.

One expects that:

- The US prices would rise to the ‘cost of production’.
- The world price would rise to the US price less transportation differentials. This would happen because the price rise is low enough and the US is an important enough supplier so that the US would still export.
- There would be large acreage restrictions on US production of maize and wheat.
- The acreage restrictions and higher prices could affect farmers’ incomes either way
- The effects on coarse grains exports from the United States would be slightly moderated by substitution to other feedgrains.
- Non-US production of wheat and coarse grains would increase. The extent of this is the main key to whether US farmers would be helped or hurt.
- The United States would expand its production of other agricultural commodities, especially, perhaps, rice.
- As the model is now set up the US price of meats would rise, reducing consumption.

Without linkage to models of other countries provided by our basic linked system, it would have been difficult to explore this issue. Runs made with the US model in a stand-alone mode would fail to show the effects outside the United States where exporting nations, or those nearly ready to export, would be helped while importers would be hurt. But more importantly, the impact of the world on the United States would have to be captured by an export demand function. Even when reasonable estimates of these are available, changes in them, due to policy adjustments of other countries consequent to US policy changes, would be hard to capture in such an unlinked run.

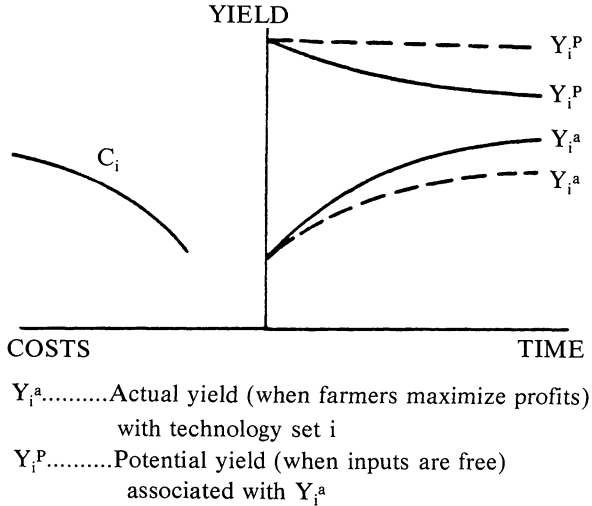
## ENSURING LONG TERM SUSTAINABILITY

From a longer term perspective of thirty years, the increasing demand for food from the growing population of the world which is also becoming richer, questions of the availability of resources to produce adequate food, the efficiency of techniques and environmental consequences come to the fore. Land would have to be cultivated much more intensively. What is the sustainable production of the world? How do we sustain it and what are the policy options needed now?

For this purpose we use a physical crop production model developed on agronomic principles which define yield functions given soil, climate and genetic information. This is further extended to give associated environmental effects of cultivation when additional information on cultural practices are provided. The environmental effects in turn are fed back to modify soil characteristics and future yield functions. Thus we can explore

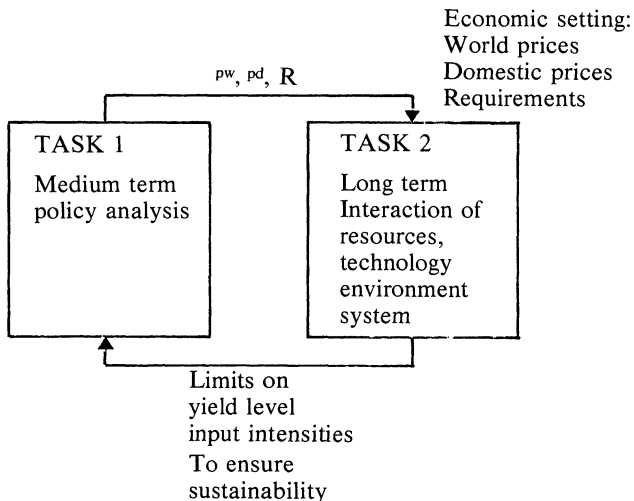
interactions of technology, resources, environment and economics, and summarize the outcome for a given crop in a region as shown in Figure 3.

FIGURE 3 *Summarizing technology, economics and environmental interactions*



One can define sustainability in many ways such as  $Y^P(t) \geq Y^P(t-1)$  or  $Y^P(T) \geq Y^P(0)$ . The former ensures monotonic increase in potential yield, but the latter only insists that it be restored by the end of the planning period. To bring considerations of sustainability into medium term policy analysis we visualize the connections shown in Figure 4.

FIGURE 4 *Bringing sustainability into medium-term policy*



The findings of Task 1 will provide a starting point for the scenarios of Task 2, providing a realistic basis for long-term investigations. The findings of Task 2 might modify the representations of permissible intensities of technologies in Task 1. Present policies and actions may have to be constrained to keep open options for technological transformations in later decades.

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## DISCUSSION OPENING – DOUGLAS D. HEDLEY

It is with considerable pleasure that I respond today to Kirit Parikh's paper. First, the Department of Agriculture in Canada has had a very close association with the FAP at IIASA for some time and we are keenly interested in the Phase II work outlined in the paper. Second, I am particularly pleased to be returning 'home' for these meetings.

The task facing IIASA in modelling a high proportion of world agricultural production and consumption on an individual country basis is awesome. In almost every case, the country models are based on a history of previous models, and some are directly linked to larger models in the individual country. In the case of Canada, the Canadian component in IIASA has a much longer companion model, the Farm and Regional Model, which is used continuously and heavily in both forecasting and assessment of policy alternatives for agriculture.

Some reflection on the growth of modelling over time is worthwhile. As the quantitative techniques emerged during and after World War II, there was an explosion of effort to use these new techniques in the practical world of problem solving. Computer hardware and software lagged behind in applying many of the multi-equation techniques and the highly iterative processes that the theoreticians generated, until at least the late 1960s. During the 1970s computer technology advanced to the point that the cost of relatively sophisticated modelling became easily within the reach of many organizations, national, international, private and public. At the same time, however, the economic shocks of the 1970s began to show up, particularly energy and cereal grain prices and more recently interest rates. While models have not been able to forecast these events, creating considerable scepticism regarding their use, models have been very helpful in exploring the impacts and longer-run implications of these fundamental changes in the domestic and international economic structure.

The conclusion I draw from this review is that while Dr Parikh has presented to us a number of policy issues he wishes to explore, one must recognize that the conclusions drawn are representative of the economic structure embedded in the model. In almost every case, these models reflect the historical or existing economic structures of individual countries. The results of any policy scenario are conditioned by that economic structure. As events unfold in the 1980s further significant adjustments in world economic structure are likely to occur, possibly invalidating the conclusions IIASA may draw in Phase II. The result is that any exercise such as FAP is a continuing process and not one that can be turned on and off. The argument I am building here is that the FAP at IIASA should have a continuing role with a long term commitment at some international organization. By the late 1970s, funding of large models had largely stabilized, replacing the surges of interest and disinterest in modelling efforts. It is important to maintain this stability throughout the 1980s.

Let me turn now to the issues raised by Dr Parikh in the policy analyses he proposes for examination by the FAP model. The approach used by Dr

Parikh relies heavily on exploration of policy issues within individual countries and then tracing the international impacts of these policy actions to other countries. At the outset, I want to express a major concern with the apparent sequence of events and efforts in the work of FAP. Model development is being undertaken in Phase I of the work with policy identification and analysis of policy issues and alternatives following in a subsequent phase of the work. Model development appears to have been conducted with only an informal and largely implicit understanding by the modellers of the issues and problems to be explored. Dr Parikh is only now identifying a lengthy list of issues both national and international in his paper. This is certainly not a fatal flaw in the work of IIASA. It could however lead to the need to redevelop some components of the overall linked model system to add specific policy instruments or economic relationships which were not earlier identified. This iterative process of model development and redevelopment to incorporate new components is well-known and recognized in the large-scale models designed for continuing use in forecasting and policy analyses. From a pragmatic point of view, it may indeed have been impossible to fully define a set of policy issues robust enough to have withstood the changing economic environment during the period of model development.

In reviewing the list of policy concerns proposed in Dr Parikh's paper it is difficult in the time allocated to me here to examine each. I want to comment on one significant issue in economic development which appears to be missing, and to explore, as well, one included in the set of international policies.

An emerging concern over recent years involves the complex set of relationships involving commodity prices, interest rates, private and institutional credit and changing debt maturities and the impacts these variables have on foreign exchange earnings, capital generation within a country and debt servicing in many countries. First, the rapid increase in interest rates since 1979 has added substantially to the debt service burden in the Third World. Second, shorter debt maturities, primarily from private credit institutions, have increased the proportion of debt falling due in each year thereby increasing the vulnerability of many countries to the vagaries of credit markets. Third, a large number of developing countries have over the past two decades moved towards private credit markets and away from the international institutional credit of the IMF, IBRD and regional development banks. The significant expansion of credit from private sources during the last decade particularly is unlikely to continue as strongly in the 1980s. The implication of this is to add to the vulnerability of many countries in debt services. Finally, as I review commodity prices generally, the coincidence of low prices across many diverse sectors is cause for concern. The base metals, ones such as phosphates, the industrial or plantation crops in agriculture – tea, coffee, cocoa, rubber, palm oil, sugar – and cereal prices, all appear to be simultaneously low. The implication is very heavy



pressure on foreign exchange earnings, adding to the debt servicing problems and deeply affecting capital formation, capital rationing between and within countries and sectoral growth rates.

If these four factors I have outlined persist for any extended period of time, levels of trade and capital development and growth processes in much of the Third World could be significantly affected for the remainder of the 1980s. It should be noted that the poorest nations of the Third World are likely to bear the least immediate impact of these events; the NICs will be most affected, possibly pushing many back towards international institutions for assistance. In Figure 1 of Dr Parikh's paper I cannot readily identify the model components to acceptably address this issue. Figure 2 is suggestive but insufficient detail exists to provide assurance that the linked system can either.

Let me now turn to an issue which Dr Parikh does raise in his paper – international buffer stocks. I doubt that the political will or the economic rationale for international buffer stocks exists today of the type commonly proposed. Valdes and Siamwalla at IFPRI have identified a range of sources of insecurity in food supplies. Many of the sources of insecurity lie completely outside the agricultural sector and do not necessarily manifest themselves in domestic or international prices and supplies. It would seem more valuable to use the taxonomy of Valdes and Siamwalla or some other comparable set of food insecurity sources and begin to address individually these issues. Certainly the broad issue of nutritional adequacy in diets is very important but I cannot visualize an international buffer stock as a means to deal with a myriad of concerns in this area. I cannot judge from Dr Parikh's presentation if the models he describes have the detail sufficient to deal with the individual issues.

My final comment on Dr Parikh's presentation has to do with the concerns of this conference – growth and equity. Table 1 gives equity as one of the objectives of agricultural policy, yet in the description of the models in Figures 1 and 2 there is little indication of how this objective is dealt with in the models. My concern stems from the relationships shown in Table 1. Growth and equity objectives are viewed as incompatible for high yielding varieties, contrary to the results of Professor Hayami noted earlier in the conference. Several other cases in Table 1 can be cited as questionable. If these relationships in Table 1 are taken as *a priori* in development of the model, then the model results may indeed be questionable. Possibly, Dr Parikh needs to re-work Table 1 substantially and to explore more thoroughly the conditions under which his proposed relationships may hold. Certainly a country by country review would seem to be needed.

In closing, I want to applaud the work of Dr Parikh and his team at IIASA for the leadership and skill they have brought to their work. All of us look forward to Phase II of the FAP work and the insights which their work can bring to the processes and policies in international agricultural development.

## GENERAL DISCUSSION – RAPPORTEUR: ZULKIFLY HJ. MUSTAPHA

### *Papers by Gerrard and Parikh*

The questions and comments from the floor were generally in line with those raised by the openers of the discussion.

On Dr Gerrard's paper, the general discussion centred basically around pricing policy relating to the choice of producer prices as against world prices in food grain production and marketing towards self-sufficiency policy and the effects of such pricing policy. This was particularly raised as producer prices normally discount possible opportunity costs as well as other charges including transport and handling costs, and that if these costs were taken into account, and they should be in a pricing policy, there would be a different result. Other comments involved the analysis of government price behaviour in the context of the real grain market structure, changes in the inter-sectoral terms of trade as a result of such pricing policy, the relationship between British colonial policy and the prevailing agricultural development policy in East Africa, and the desire to achieve other goals (for example, fiscal goals) from that of self-sufficiency alone.

In his response to the general and technical comments raised by the opener as well as from the floor, Dr Gerrard explained that there exist some shortcomings and deficiencies in the analysis. He admitted to the fact that the governments in the four selected countries in East Africa in their producer pricing policy obviously have other goals apart from that of self-sufficiency alone, and that the paper did not elaborate appropriately and adequately on the evolution of agricultural development policy in the selected East African countries in relation to former British colonial policy. He also agreed on the prevailing diversity in the food grain market structure. At the same time, he claimed that the application of world prices instead of producer prices would create problems and other related issues pertaining to the choice of appropriate border prices, particularly in view of the effects associated with producer margins, the country's status as an exporter or importer, and their overall implications on the food grain self-sufficiency policy. In summation, he indicated that the producer prices used in the analysis were the official government prices, that is the prices received by the farmers on delivery of their produce to the marketing board.

So far as Dr Parikh's paper was concerned, the discussion was mainly on the applicability of the policy analysis model formulated by the FAP of IIASA. Comments and questions raised were on discrepancies in data presentation, the extension of the model to include economic policies over time, and the relationships between sectors, in particular the indigenous sector to the general economy.

In reply, he indicated that the model had implicitly considered sectoral relationships in the economy as economic policies were normally taken in the context of various objectives of national governments. The model incorporated both national and international economic policies for growth, equity, stability and self-sufficiency. Although some variables, for example

inflationary cycles, were not accounted for by the model, others were taken care of through the international trade equilibrium mechanism and other internal and external policies. Policy variables such as allocation of funds between activities and capital injection into a sector can also be incorporated into the model. He further indicated that the model has been applicable, citing the case of India, to analyse and evaluate the impact of policies on various objectives, though there were difficulties, as an example, to determine the magnitude of benefits and the beneficiaries of policy objectives. In the light of the dynamic economic situation, he agreed that the model should be continuous over time so as to consider further developments in economic policies.

Participants in the discussion included Joachim von Braun, Susumu Hondai, D. Belshaw, W. Henrichsmeyer and I. Carruthers.