NATIONAL AGRICULTURAL SECTOR MODELS IN PLANNING A MACRO-ECONOMIC ENVIRONMENT TO FACILITATE AGRICULTURAL DEVELOPMENT

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INTRODUCTION

Land use patterns and the general structure of the agricultural sector in many of the Eastern Caribbean economies have changed dramatically over the last 10-15 years. For example, traditional export crops such as sugarcane have declined substantially in the Leewards and Trinidad, while the same is true of bananas in the Windwards.

Manifested in the structural changes of the agricultural sectors is the increasing acreages of idle agricultural land, and in many instances, the degradation of such lands by a growing number of part time "landless" livestock farmers (e.g. Antigua). Complete loss of a limited quantity of agricultural lands has also occurred through urbanization, mainly by the expansion of human settlements and to a lesser extent by the emergence of other sectors (tourism, manufacturing etc.).

The emergence of the other sectors, in particular tourism, has also been more competitive than complementary to the agricultural sectors in other ways. They attracted investments away from agriculture, thus lowering incomes from the sector; resulted in a greater dependence on a wider variety of food imports, and catalyzed the movement away from agriculture. The trend in the agricultural sectors over the last 10-15 years therefore has been one of older farmers (the mode age group is farmers 65 years and over), and a growing quantity of idle lands in the face of rising unemployment since the emerging sectors do not have the labour absorptive capacity as agriculture.

In order to counter the trend, diversification of the agricultural sector from the traditional export crops have been attempted. Generally, diversification has been attempted with the emphasis on the project approach and without adequate macro-planning considerations. This has been partly responsible for the ineffective nature of the diversification process in many of the West Indian islands. It has also resulted in: (a) poor allocation of resources from a macro perspective, (b) the lack of a rationalization of agricultural production, and (c) the unnecessary duplication of projects inter and intra territorially. It has also contributed to the rising foreign debt caused by financing and executing projects which are locationally inefficient.

This paper focusses on the importance of reinforcing existing methods of national agricultural planning with more objective approaches, particularly in a dynamic agricultural environment. These

objective methods can play a useful role in policy analysis, project identification, diversification and rationalization of production, and in agricultural development in general. In order to demonstrate this view, this paper will draw heavily on the experiences of the Organization of American States (OAS) in Grenada, and to a lesser extent in Antigua and Barbuda.

NATIONAL AGRICULTURAL PLANNING

The most common form of national agricultural planning in many Caribbean islands is manifested through the annual budgets of the countries. Essentially, the Ministry of Agriculture prepares estimates of expenditures for the fiscal year and on approval by the Ministry of Finance or the relevant budgetary agency, this becomes the basis for the annual plan. Such plans primarily consist of maintenance activities such as the sustenance of extension services and subsidy schemes to farmers with limited emphasis on capital improvements. Prior to the 1970's, such plans did not work badly because the structure of the agriculture sector was fairly static and fairly predictable. However, with the structural adjustments in the agricultural sector over the last 10-15 years, such plans have been much less effective in facilitating agricultural development partly because they relied heavily on subjective analyses. Furthermore, with the emergence of other sectors less real resources were assigned to agriculture thus intensifying the drift away from agriculture.

A second and correlated form of national agricultural planning is the Five-Year Development Plan. Such plans, unlike the annual budgets, concentrate on capital improvements. These plans rely very little on objective techniques of analyses. Instead, they tend to elaborate the ideas of a few influential officials of the Ministry of Agriculture or present projects which have good funding prospects from identified donor agencies. As a result, agriculture is treated in much the same way as other sectors. Such plans therefore, suffer from the fact that agriculture is more land using than other sectors, it involves a larger number of actors, and most critically, that comparative advantage is more difficult to determine based solely on subjective analyses or the objective analyses of a few factors. Like the annual budget, such plans will not work badly when the structure of the sector is relatively static because subjective judgements may be quite accurate. However, with a dynamic sector there is a greater need for objective analyses and the presentation to policy-makers of a wider spectrum of alternatives.

There is another form of national agricultural planning which has emerged over the last 10-15 years. It can be denoted as "Project Planning". Many countries of the Caribbean now have planning units within the Ministry of Agriculture or a relevant ministry. The role of these planning units is generally to: (a) facilitate the identification, listing and prioritization of the project ideas, (b) prepare project feasibility and even complete project documents, and (c) monitor existing projects. Usually, projects are implemented based on such factors as their internal rate of economic rate of return; political appeal particularly when there is a large number of potential beneficiaries or it is large financially, and on funding availabilities. The problem with these planning units is that they approach project planning in a one-dimensional way with little

emphasis on the overall strategy of the agricultural sector. As a result the projects determine the strategy of the sector and not the macro strategy dictating the projects. There is no macro-economic model of the sector which helps to identify project characteristics or present a clear macro view of the agricultural sector.

The development of a macro-economic model of the agricultural sector will certainly be complementary to the current planning process. Such models will provide an objective basis for the presentation of a wide range of alternatives to policy-makers, and will provide a functional basis for the analysis of the effects of macro-economic policies on the agricultural sector.

FEATURES OF A NATIONAL AGRICULTURAL PLANNING MODEL

The development of a macro-economic agricultural sector model can be based on an approach used by the Organization of American States (OAS) agricultural planning project in Grenada in 1982 and now being refined in an ongoing project (Natural Resources Assessment for Agricultural Development) in Antigua and Barbuda). Briefly, the approach consists of the following steps:

(a) an assessment of the natural resources - this involves soils, land capability, existing land uses and water resource studies to determine the potential of the country and whether existing use is compatible with future agricultural development. Most of the Caribbean islands have some background data on soils, land capability and water resources; thus only a limited amount of work will be required to provide the necessary information on natural resource assessment.

(b) determination of the resources for agriculture - this involves the integration of the work on natural resources with data on land ownership, human settlements, tourism and other sectors which may compete with agricultural resource use. Data on land ownership are particularly important in countries where land zoning is non-existent. In such countries, the information on natural resources, human settlements, and land ownership can provide the basis for the comprehensive land policy. In general however, the determination of resources for agriculture will involve considerable interaction with policy-makers in cases where there is competition between agriculture and other sectors of the economy for the same resources.

(c) examination of the structure of the agricultural sector - this is particularly important given the structural changes which have occurred in the sector over the last 10-15 years. Recent agricultural census and surveys can provide the relevant data on farm size, status, labour use, technology and other variables which can be used to determine typical farm types and regional differences.

(d) Modelling of the agricultural sector - this entails a review of the goals of the agricultural sector in order to ensure that as many goals as possible are treated endogenously in the model. The model should also be constructed such that there is the flexibility of analyzing contemporary policy issues such as changes in input costs, prices and wage

rates; optimal farm size and the reduction of foreign cost in production. The determination of key enterprises to be treated endogenously in the model is also required, since cost and other considerations will limit the incorporation of all enterprises within the model. Also required are cost of production information and input/output relationships on the endogenous enterprises by farm types and distinct regions of production. This is needed so that comparative advantages can be determined objectively within the model framework. The modelling component also requires estimates on the potential demands on the agricultural sector and any linkages which may exist with other sectors.

In order to clearly demonstrate the benefits of a national agricultural sector model in facilitating agricultural planning, the results of Grenada model (1982) are considered as a case study. The development of the Grenada model more or less followed the basic steps outlined above. An inter-regional linear programming model was constructed with the objective of minimizing the cost of production and transportation associated with the production of 17 major agricultural enterprises (crops and livestock) in Grenada. The model was subject to resource availability constraints (land type and labour) and required to meet fixed point demands on each enterprise. The nation (Grenada and Carriacou) was divided into ten producing regions, and based on census and survey data three different farm size groups were defined, namely small (0-2 acres), medium (2+ - 10 acres), and large scale (10+ acres). Five principal market regions were defined consistent with local and export considerations.

The model was constructed with sufficient flexibility to consider the following options: (a) the minimization of foreign cost or some ratio of foreign to domestic costs of agricultural production; (b) changes in agricultural wage rates; (c) the immobility of labour inter-producing or market regions; (d) the mobility of land among farm size groups within producing regions so that optimal farm size distribution could be determined, and (e) sensitivity analysis on agricultural output requirements.

The results presented here, however, are based on the model simulation using the minimization of total cost (domestic and foreign), the immobility of labour among market regions, the existing (1982) farm size distribution, and sensitivity analysis on the output requirements. The results of the simulation are viewed in terms of its implications for the rationalization of agricultural production, farm size, ongoing projects (1982-86), and future project ideas.

(a) Rationalization of Production: The simulation indicated that its rationalization of production was not very different from the actual situation for the major traditional export crops (cocoa, nutmegs and bananas). Table 1 shows that the simulation and the actual situation were quite close in terms of production of such crops from both regions and farm size groups. The disparity between the simulation and the actual situation became sharper, however, as the enterprises became or were perceived by farmers to be of less economic significance. For example, the model indicated that livestock production should be concentrated on large farms; while the actual situation is the reverse primarily because of the existing abundance of idle lands, minor spices (clove and cinnamon) showed both regional and farm size

differences mainly because farmers treat such crops as shade trees or for soil conservation purposes and the true economic benefits are not fully apparent. As a result, production of such crops follow the same pattern as export crops while the model suggests small scale, part time farmers should be encouraged to produce these crops.

A major problem of the agricultural sector in Grenada is the diffuse nature of production of non-traditonal crops. This is very costly since it reduces the effectiveness of support services such as extension, marketing and technical assistance. Transportation and other direct costs of production are also increased. With the emphasis on diversification, the problem of scatter production would be amplified. More crops in more locations combined with different farm size groups must imply a greater demand on support services. Rationalization of production is therefore, an important ingredient in facilitating the diversification process. The simulation gives an indication of acreages, location and farm size groups which should be engaged in production.

TABLE 1: Comparison of Regional and Farm Size Differences in the Percentage Production Between the Simulation and Actual Situation for the Traditional Export Crop in Grenada

Regions and Farm Size	% of Total Production for Traditional Export Crops					
	Cocoa		Banana		Nutmeg	
	Simulation	Actual	Simulation	Actual	Simulation	Actual
Regions:						
East	43	36	40	45	73	43
North	20	12	30	29	-	28
West	7	21	19	21	6	19
South	30	30	11	5	21	10
Farm Size: (acres)						
Small (0-2)	15	13	24	20	46	16
Medium (2+-10)	55	41	53	42	7	43
Large (10+)	30	46	23	38	47	41

Table 2 briefly summarizes the rationalization proposed by the sumulation.

One question is how could policies effect this rationalization of production. The Ministry of Agriculture is the key to the rationalization process. The Ministry directs extension, technical assistance to farmers, and in many cases is responsible for the provision of planting material as well as the control of farm input subsidies. This leverage (rather than legislation) should be used to control the rationalization process. All projects (present and future) must also be targeted and prioritized by farm size and regions of production in a manner

TABLE 2: Summary of the Rationalization of Agriculture Delineated by the Model

Enterprize	Principal Location of Production (farm size)
Nutmeg	Middle belts (a); St David's (s)
Cocoa	St. Andrew's North-east (a); St. George's South (a); West Coast (s,m)
Banana	Middle belts (s,m); also see Cocoa - 42 to 58% pure-stand to banana from cocoa production
Clove	St. Partick's (s); St. David's (s)
Cinnamon	St. John's (s)
Avocado	St. Andrew's South (s); St. John's (s); St. David's (1)
Orange	St. John's (1); Carriacou (s,m)
Grapefruit	St. Andrew's North-east (1); St. John's (1)
Sugarcane	St. George's (a); St. Andrew's north (s)
Coconut	St. Patrick's (s); St. Mark's (1); Carriacou (s,m)
Other*	St. Andrew's North and South (m,1); St. Patrick's (1); Carriacou (s,m)
Beef	North and East Grenada (1); Carriacou (1)
Sheep	St. Andrew's (m,1); Carriacou (m,1)
Goat	Carriacou (m)

*Other - Mango, lime, guava and pawpaw.
m: Medium farm size;
a: All farm sizes
s: Small farm size;
1: large farm size;

consistent with the rationalization process. Efforts must also be made to involve farmers at the community and village levels.

(b) Farm Size: Results of the model indicated that the medium scale farms (2-10 acres) were the most productive. The optimal farm size, however, will depend on such factors as enterprise mix, location of production and the farmer status (full or part time). The model suggested the demise of the plantation (crop) farms unless appropriate technologies can be devised to mechanize the more labour intensive operations such as harvesting. Labour productivity was low (e.g. the elasticities of production for labour and capital inputs were 0.5 and 1.0 respectively) and such larger farms cannot compete with the low opportunity cost of household labour on family farms. Farms of less than 10 acres account for 95.8 per cent of household farm labour in Grenada.

(c) Ongoing Projects: The simulation had implications for at least two ongoing projects, namely: (a) a Canadian International Development Agency (CIDA) sponsored project on cocoa rehabilitation, and (b) a proposed World Bank funded "Crop Diversification and Expansion Project". The cocoa rehabilitation project was aimed at boosting cocoa production essentially through the subsidization of planting materials, fertilizers and pest - and disease control to all interested cocoa farmers. The model results suggested that the project should have been better targeted. A better approach would have been to phase the project so support services were directed at medium and large farms in

the eastern regions and then to the small and medium size farms in the west.

Phasing of cocoa rehabilitation would have also created less organizational problems for the banana industry. When cocoa rehabilitation occurs in a diffuse pattern (as presently organized 1984), production of the complementary crop (banana) will occur in like fashion. As a result, the effectiveness of the banana industry in providing support services will be diminished. This illuminates a further point which is: the planning, targeting and execution of the cocoa rehabilitation project should have involved very close collaboration between the cocoa and banana subsectors.

The Crop Expansion and Diversification project is a project which is aimed at providing short and medium term credit to small and medium scale farmers to produce bananas and non-traditional crops. The project also recognizes the need for infrastructural improvements and support services. Unfortunately, the project is not totally compatible with the simulated rationalization of agricultural production.

The project document shows that the following acreages of crops are proposed: (a) banana 1000 acres, (b) avocado 500 acres, (c) mango 140 acres, (d) other fruits (guava, tamarind, soursop etc.) 160 acres, (e) pawpaw 40 acres, and (f) roots, vegetables and other 745 acres. In the case of banana and avocado, the model is in reasonable agreement with the acreages proposed by the project. The simulation indicated that Grenada's potential banana production was at most 15,000 short tons/year. This production will require 1225 acres of purestand and the rest (58%) from the production of banana as a complement to cocoa. Present production is 8000 short tons/year from 1700 purestand equivalent acres. As a result, the additional 1000 acres proposed by the project mainly as a short run complement to tree crops establishment is not a marked deviation from the model. The avocado target was very compatible with the model's target; however, no regions were identified by the project for avocado production.

For pawpaw and other non-traditional fruit trees, the model indicated that the acreages required were small and production should be concentrated at Carriacou. The location of production represents a marked deviation between the project and the simulation. Evidently, the project selected location based primarily on yields which are higher in Grenada, however, in a multi-dimensional analysis the simulation indicated that production of such crops at Carriacou was stable and more efficient.

FUTURE PROJECTS

The simulation provided a number of ideas for future projects. These included:

(i) a project to increase minor spice (cinnamon and clove) production. These crops have good economic potentials but farmers do not realize their full potential. The model suggests that production should be intensified among small scale, part time farmers;

(ii) the model implied that beef, sheep and goat production have important roles to play in the development of Grenada's agriculture. Beef can be produced mainly on organized large scale farms to satisfy the domestic maker and part of the tourist consumption. Sheep and goat can be grown on farms 5-15 acres with adequate exports for the lucrative Trinidad market;

(iii) an integrated project for the development of Carriacou was fairly obvious from the simulation. Carriacou can be used to produce much of the national livestock requirements, a fair bit of agro-industrial raw materials (guava, soursop, etc.) and all the limes and 58% of the oranges. The orange production will seem quite surprising given the fact that Carriacou has the lowest orange yield among all producing regions. However, the multi-dimensional view of the model suggests that production of oranges there was both stable and efficient if Grenada is to attain its maximum agricultural potential;

(iv) the simulation indicated that the agricultural inputs for agro-industry can be grown on very small acreages. For example, pawpaw requires 36 acres nationwide, while guava 53 acres. Crops such as tamarind, golden apply, soursop and cherries would require similar acreages. Because only small acreages are required, care must be taken in planning production of these crops in order to prevent over-supply. Furthermore, such crops should be targeted at: (a) the part time farmer so seasonality of income is not a problem, (b) the small scale farmer where household farm labour is available in abundance for harvesting the crop, and (c) locations in the country which do not have a good comparative advantage in producing major crops. With this strategy, most of the agricultural based raw materials for agro-industry would be produced in the north and east or Grenada, and Carriacou. This implies that from a raw material standpoint, agro-industry should be based in one of these areas. However, it is recognized that water, electricity, communications, and other raw materials are also components of agro-industry.

CONCLUDING REMARKS

Given the dynamic structural adjustments taking place in the agricultural sectors in the Caribbean and the attempts at diversification within the sector, there is a growing need for agricultural planning models to reinforce existing national agricultural planning procedures. Such models will lead to better project ideas, and a more efficient use of resources in the rationalization of agricultural production. Better rationalization of agricultural production cannot occur without governments playing the lead role. Governments may or may not engage in production but they can influence the rationalization process through the control of inputs, subsidy schemes, extension services, and better targeting of agricultural development projects.

Without being too futuristic, national agricultural models could also lead to a Caribbean agricultural model. Such a model may lead to

less inter-territorial duplication of projects, provide a multi-dimensional view for policy analysis, and probably buttress trade within the region.