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SOME USES AND POTENTIAL USERS OF
A LAND USE CAPABILITY MAP AND A LINEAR-PROGRAMMED OPTIMIZER MODEL
OF THE SAHEL STATES AND THE REPUBLIC OF CAMERON

--An AFR/CWR technical staff paper
by Lloyd Glyburn, October 1974

I. INTRODUCTION

We are exploring the feasibility of making an interpretive, quantitative, land use capability map for the Sahel States and the Republic of Cameroon. The project would be a joint undertaking with the host countries and FAC. The map is necessary in its own right as a valid means of (1) estimating the possible mix and volume of agricultural activity and output with given inputs; (2) assigning priorities among projects within such groups, among groups and among industries and enterprises. Of course, it is possible and indeed advisable at the outset of a national development program to implement certain projects without having a national land capability map as a guide, simply because they have been identified and given high priorities through other means. Such lists are usually limited to about one per subsector.

Further, the land use capability map and its accompanying tables provide the prime variables in national and regional development planning. Along with land the natural resource inventory would include water, timber, wildlife, and minerals. There would be inventories of human resources and the national infrastructure, including public and commercial services. It would also include tables on consumption, employment, income, internal commercial flows, imports and exports. This all adds up to the makings of a linear equation programed to optimize resource allocations with prescribed requirements and constraints, which may be both arbitrary and infinite. While it is not the purpose of this paper to sell the linear programed model, these appear to be some of its favorable characteristics as one of many tools needed for planning an integrated development program for the Central-West African complex:

1. It is difficult to conceive of another means of bringing together all of the variables pertinent to development in the fourteen or so countries that are economically linked and involved in alternative relationships in a format such that options may be rather quickly evaluated.
2. As implied above, the linear model is a means of economizing on scarce manpower and machines as well as time.
3. Some sort of linear model is required as a resource data framework for the intensive development projects of the Organisation pour la Mise en Valeur du Fleuve Senegal (OMVS) type.
4. A valid linear model could be used by a recipient Government to point out the relative advantages and costs of optional resource allocations.
5. An integrated regional model" should be helpful to regional donors in program planning.

6. Ideally, there could be one model with duplicate tapes and maps in the possession of each recipient country, and each donor would provide a single point of reference. This is a feasible objective. Linear programming is a skill that is taught academically, and thus is available for the effort.
7. A valid economic model of the region could advance the capabilities of the Pan African Institute of Development (PAID) immensely.

The major disadvantages of the linear programmed model as compared to other analytical tools is that where other methods are applicable, first-run outputs could be available sooner. (It took 18 months to get the first run of the Vietnam problem. ^{1/} As Arlo Minden said, an awful lot of information can run through a calculator. ^{2/} The often repeated, "garbage in, garbage out" is self-disqualifying in that any reliable data available for hand calculations would be available for linear analysis.

To repeat, while the map itself is useful in development planning, an assessment and analysis of the sector and the economy is much more important for the rational allocation of scarce resources in national and regional development planning. Such an exercise should be viewed as a follow-on to the soil mapping project. In fact, the two should be planned and advanced almost in unison.

The purpose of this paper is to suggest the potential uses and users of (a) the map, and (b) a resource allocation model.

II. CLIENTS

A. Recipient Governments

Each Government in the Central-West Africa region has or should have a national planning office attached to the Ministry of Finance, Prime Ministry, or - less desirable - in a ministry of its own right. The job of this office should be twofold: one is to propose development policy, and the other is to recommend the allocation of development resources among projects. The model should be the principal reference in drafting development policy.

In the ministry of production, rural production, agriculture or whatever the designation, there is, or should be a small planning staff which reports to the Chief of Cabinet or whoever is responsible to the minister for the overall operations of the ministry. This team would propose production targets for consumption and exports along with rough

^{1/} Bolton, Bill, et al., Production Capacity and Supply Response in Vietnam's Agriculture... (Washington: USDA ERS Int. Dev. Center, May 1974)

^{2/} Minden, Arlo J., U.S. Government Memorandum to Lloyd Clyburn (Washington: AID, September 1974)

estimates of input costs to the central planning office. The targets should have been suggested by the optimizer model, and they should be fed back into the model for updated validation. After these figures are adjusted and accepted for funding, the planning staff should go to the appropriate services (i.e., Agriculture, Elevage) and get from them their rough project proposals addressing the targets. There should be alternative projects, located on the map, addressing each target. The planning staff would then request optimizing runs to establish priorities among projects.

In summary, the model should be the prime reference in drafting development policy, validating targets and choosing among projects addressed to the same or competitive target activities. Besides its essential role in the model, the map would be the prime reference in locating agricultural and range project sites. One could dream that the map and the model would become the torch and the Koran of the planners and power figures of the client countries. But at times and places, the allocation of resources must be based on decisions other than economic. The model should be consulted, anyway, to apprise those concerned with the cost of other than optimizing decisions.

B. Strategic interest and resource groups

1. Intensive development projects:

It seems obvious that OMVS will require a linear programmed model to manage its planning data, as the only practical means of reducing the problem to a common language and simplifying the job of gathering basic data to the point that it can be done. This in no way suggests that OMVS needs a computer. They will not, at least for a long time. They may need punch machines. Since OMVS is food-production oriented, the map is required.

The goals and targets should be set by the OMVS Council of Ministers with the guidance of the model. Beyond this, implementation should turn rather tightly around the model.

Linear programming tied to soil map information has been applied to test the feasibility of developing the Bol Polders in Lake Chad. An optimizing model should be consulted in updating the Lake Chad Basin plan and in validating its projects. The map is needed.

2. Regional interests:

The Entente group recognizes interdependent, mutual or accommodational economic interests which may be best rationalized through the Entente forum, where inventories of resources, problems, and aspirations of all concerned countries (Niger, Upper Volta, Ivory Coast, Togo and Dahomey) may be linked, considered jointly and planned for optimum development, given the available resources.

3. Regional institutions:

If the PAID is not teaching linear programming (as well as input-output accounting) for development planning, they should be, and the trainees should include two persons from each aid-receiving country. This can be done by mailing cards to a computer center. PAID should become more and more involved in development planning, first through hosting seminars on the subject, and later by providing planning consultants to aid-receiving countries.

The African Development Bank (AFDB) should monitor an economic resource model of the region as a service to its clients and for its own reference in the allocation of limited loan funds.

III. DONORS

A. Uses

While motives and purposes may vary, most economic aid has the common objective of a successful outcome of the undertaking. Big volume donors tend to sponsor big impact projects, while small budget donors search for critical interventions. The whole picture is of about equal interest to both groups as well as those along the scale between the two.

A regional optimizer model should be the prime reference for the big volume donors in devising their respective regional and worldwide, long-range programs, and to the small budget donors in selecting countries and technical areas for interventions.

As for AID, such a model should be the appendix and backbone of its Central and West Africa Regional Development Assistance Paper. Further, it should be the prime reference in drafting and updating regional interest projects. It, including the respective country model components, should be the prime reference in assessing national economies and sectors.

Within a recipient country, a donor's interest should parallel that of the country's Government in the matter of policy, targets and projects; hence the donor would have the same need for both the map and the model as would the recipient Government.

B. Utilization

As means of getting the maps and the models used in national planning and project planning (regional interest projects included) donor agents would simply negotiate (jointly plan) their programs and projects with and around them and, most important, provide sufficient training to the recipient government personnel that they feel comfortable with these development tools.

C. Realization

The basic genesis maps from which the land capability maps would be drawn were made by the Office de Recherche Scientifique de Territoires d'Outre-Mer (ORSTOM); hence they should exercise a measure of initiative in creating the new map. At the same time the Institut de

Recherches Agronomiques Tropicales et des Cultures Vivrieres (IRAT) no doubt possesses a large volume of agronomic data highly pertinent to the interpretive map. On top of this is the rainfall and groundwater data which must go into the map. All of this must be a joint activity implemented on the invitation of recipient Governments. The collection of other resource and economic data is a relatively simple task.

Once the map is printed, it should be the property of the respective recipient countries, with copies provided to regional interest groups and interested donors. Likewise, the model should belong to the recipient countries, with duplicate tapes provided to interested donors.

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