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PROBLEMS AND ISSUES IN AFRICAN RIVER BASIN PLANNING

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Settlement and Resource Systems Analysis
Cooperative Agreement (USAID)
Clark University/Institute for Development Anthropology

Clark University
International Development Program
950 Main Street
Worcester, MA 01610

Institute for Development Anthropology
Suite 302, P.O. Box 818
99 Collier Street
Binghamton, NY 13902

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Submitted by

Settlement and Resource Systems Analysis
Cooperative Agreement (USAID)
Clark University/Institute for Development Anthropology

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CHAPTER ONE

A CONCEPTUALIZATION OF AFRICAN RIVER BASIN PLANNING

by

Eileen Berry
Leonard Berry
Gerald Karaska
ARB Steering Committee

The chapters in this report were prepared by the Settlements and Resource Systems Analysis Cooperative Agreement as an articulation of an appropriate river basin planning strategy for USAID. It describes our collective thinking about a proposed strategy for future river basin projects, and it is intended as input to discussions with USAID staff regarding future research efforts which could lead to actionable projects and investment strategies.

This report begins with a conceptualization of important dimensions of river basin planning (Chapter one), followed by an overview of the major issues discerned by the SARSA team (Chapter two). This overview presents a suggested implementation strategy for AID that integrates state-of-the-art knowledge with African realities and USAID interests and constraints. Individual chapters, next, treat more specific aspects of the economic, social, and institutional components of river basin development. The subsequent chapters also discuss details of the engineering and legal issues that are crucial to river basin development. One chapter articulates the vital resources management context of river basin projects. Finally, an

appendix lists those documents in the vast literature on river basins in Africa which we feel are of primary importance (including brief abstracts of the more important documents).

This first chapter conceptualizes the most important ideas and salient features of our investigations. We begin by calling attention to our major thesis which is that river basin planning and development is first and foremost an opportunity to exercise regional planning. The goal is to plan and develop a region so that the inhabitants and their institutions will become the beneficiaries of the investments in water infrastructure.

As another important theme, we distinguish between a development strategy focusing upon large dams and grand schemes, on the one hand, and smaller, integrated projects which build an institutional capacity to focus upon local problems and goals designed for households and a coincident effective management of resources at a smaller scale.

General Concepts of River Basin Development

The recent history of River Basin development suggests that throughout the world there has been a desire to integrate all aspects of the hydrological system. The basic premise was that a river was the principal resource in the area, and its coordinated and planned use was the key to unlocking all of the components of resource use. Energy use was seen as a vital first result of river basin development; however, because of the need to reduce siltation in dams and power installations, soil and land management for agriculture were important "up-stream" elements of river basin planning. "Downstream" investments were likely to be in industry, processing, or in rural/urban hydro-electric schemes which made good use of the new power supplies. By these linkages, the control of the hydrology of

the basin could be turned into different levels of resource management for the entire basin.

For example, in the United States, this set of concepts was the guideline for the Tennessee Valley Authority schemes and for the early development of the Colorado River, both pioneering projects in modern river basin management. The initial purpose of each of these efforts was to address problems in the area, improve power availability in both basins, and in the case of the TVA region, to attack rural poverty.

In general, some modification of these concepts has occurred over the intervening fifty years. The most important development has been the greater sophistication in analysis and programming of the most effective ways of managing the river and its tributaries. Another development is a greater awareness of the need for overall catchment management to ensure the continued long-term use of the water power. There is also much more effective assessment and programming of the multi-purpose uses of the water system. For example, planning for hydro-power, irrigation, recreation, and fish production are commonly combined in an integrated way. Finally, in the last thirty or so years, problems of dealing with international river basins have come more and more to the forefront; while technical issues in international river basins are not much different from conventional basin management, governmental arrangements are vastly more complex.

From an institutional perspective, the prevailing concept has been one of creating special "regional" agencies or "authorities" to deal with the development of river basins. The TVA has been followed by a host of others, some national and a few -- such as the Mekong Basin Authority -- international in scope. Both a cause and an effect of this mode of operation has been that data gathering, analysis, decision making, and investment have

largely taken place outside the normal structure of national government organizations.

The African Context

River basin planning has had a long history throughout the world. Even in the United States, where planning has not been an integral part of its historical development, river basins have been the scenes of a concerted effort at regional planning. Certainly other parts of the world have seen a loci of investment projects in river basins; but, in Africa a major thrust in an attempt to develop its regions has been through river basin projects. River basin projects in Africa can be viewed, first, as an attempt to rapidly solve development problems through enormous investments at grand scales, but also, these projects are demonstrations that water and its effective management are at the base of Africa's problems. The essential fact of life in Africa is that much of its geography is coincident with an arid and semi-arid climate where economics and culture are continually at the mercy of water availability. Added to this is a political geography characteristic of exploitation by western empires, having led to national fragmentation and an all-too-short history of selfgovernment, coupled with wide variations of culture and physical environment; these have not allowed sufficient time for the development of an institutional experience to deal with effective management of large river basin projects.

Another aspect of river basin planning must be articulated at the outset; that is, there is now, and likely in the immediate future, a clear desire by donors to make large investments in Africa, and surely river basin projects will continue to receive a large part of these resources.

Thus, there exists a pressing need to structure goals so that these investments will, in fact, be a real opportunity for African development. Further, if appropriate needs, wants, and priorities are established by indigenous institutions, then the concomitant expertise usually available from western donors will be more effectively utilized.

Finally, it is important to recognize that any planning strategy will be only the latest (or next) phase of another strategy that is already in place. In some river basins there will exist elaborate plans and substantial investments; in others there will be found only simple schemes but complex cultures and an ingrained history of economy and society. Thus, the proposed strategy must be viewed as part of the next sequence in a series of development strategies.

African River Basin Concepts

To our knowledge, there is no coherent set of concepts which have guided African river basin development, but the general principles of that development are quite clear from a study of the pattern of evolution of river basin management in Africa.

Prior to World War II, planning of the Nile and Niger basins (where most of the early initiatives took place) was focused upon the need for water control primarily for irrigation; the need for power, if a consideration at all, was secondary. The history of the use of Nile waters for irrigation and the perceived opportunities in Egypt and Sudan were strong elements in the building of dams south of Khartoum on the Blue and White Nile rivers. Cotton production for English consumption was the major economic goal in Sudan. The French initiatives on the Niger appear to follow the same set of assumptions and pattern of thinking.

Following World War II and independence for many African nations, the need for rapid economic advancement led Ghana, Sudan and Egypt, Tanzania, Zambia, Zaire, and others to focus on the potentials of their river basins. New energy, available cheaply and in massive quantities, was Nkrumah's vision for the Volta River basin development, which was intended to provide the basis for massive aluminum extraction from bauxite. The Aswan dam in Egypt was based on the concept of power and irrigation; dams in Zambia, Tanzania, Uganda, Sudan, and Zaire were primarily designed as sources of energy either for the burgeoning urban areas or for the hope for new industrial enterprises that would soon be coming to independent Africa.

Sudan, together with Egypt, continued to place high priority on irrigation as an essential outcome of any river development scheme. With these exceptions and possibly more recent activities in the Senegal and Niger basin, the emphasis on river basin development in Africa has continued to be on large hydro-power generating projects with supplementary benefits in other areas.

Because of the large river basins usually involved in the projects and the complications arising from the multi-national nature of most river basins, less attention has been given to the need for catchment control to prevent silting and to the integration of different kinds of water development. In smaller basins, such as the Tana River basin in Kenya and the Pangani in Tanzania, some progress has been made in this area.

Institutionally, African river basin development has generally followed models set elsewhere. The Tana River Authority in Kenya and the river basin authorities in Tanzania and Zambia follow the general pattern. In West Africa, OMVS is an example of an international authority which typically has much lanning but little implementation capability. The Nile has been

administered in a quite different way. In the pre-World War II period, technical studies of the whole basin were carried out from Egypt, but since then, most major initiatives have taken place as a result of political agreements between the governments of Egypt and Sudan, with the cooperation of Uganda. These agreements essentially allocate rights to build dams and to maintain control of different parts of the water flow. Other countries in the basin have not been party to these agreements.

A special factor operating in the African context is the role of donor agencies, both bi-lateral and multi-lateral such as the World Bank. These agencies have had a large influence in the institutional and financial arrangments and in the patterns of river basin development. In general, they have tended to reinforce the desire for large projects and water oriented planning. The influence of donors and the shortage of technical expertise in some parts of Africa have contributed to a situation wherein river basin authorities are not only separate from other parts of government but are dominated by expatriate personnel.

Evolving Concepts in African River Basin Planning

Any consideration of proposed river basin planning in Africa must emphasize the fact that many African river basins are characterized by multi-tributary headwaters located in moist, hilly terrain and long trunk streams which carry water across flat, arid and semi-arid areas to the sea. These characteristics often limit the number of viable dam sites and the variety of options for managing the river.

Even with this caveat, there is a strong case for encouraging an articulation of a set of concepts whose utility would lie in increasing the impacts of investments in African basins. These concepts should be

presented such that river basin development:

(i) is set in the context of the development needs of the basin as a whole;

(ii) builds on the human and physical infrastructure of the area;

(iii) uses a mixture of small and, if necessary, large projects;

(iv) works under existing management structures or compatible extensions of them; and,

(v) develops backward and forward linkages in the form of catchment management and appropriate use of any new energy generated.

River control initiatives are usually, by their nature, very expensive and it is vital that the pay-off be maximized, not only in dollars earned, but also in people served. If basin development is conceived in the context of the administrative regions served by the basin, there is an opportunity to allow basin development to build on existing and planned development initiatives. Quite obviously, everything cannot be done at once, nor should it be. What can happen is a step-by-step linkage of key projects which can transform energy use, agricultural production, infrastructure, and basic services in the area. River basin development must be a form of <u>regional</u> development to make any sense. Good regional development builds appropriately on the physical and human resources already available and strengthens them.

An important element in river basin development, conceived as regional programs, is the mixing of large and small-scale projects. In a conceptual sense, the best evolution of the use of a basin resource is to build gradually from small-scale, rain dependent cropping, to small stream water control and gardening, to more formalized and larger irrigation schemes. If

such incremental development were possible, the management experience so badly needed could be acquired gradually. Although this evolution is not always possible, there are situations where it is feasible to mix small-scale perimeter plots with larger scale irrigation fields and to phase in the two scales of activity. Social transformations incorporated in large-scale water control projects should be expected to take a considerable period of time.

This point is linked with the need for a broader concept of basin development, particularly in following through on the most important backward and forward linkages. The needed minimum backward linkage is the degree of catchment or upper basin control to prevent silting. The needed minimum forward linkage is to ensure the development of appropriate monitoring structures and economic end uses of energy and urban water supply.

Planning versus Development

Development and change for Third World regions are a sequence of events, in a temporal context, that have long-term historical roots, short-term contemporary relevance, and both short-and long-term future considerations. The current attitude in river basin development seems to be one of "here's a basin; let's develop it." This is often a symbolic gestures, which, on the one hand, can be a powerful incentive and thus an opportunity to effect positive change; on the other hand, one must also be cautious to proceed in a carefully articulated way so that disastrous mistakes are not made which could severely handicap future investments.

"Planning" is a complicated issue, comprising such elements as "plan,"

"projects," and "paths." We subscribe to the tenet that planning is a process, wherein those elements undergo continuous change and, therefore, they must be scrutinized through monitoring and evaluation. Thus, flexibility and robustness in design are essential so that projects and investments may be seen to operate under a broad range of conditions and constraints (present and future). We strongly advocate the preparation of dynamic plans which focus upon the articulation of the impacts of changes and investments (i.e., predicting effects).

The Systems Perspective

We strongly advocate that the primary goal in river basin planning is to develop a region coincident with the river tributary area. Inherent in this goal is a perception of the "region" as a system of interrelated elements, such that each element is related to all others. In effect, there are two systems: the temporal and the spatial. In the former, the life of a river basin plan or strategy can be viewed as a sequence of time intervals with critical events. For example, in one generation an investment project is put in place (which impacts upon the environment and society in the region). In the next generation, another project must build upon the impacts incurred by the first investment. Thus, the plan for the second project must anticipate the changes brought about by the first, and predict the impacts to be expected by the combination of the first plus second projects. It is obvious that the sequence of projects is a long chain of events such that the total impact is more than the sum of the effects of the individual projects. This perspective does not advocate large, comprehensive plans, wherein numerous projects are put in place so as to cover a wide range of sections. Rather, the view is to acknowledge a

sequence of projects at a level which is manageable both in terms of conflicting goals and the ability to control the impacts of investments. Thus, each project is seen as a catalyst for desired change, nudging each subsequent or follow-on project and its impacts.

As a spatial system, the region is a series of sites of human occupance such that any change at one site will have repercussions at all other sites. In this view, each site is "linked" to other sites, either as a result of the "flow" of a natural resource (such as water) or the "flow" of economic goods or information. As in the temporal system, planning for a change in the resources at one site in one generation must consider the changes incurred at other sites by other generation projects. However, in a spatial systems context, there is one important factor that must be recognized, namely, human interactions are known to be strongly influenced by the effects of boundaries of the region, that is, flows or interactions of economy and society are maximal within the boundaries of the region than outside the region. These boundaries are usually administrative lines, but in many cases the limits of effective or optimal organization extend across legal limits. Thus, special care must be exercised in delimiting the boundaries of the planning region.

Regional Planning

One of the major points we wish to put forward is that river basin development should be viewed as an opportunity to affect regional planning Implicit in this recommendation is the view that planning is perhaps the most critical ingredient in successful development, and, secondly, that planning for river basins should not be any different from contemporary planning for any large region. Obviously, river basin planning includes an

emphasis upon water management together with the siting of large infrastructure, a situation not common to usual region plans.

Regional planning may be seen as encompassing two major dimensions. The first is a concern for effective (meaningful) planning units. At one scale, there is the encompassing broader unit or region, which in this case is the river basin itself. While the watershed or basin is an obvious boundary (the water divide), caution must be exercised to ensure that planning is directed to the effective space influenced by the infrastructure because imports may (i) affect space beyond the river basin or (ii) have little effect upon some parts of the basin.

At another scale, "regional" concerns must also concentrate upon a partitioning of the river basin into smaller planning units, or sub-regions. The careful articulation of such units will not only ensure a more manageable scope to the planning effort but will also allow for the implementation of actionable programs directed to specific target groups associated with each sub-region.

The second dimension of regional planning involves the relationship between the design of a plan and the implementation of investment projects which reflect the goals of the plan. This process comprises three stages: the study/survey stage, the planning design phase, and the implemenation phases. Here we place emphasis upon the first two phases, as the multidimensionality and complexity of the regional system demand careful articulation of the expected impacts of each investment or changes.

We take care in recommending this regional planning approach not being synonymous with the "integrated" and "comprehensive" approaches common to numerous USAID projects of the past. This is not to say that integratd or comprehensive planning is undesirable, for, indeed, such planning is

clearly the ultimate goal. Rather, experience has shown that the realities of administration and control do not allow for effective cooperation. For example, it is virtually impossible for the multitude of sectoral agencies to coordinate their objectives and appropriately sequence the siting and timing of their investment portfolios. On the other hand, the establishment of "regional authorities" has rarely proven to be a solution to implementation problems and issues.

The regional planning approach being advocated here first emphasizes a limited scope to the implementation phases, wherein primary goals are designated and attention is directed to the coordination and cooperation of a few key line agencies. Secondly, the survey and design phases should make every effort to be as comprehensive as possible, with the caveat that attention be directed to the issue of flexibility in the subsequent implementation stages so that modifications and changes may be possible as responses to changing goals and local initiatives.

Goals

One of the most important aspects of river basin planning and development is the articulation and careful specification of the goals and benefits of investment projects. These goals and objectives are reflections of the multiplicity of institutions involved in regional planning schemes, and they are obviously a source of considerable conflict. In the case of river basin projects, this conflict assumes a more specific form in the guise of large scale projects--with capital intensive infrastructure and a coincident attention of urban and industrial oriented goals--as opposed to small scale projects--where the emphasis is upon the rural household and local participation in planning. While multiple goals are within the realm

of reasonable management, the history of experience in Africa appears to fall more heavily on the side of large scale schemes. Clearly, future planning must shift some emphasis to smaller target groups and more simplified and sequential schema.

Some Basic Postulates

As a summary of our thoughts on river basin planning and development in Africa, we list some notions which serve as postulates basic to any consideration of appropriate strategies. These are:

(i) Since aridity is a serious environmental constraint to development in Africa, water management will continue to be one of the most critical factors.

(ii) Sites of dams and related structures crucial to water management are valuable resources in the African context.

(iii) The spatial characteristics of the planning region, both the water management sites and economic and societal infrastructure (farms, roads, cities, etc.), are of paramount importance to river basin planning schemes.

(iv) Increased food production is a life or death factor in African development, followed by goals of income generation and increased employment opportunities.

(v) The careful management of all resources in the context of long range solutions is the desired approach. Since ecological systems are complex, effective resource management must concentrate upon restoring the damaged environment, upgrading farming techniques, and improving the quality of life--along with the effective control of water systems.

Multi-objective Economic Analysis of River Basin Development: The next steps in River Basin Planning

This outline of a conceptualization of river basin development has presented our views on river basin planning, and we offer here some suggestions as to how current African planning might be modified on the basis of recent experience.

To emphasize the current stages in African river basin planning, it is useful to conceptualize the evolution of thinking in four main stages:

I. A first, very simple, stage may be characterized as government/donor decision making. Here the government concern identifies a particular basin project as high priority and an eager donor responds with the commitment to meet all or a large part of the costs.

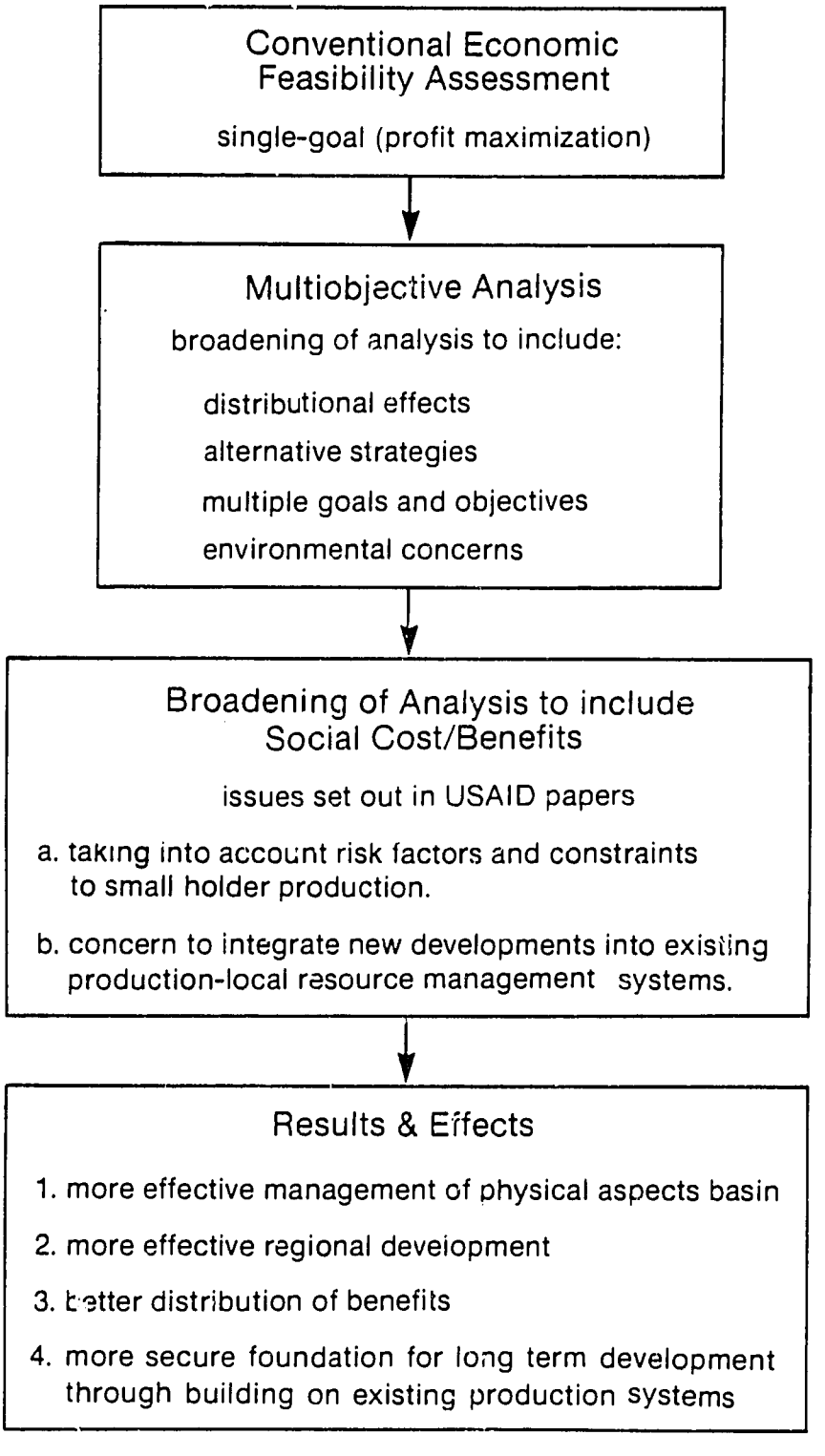
All subsequent steps are taken to rationalize this decision. Engineering feasibility studies are undertaken, and unless they reveal disasterous errors, they are followed by efforts at economic rationalization and by impact statements which seek to ameliorate the side effects resulting from dam and project construction.

Many of the activities of the planning stage are designed to rationalize decisions. For example, if 20,000 ha of irrigated land is needed to make the cost/benefit ratio of the project "right," much effort and even some squeezing will go to identifying the 20,000 hectares and pronouncing them fit for irrigation. Not to do so could invalidate the project!

II. If we assume a greater degree of pre-decision analysis and planning, we move to Stage II of Diagram 1. This procedure is characterized by the traditional economic feasibility assessment. In this kind of assessment, the outlays needed for the development of the basin are set

Diagram 1

Stages in the Evolution of African River Basin Planning



against the total benefits expected to accrue in the whole basin. In Africa, many decisions on large and small dams have been made with little else than this very basic, yet very incomplete, form of analysis.

III. Multi-objective analysis seeks to move to a broader set of parameters. A general political decision to consider broader issues is followed by a much broader analysis of the feasibility either of the whole river basin project or of component projects within the general design.

Multi-objective analysis seeks to bring together the economic aspects of a number of different aspects of basin development. In this kind of analysis, we are concerned with:

--the distributional character and impacts on different ethnic economic groups;

--the assessment of alternative strategies to the one already proposed. Are these the right dams to be built? Are dams needed at all?

--the consideration of a nubmer of issues as part of the evaluation and decision making, especially environmental and social impacts.

The multi-objective approach is about where the conventional wisdom is today, though it is not always honored by those who profess it. Most river basin planning and implementation groups do seek to bring a range of objectives into the analysis. The results indicate that a better understanding of the dynamics is possible and can be based on sound analytical procedures.

IV. Our concepts include a cautious next step from the multi-objective analysis, essentially involving a broadening of the analysis to include more specific and in-depth social and institutional aspects of the river basin.

The core issues are: natural resource management dealing with physical or environmental efforts and particularly with the trade-offs between good water and good land utilization; engineering management dealing with the problem of physical constraints; and regional planning dealing with the impact on the area served as a whole or in its component parts. In addition to these core elements, our approach would add an analysis of risk factors and constraints to small-holder producers and investigation of ways in which useful changes in agricultural systems may be brought about. As an extension of this approach, we would take special care to integrate new developments into the existing production and resource management frameworks.

We view the purpose of the analysis outlined about to be:

--more effective management of physical resources;

--more effective and better linkages for regional development;

--a broader and more effective distribution of benefits;

--a more effective production system;

--a secure foundation for long-term development by building upon existing production systems.

In attempting all this, the need for the most cost effective analytic techniques should be kept firmly in mind. The concept of the most cost/effective study could provide a useful device for defining the requisite analyses, for any particular set of goals and objectives.

A Conceptual Model

Diagram 2 is a schematic diagram of our perspective of river basin planning and development. The separate papers in our report treat many of the elements of this schema in greater detail, while here we attempt to

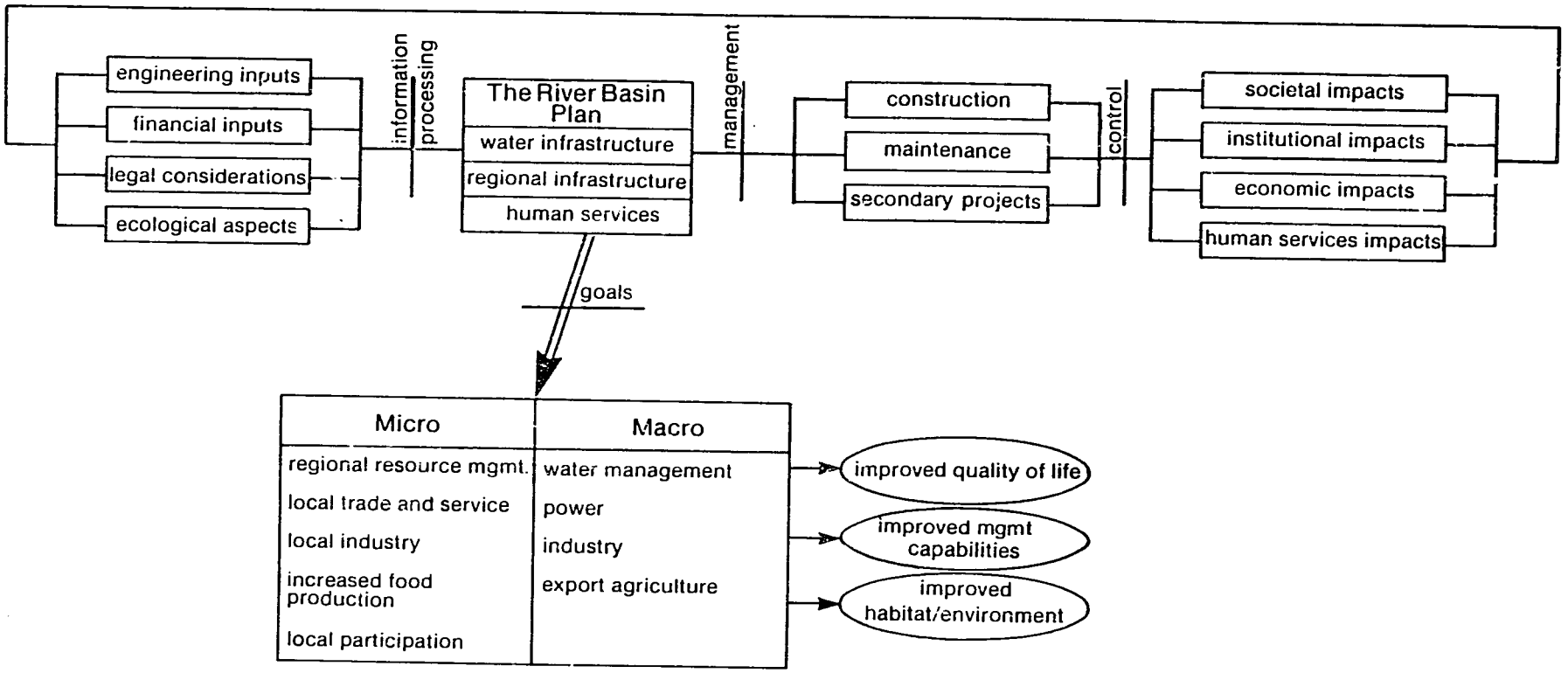


Diagram 2 A Conceptual Model of the Regional Dimensions of Africa River Basin Planning and Development

summarize the major points of interconnectivity of that detail.

One major point to be gleaned from a study of this model is that current attempts at river basin planning in Africa focus primarily upon the water infrastructure in the plan and upon the macro goals of water management, power, industry, and export agriculture. Neglected are micro goals and especially the wider implications evolving out of consideration for the question of "how is the basin to be developed." Thus, the overall goal should be an emphasis upon regional development, not upon the current emphasis of water management.

The diagram emphasises that information and data are vital components to effective planning and management. On the one hand, this data set comprises the inputs to appropriate construction of infrastructure. And, on the other hand, the data are also part of the information set which is used to analyze and measure the impacts, or anticipated effects, of the new infrastructure and water changes (societal, institutional, economic, and human services).

The essential point illustrated by Diagram 2 is that while the focus of the river basin plan is certainly directed to the management of water, the core of the plan or the ultimate goals are really focused upon improved quality of life and habitat and an increased capability of local institutions to manage their resources and society.

Finally, we offer Diagram 3 as a guide to the structure of the papers in this SARSA report. The individual papers describe the critical legal, social, an institutional issues requisite to a consideration of the river basin as a planning unit. And, the format suggests that the resource economics issue (emphasizing multiobjective analyses) may be the most important substantive factor to be considered in achieving carefully defined goals.

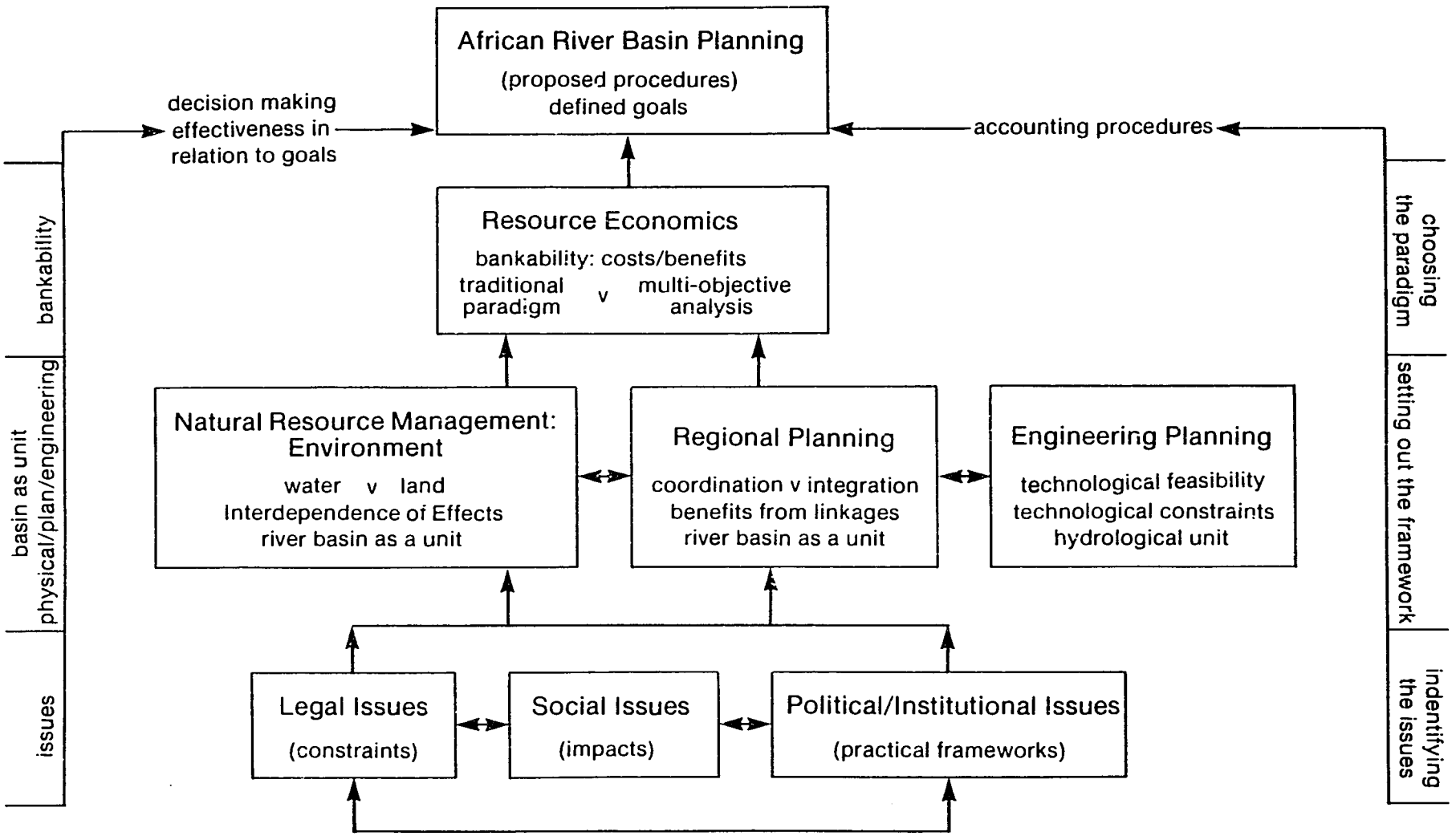


Diagram 3
The SARSA Papers

Making River Basin Development Work - the final test

Successful river basin development is a key to successful development for many countries in Africa. In the view of the group, the following are key ingredients to successful river basin development.

Making river basin development work may involve somewhat different sets of issues in different regions but the following are common criteria:

--(i) treat the basin development as regional development and integrate river basin plans into national and regional investments

--(ii) develop institutional structures which allow planning and coordination at the whole basin level, whether this be national or international but which involve regional authorities in the design and implementation of projects

--(iii) allow enough time for a balancing of local, regional and national perspectives on the kind of of changes which should take place

--(iv) use decision-making procedures which take a broad view of multi-objective economic analysis allowing environmental social and legal issues to be incorporated with plans and designs

--(v) use investment procedures which balance point source financing of large dams and structures and other development initiatives in the basin as a whole

--(vi) where possible, build up managerial experience

among local people in irrigation and other forms of coordinated agriculture

--(vii) last but not least, allow investment plans to evolve as the project unfolds over time. River basin development takes place over a period stretching into decades in some cases. No rigid plan can predict circumstances over a long period and the development itself will change the dynamics of change in the area. Flexibility within a grand design is, therefore, important.

CHAPTER TWO

OVERVIEW

by

Thayer Scudder[1] with Steering Committee Assistance

I. INTRODUCTION

Declining per capita food production sets Africa aside from other regions of the world. The inadequacies of food needed to ensure not merely good health but the survival of millions of people are critical. Of countries reporting abnormal food shortages to the Food and Agriculture Organization during 1984, approximately two-thirds are in Africa. In a 1982 article in Foreign Affairs, Eicher emphasized the seriousness of the situation when he wrote that "the most

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1. Thayer Scudder is Director of the Institute for Development Anthropology and Professor of Anthropology at the California Institute of Technology. His major interests include over 25 years of research on river basin development and land settlement in the tropics and subtropics with areal emphasis on West, Northeast and Southern Africa and on South Asia. Educated at Harvard University, Scudder has been a consultant on river basin development to the World Bank, various UN Specialized Agencies, AID and the Ford Foundation.

intractable food problem facing the world in the 1980s is the food and hunger crisis in Sub-Saharan Africa."

The seriousness of the situation has produced a number of recent reports including the Organization of African Unity's The Lagos Plan of Action for the Economic Development of Africa, 1980-2000 (1982); two reports by the Economic Commission for Africa (1983, and, in cooperation with the African Development Bank, 1984); three reports by the World Bank (1981, 1983 and 1984); and the Christensen report of the U.S. Department of Agriculture (1981). The most recent of these is the World Bank's Toward Sustained Development in Sub-Saharan Africa: A Joint Program of Action (1984). In presenting an agenda for attacking Africa's problems, the Bank stresses a number of areas relevant to an AID strategy for river basin development, including agriculture and environmental management.

We believe that any AID strategy should give first priority to agricultural development within the context of African conditions. As defined here agriculture includes cropping systems, livestock management, fisheries and the management of forest, soils, and rangeland resources. As for the phrase "within the context of African conditions," of particular relevance for AID "are budgetary and pricing policies (including correction for the overevaluation of exchange rates) that will switch the internal terms of trade in Africa toward agriculture" and "greater emphasis on small holders rather than large farms" (World Bank, 1984: 2-3). Because African river and lake basins include agricultural heartlands, sound budgetary and pricing policies

are an appropriate starting point for their development. AID already is stressing budgetary and price policy reforms (and with considerable success as in Senegal and Zambia), linking them with the possibility of increased financial assistance. Here AID's strategy for river basin development can be integrated within an African wide strategy.

According to the Congressional Office of Technology Assessment (1984), "generally, the role of small farmers, not large-scale developments, is emphasized" in recent reports on the African crisis; indeed, OTA concludes that "experience has shown that technical assistance to the smallest African farmers is the key to increasing food production." Granted the large numbers of recent microstudies dealing with the production potential and dynamic nature of local production systems at the household and community levels, and recognizing the critical role of households in community, regional, and national development we believe that this emphasis is sound. Hence our first recommendation is that any future AID river basin development strategy should focus its attention on increasing the productivity and <u>the net incomes</u> of small-scale farmers, herdsmen, and fishermen. Noting that "the responsiveness of farmers (particularly smallholders) . . . is not in doubt," the latest World Bank report adds that "poor agricultural performance has resulted from the combined impact of inadequate incentives . . . and the supply of incentive goods and services . . . and inefficient systems of marketing, transport, extension, and other support services" (pp. 4-5). Lack of incentive does not mean a lack of willingness or desire to increase production

but rather a lack of means, especially capital but also labor and (good) land.

Recent African drought reports indicate that hunger is most prevalent in rural areas; in other words the same farms that national governments and donor agencies alike hope will become the food basket of urban consumers and cash crop exporters are unable to satisfy even their own food needs. Some might argue that what is happening in Africa today is an intermittent and extreme condition by which one ought not to judge the normal state of affairs. The truth is more likely be that it is the public awareness of African hunger that is intermittent "due perhaps to the medias' own short attention span; hunger is the constant condition of the poor majority in most African countries, evidenced by Africa's extraordinarily high rates of infant mortality in 'good' years as well as in bad" (Horowitz, 1985).

II. DISTINGUISHING CHARACTERISTICS OF AFRICAN RIVER BASINS

Four characteristics of African river basins are especially relevant to developing an AID strategy. The first characteristic is that many African nations have access to only a single major or intermediate river system (i.e. the Nile in Egypt and the Sudan; the Volta in Ghana; the Zambesi in Zambia). Often the heartland of the nation, the way in which this system is developed will have a major influence on future living standards. For this reason, African nations cannot afford to proceed hastily. Rather broadly gauged optimization studies need be undertaken that look carefully at the development

potential of each country's resource base, including soils, vegetation and fauna, surface and ground water resources, and production systems practiced by rural populations (cf. Berry and Berry). USAID can play a major role in conceptualizing and financing such studies, in distributing their conclusions, in converting those conclusions into feasible plans and policies for implementation, and in monitoring and evaluating the implementation process.

A second characteristic of African river basins is their international character. Throughout the continent there are 57 river or lake basins which are shared by two or more countries (Biswas, 1983). Five of these, including the Nile, the Niger, the Zaire, the Zambezi, and Lake Chad are shared by six to ten countries (cf. Thomas and Brokensha). These two distinguishing characteristics of African river basins raise important legal, institutional, and management problems which include: security of access to water; institutional mechanisms for coordinating the development of those rivers which are trans-boundary; impediments to achieving agreement for joint action; and the conjunctive management of surface and ground waters (cf. Utton).

A third characteristic of African river systems is the dependence of millions of people on their current regimes. Most African rivers flow through savanna environments. More extensive in Africa than elsewhere in the world, savannas are characterized by alternating rainy and dry seasons which are reflected in rivers' annual regimes.

Typically water flows increase by a factor of ten or more during the flood season, with the production systems of millions of

local farmers, herdsmen and fishermen dependent on the annual rise and fall of Africa's rivers. For example, within the upper basin of the Niger it is estimated that over 150,000 hectares are cultivated by small-scale flood water farmers. During the dry season hundreds of thousands of herders are dependent on riverine grazing with over three million cattle and smallstock utilizing the inland delta of the Niger at that time. Some 80,000 fishermen, catching up to 100,000 tons of fish in a good year, are also dependent on the inland delta. In the Juba Valley in Somalia 107,790 people, about 42,000 of whom are engaged in "deshek" (flood recession cultivation), farm the area. The pastoral nomads constitute about 50 percent of the population of the regions through which the Juba passes. The pastoral nomadic groups that use the river at least part of the year are even larger as they include most of the Bay Region herders on an annual basis, and pastoralists from other parts of Somalia in drought years.

With a few exceptions, dams in Africa have drastically reduced the annual flood, with adverse impacts on millions of downstream residents. Negative environmental impacts include loss of flood-borne siltation, and therefore of organic fertilization of alluvial fields, and a decline in the nutrient values of the river for fishing, as nutrients tend to be trapped above the dam (cf. Salem-Murdock). Though the extent of the damage is being increasingly documented, development plans have yet to devise mechanisms for bringing the benefits of river basin development to the majority of downstream residents. USAID could make a major contribution here.

A fourth characteristic of African river systems relates to their considerable potential for the generation of hydro-electric power, the African continent having approximately one-third of the global potential. While this is a fortunate situation, since electricity pays the bills for development programs (cf. Schwarz), during the 1950s, 1960s and 1970s it led to an over emphasis on power generation for the urban industrial sector at the expense of rural development (cf. Berry and Berry). Though less glaring, this bias continues today with the result that the returns from most African river basin development projects in terms of rural development continue to be disappointing (Scudder, 1980). Part of the problem is that major engineering and site decisions continue to proceed often without the necessary social and economic studies to set objectives, with too easily transferred engineering technologies and macro-economic appraisal techniques not adapted to African conditions.

III. INSTITUTION BUILDING

A. River Basin Development Authorities and Parastatal Organizations

Donor nations, international organizations and consultants, on the whole, favor the creation of national or international authorities for the development of African river basins. The same tends to be true for large scale irrigation projects within river basins, Sudanese examples being the Sudan Gezira Board, the New Halfa Agricultural Production Corporation and the Rahad Corporation. The World Bank, in particular, favors such organizations often requiring their creation as

conditions of loan effectiveness. And African nations have not been loath to institutionalize them.

In recent years, however, critics have begun to question the effectiveness of such organizations over the longer term. A number of problem areas have been outlined, of which three have special relevance to AID river basin development programs. These are first the "growing ineffectiveness" problem; second, poor relationships with other government agencies; and third the "local involvement and handing over" problem (cf. Thomas and Brokensha).

1. The "Growing Ineffectiveness" Problem

While not well studied in connection with African river basin development authorities, the history of other African parastatals contains numerous cases where a special organization created to foster development in time becomes a major constraint to that development. When first established, new parastatals are in the "limelight." Often established with a political mandate and ample funds, they are able to attract good staff through exciting prospects and higher salaries. But as time goes on, and new projects are formulated, competition for scare funds from national treasuries increase. Though salaries continue to be paid, funds for operations and maintenance expenses usually are inadequate, with the result that facilities, including infrastructure and equipment, begin to deteriorate. The same applies to staff quality, with the best staff moving on to other more exciting assignments. The histories of the Sudan Gezira Board and the New Halfa Agricultural

Production Corporation illustrate the problem of growing ineffectiveness, with deterioration of equipment pools and deflection of staff to the newer Rahad Corporation interfering with scheme efficiency. A related issue is that these parastatals often serve as monopsonic purchasers of the "preferred" crops that force farmers into undesired production strategies such as cotton cultivation. Further, the "profits" are increasingly utilized to fund the operating corporations rather than being returned to the producers. In some cases, profits are even claimed by the Ministry of Finance to cover deficits in other areas of government as was seen happening in Richard Toll.

2. Poor Relationships with Other Agencies

Poor relations between government parastatals and other government agencies is a chronic problem, which could be partially overcome by decreasing the implementation (as opposed to planning) responsibilities of parastatals. The very establishment of parastatals infringes on the "turf" of such line ministries as agriculture and irrigation. It also increases demand on scare funds. As a result, cooperation is difficult. At worst parastatals and international authorities are set against other national institutions in a zero-sum game in which the one's loss is the other's gain. Where cooperation does occur, such line ministries as public works may have insufficient staff, equipment and funds to handle their responsibilities, hence causing major delays in the construction of infrastructure. And where handing over subsequently occurs, such ministries may direct scarce

resources to older constituencies with the result that infra-structure, and agricultural and other services deteriorate (cf. Thomas and Brokensha).

3. The "Local Involvement and Handing Over" Problem

The "local involvement and handing over" problem has a number of facets, all of which have proved to be rather intractable within the African context. On the one hand, river basin and other parastatal organizations tend to bypass local level authorities even at the district and provincial level in regard to the planning process (the OMVS being a major exception) and the selection and design of specific projects. On the other hand, they resist eventually handing over managerial and other functions to line ministries, district and municipal councils and such other local organizations as tenants' unions, community development societies, and water user associations (cf. Salem-Murdock; Thomas and Brokensha).

The basic problem here is fundamental to the structure of parastatal organizations. While their hierarchical, centralized structure lends itself to greater flexibility and better planning and implementation during the planning and construction phases of river basin development, that same organization subsequently hinders the devolution of authority to other organizations during the development phase (it also makes it difficult to decentralize responsibilities within the organization). While there are additional problems such as duplication of functions with line ministries and higher financial costs,

the devolution problem, when coupled with increasing inefficiencies and interagency jealousies, can become a major developmental constraint.

During the development phase that follows construction of infrastructure, beneficiary involvement in program and project implementation becomes increasingly important. Yet case after case illustrates a resistance on the part of parastatal organizations to hand over increasing managerial responsibilities to local organizations. In the Sudan, the Gezira Board has resisted devolution directives from government for twenty-five years, a not unexpected situation since increases in the strength of the Tenants' Union is seen as a threat to the autonomy and strength of the Board. While SAED in Senegal has agreed to hand over increased responsibility for irrigated sections to village associations of farmers, this decision was caused more by pressures on SAED to bring on new sections than on a readiness to devolve authority.

4. Implications for USAID

a. The Need for Capacity Studies to Identify Appropriate Institutions to Plan and Implement African River Basin Development

We have emphasized the above weaknesses not to discredit parastatal organizations, but rather to point out problem areas which need attention. While they are solvable, as the TVA prototype illustrates, TVA-type solutions dealing with devolution, for example, are not easily transferred to Africa. There is an inconsistency here,

with AID supporting strong river basin development authorities which to date have proved themselves incompatible with the type of decentralization and devolution of authority to local participatory organizations which AID also supports. At the very least, more consideration should be given to how existing institutions might be more effectively involved in the planning, implementation and management of river basin development. If local organizations are involved from the very beginning, they are in a better position to expand their influence and level of activities over time thus facilitating the "handing over" process.

As for the interagency problem, serious as it may be within nations, it is exacerbated as the number of members within an international river basin authority is increased (cf. Utton). Adams (1984) has written on conflicts between Nigeria's nine federally sponsored River Basin Development Authorities and the States within which they operate. A classic example of the difficulties involved in international cooperation is the eight member Niger Basin Authority. In such cases, cooperation between nations might be facilitated if the basin was divided into subbasins within which no more than three nations had territorial claims, with the umbrella organization assisting by providing research, information dissemination and planning support (cf. Utton). Better subbasin planning might also lead to more attention being paid to tributary development and to the incorporation of local populations within development plans. The division of a basin into subbasins might, understandably, face the resistance of downstream states, however, in

fear of potential actions by upstream subbasin groups.

Notwithstanding these problems, the three member OMVS (Mali, Mauritania, and Senegal) for the development of the Senegal River and the four member OMVG (Senegal, Gambia, Guinea and Guinea-Bissau) for the development of the Gambia River are considered to be international "bell weather" organizations by some experts (cf. Utton). Since clearly different criteria of evaluation are involved, a broad-based survey of the functioning, with special emphasis on effectiveness and on constraints, of African river basin and irrigation development agencies is needed as a first step toward adapting organizational structures to African conditions. Notwithstanding the strengths of parastatal organizations, their record in Africa is poor in regard to planning, enhancement of local production systems, environmental protection and rehabilitation, and project, program and rural-urban linkages, four components which we believe need special attention and which are logical options for AID intervention.

While most of our strategy suggestions are best carried out by AID within specific river basins, some involve a more general approach. A case in point is the need for a general survey of the capacity of existing organizations to plan, implement, manage, monitor and evaluate more broadly conceived programs of river basin development. Though existing agencies are experimenting with decentralized approaches which include other organizations within the planning process (while international agencies like the OMVS leave implementation to national parastatals and other organizations), we are aware of no

comparative studies of African river basin development institutions. Granted the hesitation of African nations to delegate what they consider to be "national prerogatives" to international agencies (a hesitation which to date has kept the Niger Basin Authority, for example, from developing an appropriate planning unit), there is a major need for developing institutions appropriate to African conditions. Important questions concern not just the functions of such institutions in relationship to national, regional and local organizations but also their articulation to the higher echelons of government. To date most river basin development parastatals continue to be articulated to "the top" through ministries or ministers primarily concerned with energy development and irrigation as opposed to the integrated development of river basins as resource units.

b. The Need for Research, Information Dissemination and Planning Units within River Basin Development Organizations

While capacity studies may suggest major ways for altering the structure of river basin development agencies in order to increase their effectiveness under African conditions, we believe that USAID can make a major contribution now by increasing current efforts to improve the research, information dissemination and planning capabilities of existing agencies. Though the location of these functions may vary from organization to organization, their establishment within a single unit should be seriously considered.

USAID is already strongly supportive of hydrological, soil, environmental, agronomic and socio-economic studies in tropical river basins as illustrated by studies currently underway in the Gambia River Basin and intended for the basins of the Niger and the Juba Rivers. AID has also been supportive of planning units, insisting -- along with other donors -- that such a unit be established within the Niger Basin Authority before too many studies have been commissioned. AID's insistence here makes sense. According to the mid-term project evaluation of the AID-funded Gambia River Basin Development Project, a major flaw in an otherwise well conceived program has been the failure, through mid-1984, to develop a planning unit within the OMVG which can effectively utilize AID-financed studies and mapping (AID, 1984). We recommend that henceforward studies be more systematically linked to the institutionalization and upgrading of planning capabilities, and that these two interests be more systematically linked, and integrated with information dissemination between and within nations.

Coordinated international development requires a broader perspective than merely allocating shares in river flows. It requires coordinated planning based on multiobjective analysis which in turn requires a well-trained interdisciplinary staff and a carefully thought out program of studies for assessing and optimizing development potentials and a capacity to model and utilize the results of those studies. Research, data processing and modeling, information dissemination and planning capabilities are not effectively developed,

let alone integrated, within river basin development agencies in tropical Africa. Where such capabilities exist, their instigation is more apt to come from donors than from within host nations.

UNDP, for example, has played a major role in the development of documentation centers within African river basin development agencies, while the Ford Foundation (with Institute for Development Anthropology assistance) provided consulting advice and seed capital for the establishment of the first Socio-Economic Research Unit (SERU) within a Sudanese parastatal. Now well-established within the Rahad Corporation, this unit has served as a model for the establishment of a similar unit within the Sudan Gezira Board as part of a proposed World Bank funded rehabilitation program.

For the results of such research units to effect policy, however, they need to have the capability to feed processed information at the right times into the planning process both within and between development agencies. This would be facilitated if research and planning (as well as evaluation) were within a single unit. Where that unit is within a international agency such as the Niger Basin Authority it should have the capability to disseminate information the sharing of which can promote cooperation between nations by showing the costs and benefits that may arise from different development alternatives. Presentation of these alternatives require modeling capabilities within the research unit, capabilities which, for example, can assess the trade-offs between reducing power generation, on the one hand, in order to increase, on the other hand, flood water irrigation, grazing and

fishing through regularization of reservoir drawdown and controlled downstream flooding.

While staffing should be determined by organizational responsibilities, the training and expertise of existing staff is inadequate. It also does not tend to reflect African conditions, and especially the need for staff who can build on the productivity of local production systems. Though AID projects for river basin development include training, subsequent evaluations often note that training goals were not sufficiently realized (see, for example, the previously mentioned mid-term evaluation on Gambia River Basin development). At the same time, AID still tends to perpetuate a mismatch between staff needs and staff training by emphasizing training in conventional water resource development fields. Hence though social impact studies figure prominently in the analytical studies proposed for the Juba Valley, the long-and short term training proposed for Ministry of Juba Valley Development staff does not include the type of social science expertise needed for relating the basin's Master Plan to the current activities of the majority of the basin's inhabitants. It is not that water resource training is over-emphasized but rather than other types of training are under-emphasized.

In discussing advisory and local staff for river basin agencies, the Clark University/Institute for Development Anthropology team were in general agreement that the following skills should be included: engineering, natural resource management, agriculture, economics, development social science and regional planning. In each

case broad gauged personnel are needed who can relate state-of-the-art knowledge to the realities of African river basin development (cf. Schwarz). In the case of agriculture, this means sufficient knowledge to advise on rainfed and irrigation production systems for incorporating local farmers, herders, and fisherfolk. It is not that such conventional fields as hydrology and soil science should be deemphasized. On the contrary, study after study of African settlement projects show that soil surveys, for example, are insufficient and hence should continue to receive high priority as part of AID's development strategy. But the same also applies to the strengths and weaknesses of local production systems for utilizing those soil resources (cf. Major and Little).

B. At the Micro-Level: Local Participation Through Local Organizations

The new conventional wisdom is that local participation of producers in the planning, implementation, management and evaluation of development projects through strong participatory action organizations is associated with increased productivity (cf. Major and Little; Salem-Murdock; Thomas and Brokensha). In their volume on rethinking rural development, Johnston and Clark (1983) summarize this viewpoint when they state that "where the organization reaches down to local levels, and is accountable to local people, and is involved with rural development, it has been found that the objectives of rural development have been more successfully accomplished." Such statements are especially relevant to irrigation projects of all sorts granted the increasing number of microstudies associating increased productivity

with water user associations at the different project levels.

While the CU/IDA team strongly support local participation in the African context, there are few African models to utilize. Though small-scale gravity flow irrigation occurs in parts of tropical Africa, most irrigation is of the flood water variety which usually does not involve associations of water users. Nor has the formation of water user associations (as opposed to such residential units as tenants' unions) been encouraged in government sponsored irrigation projects. Where indigenous cooperative activities do exist among producers, not only are they apt to involve "one time only" activities, but they also tend to be undermined by the more tightly scheduled timing of activities associated with agricultural intensification. A case in point are widespread cooperative work groups which rotate among the fields of the participants. Not only are these not institutionalized to undertake such on-going tasks as water management and conflict resolution, but they are incompatible with more rigidly scheduled activities which require farm families to undertake similar tasks at the same time.

In Africa it is not sufficient to merely voice the importance of local participation. Rather much more attention need be paid to the identification of appropriate local institutions which can be adapted to the needs of development or the creation of new institutions where necessary. It is especially important that these involve both men and women, since river basin development projects all too often have deleterious effects on the status of women, and on their access to

production resources and to income generating activities (cf. Salem-Murdock).

There are many African examples of economic cooperation through time which involve extended kin groups, on the one hand, and such residential units as villages and village sections, on the other. Some, as is the case with village management of small scale perimeters along the Senegal River, and the nafeer or the work party system on the New Halfa Agricultural Scheme in the Sudan, are already playing an important role in river basin development. Examples, however, are few, and even these are apt to be problem-prone (Watt, 1982).

We recommend that USAID pay more attention to the identification and institutionalization of appropriate producer organizations for mobilizing river basin residents. While identification of appropriate institutions is included in the scopes of work of the African Irrigation Overview and the Access to Land, Water and Natural Resources Project, we suspect that a separate project on this topic is needed. As for institutionalization, this is a very time consuming task which might best be advanced by focusing attention on carefully identified prototypes in river basins in which AID has an ongoing program, and by involving private voluntary organizations in their development as AID is doing in Somalia in connection with refugee settlement (AID, 1985).

In the context of medium and large scale irrigation projects, there is a need to address the issue of how to federate water user associations at the turnout level up to the project level with

intermediary distributary and branch canal associations for subdividing projects into more manageable entities. Indeed, rather than contrasting large versus small projects, more attention need be paid, on the one hand, to decentralizing management responsibilities within large projects, and, on the other hand, to articulating small projects within a regional context so as to increase such potential multiplier effects as nonfarm employment.

V. PRODUCTION SYSTEMS FOR MILLIONS OF SMALL SCALE PRODUCERS

At the October, 1984 CU/IDA workshop on African river basin development participants from a wide range of disciplines including engineering, law, anthropology, economics, geography and political science were asked briefly to summarize the first drafts of their topical papers. Without exception, they emphasized the need for increased food production. Though a range of options were touched on, including large-scale irrigation, the consensus was that development programs and projects should concentrate on small-scale producers. The report on natural resource management issues recommended "research into the benefits of rural production systems as base line data for improving the productive capacities of local people, without whose active participation all schemes are useless," while the papers on economic and social issues emphasized the "the role of local production systems in river basin development." Furthermore, even where large-scale irrigation is the approved option, the farm household at the turnout and field levels was considered to be "the critical link in the

effective management of river basin development."

Notwithstanding the current emphasis on small-scale producers as the key to increasing food production in Africa, a headworks orientation based on the construction of mainstream dams and other large-scale infrastructure for water management continues to dominate planning for African river basin development. More easily based on calculations of water and power output, cost-benefit ratios tend to gloss over agricultural and industrial production options. While the resulting development may well provide the water and power outputs expected, not only have they failed to produce the economic and social benefits envisioned, but they have also produced negative side effects (cf. Schwarz).

In spite of Africa's overwhelming need to increase food production, monies allocated for implementing a broad-based strategy of agricultural development within river basins tend to constitute a very small percentage of budgeted funds. For example, in the case of the Kagera Basin Programme only $75 million and $19 million respectively were allocated for agricultural development and afforestation out of a total budget of $6.3 billion (cf. Berry and Berry). Furthermore, what agricultural development is planned tends to concentrate on large scale irrigation projects as opposed to a strategy that integrates large, medium and smallscale irrigation with rainfed agriculture, livestock management and other local production systems. In Rwanda the unanticipated loss of productive lands to the reservoir is staggering, given the extraordinarily high rural population density in that tiny country.

While increasingly AID is funding, as in the Gambia and Juba Valleys, socio-economic studies that cover the entire range of contemporary land and water use systems, with few exceptions national policies and parastatal agencies at both the national and international level continue to emphasize the generation of electricity for the urban industrial sector at the expense of rural electrification, and large scale irrigation projects which only benefit a relatively small number of river basin residents when they finally come on line.

Where appropriate socio-economic studies are undertaken, to the best of our knowledge African river basin development authorities do not have either the staff or the modeling capabilities to incorporate them into subsequent development plans with the result that adverse effects continue to reduce the productivity of tens of thousands of local producers. Adams (1984) notes that river basin development authority schemes in Nigeria, "particularly irrigation schemes in the North, have been extensively criticized for their insensitivity to farmers' needs, failure to understand the economic environment of the farmers involved on schemes . . . and adverse distributional effects whereby larger producers and traders gain at the expense of the poorer groups affected."

Little appears to have been learned from the lessons of the past. In spite of careful documentation showing that the downriver productivity of tens of thousands of Nigerian farmers and fishermen was adversely affected by the Kainji dam in the late 1960s, Adams reports remarkably similar impacts in the Sokoto Rima basin in the 1970s where,

"in place of the downstream benefits forecast, there was a reduction in downstream agricultural production and fish catches due to the reduced wet season flooding." Well over 50,000 people were adversely affected with the result that farmers who formerly practiced a relatively intensive form of flood water irrigation during the dry season "have turned to dry season labor migration, a traditional response to periods of drought and hardship, . . . and few fishermen stay in the valley after the end of the rains."

There is a very real danger that similar adverse downstream effects will follow the construction of the Manantali dam in the upper portion of the Senegal river basin, even with a simulated downriver flood of 30 days for the first five years. And while AID has gradually broadened the scope of studies in the basins of the Gambia and Juba Rivers, one wonders if the OMVG and the MJVD will have the support and the capability to build the results into development plans. This brings us back to the need to develop within river basin development agencies the ability to model the range of development options, and to formulate plans for consideration by decision makers.

Whatever strategy AID evolves should be integrated from bottom to top. If, as we recommend, AID's strategy focuses its attention on local production systems, any attempt to increase their productivity must deal not just with such local level inputs as adaptive research, extension services for both male and female producers, credit and marketing but also with national policies and national institutions.

VI. LINKAGES

Under linkages we have three categories in mind of a rather different sort. The first involves linkages among donors. The second involves linkages between specific projects and programs within river basins. The third involves linkages between rural and urban sectors.

A. Inter-Donor Linkages

We have already mentioned the need for policy reform as it relates to improving rural-urban terms of trade and to broadening host country (and donor) perspectives as they relate to river basin development. Pointing out that policy changes are limited "to a few countries, and even they have not gone far," the World Bank (1984) emphasizes both the need for external support for "reform programs" and the need for donor aid coordination through "consultative groups, UNDP roundtables and similar meetings." While AID is already involved in such coordination, we believe there is a still greater need for donors at least to attempt to formulate an integrated approach to river basin development, and to apply more leverage on host governments to follow appropriate policies. Historically some AID missions have informally played an important coordinating role in some countries. We recommend that such a role at least be considered as part of a more systematic AID river basin development strategy.

B. Inter-Project and Inter-Program Linkages

We recommend that any future river basin development strategy be used as a mechanism for linking, at the very least, AID projects and programs within the member countries. Whether AID or the World Bank, the organization of development agencies does not facilitate linkages between discrete projects and programs. Yet the realization of such goals as the integrated development of specific river basins requires such linkages, as does the successful development of large-scale irrigation projects which involve the cooperation of different government agencies. This is a lesson learned, for example, from the World Bank's involvement in large-scale settlement projects. While the responsible parastatal organization or project management unit may be doing a competent job, progress still may be unsatisfactory because other agencies are unable to meet their commitments. The public works department, for example, may not have the capacity to provide timely infrastructure, while the training and numbers of soil scientists and land surveyors may be totally inadequate to identify project areas and complete the necessary surveys for farm layout and titling. To correct such deficiencies, the World Bank has begun to link sectorial programs and projects in a number of countries. This is a role which we believe is suitable for AID in connection with river basin development, with funds being used to identify and correct training, planning and implementation deficiencies which threaten the execution of feasible strategies for optimizing African river basin development.

C. Rural-Urban Linkages

Recent micro-studies in tropical countries indicate that linkages between agricultural and industrial development are significantly greater than previously realized, with rising net incomes of tens of thousands of rural producers generating nonfarm employment and enterprise development, and urban functions, in turn, stimulating rural development. While marketing facilities are receiving increased attention in river basin development, the development of a hierarchy of service centers, and particularly of market and regional towns, and of the appropriate services supplied by those centers, continues to receive inadequate attention -- the Senegal River Valley being a case in point.

With its interest in adaptive research, farming systems, nonfarm rural employment (which recent studies shows employs far more people than previous realized; see, for example, World Bank, 1978 and AID, n.d.) and urban functions for rural development, it makes sense for AID to incorporate the enhancement of rural-urban linkages within its strategy for African river basin development.

VII. NATURAL RESOURCE MANAGEMENT

Because of AID's emphasis on environmental impact assessment, there is no need to elaborate, in this overview, on the importance of natural resource management for any future AID river basin development strategy. While experts may differ on why degradation of African habitats is occurring, and on the resiliency versus the fragility of those habitats, no one questions the seriousness of the degradation

that is occurring, including desertification and depletion of arid, semi-arid and humid forest resources. The erosion of natural resources is listed in the latest World Bank strategy paper as one of the major long-term constraints on development -- constraints which if unchecked will lead to what the Economic Commission for Africa calls a "political, social and economic ´nightmare´ by the turn of the century" (World Bank, 1984).

Whether the management of surface or ground water supplies, soils, or vegetation and wildlife, the need for improved natural resource management cannot be divorced from local participation, for if households and communities adjacent to deteriorating resources are unable or unwilling to manage and enhance them, degradation will continue. More attention should be paid first on ways to maintain habitats (including utilization of indigenous knowledge) and second on institutionalizing appropriate local organizations for protective, managerial and extractive purposes. Where local populations are to be the major custodians of natural resources they will need assistance in protecting those resources from outsiders. As for extraction, the necessary cooperation is unlikely unless local communities at the household level have an appreciable "economic stake" in resource management. This applies not just to utilization of soils by farmers and rangeland by herders, but also of fish by fisherfolk, and game and forest products in the case of adjacent communities.

To date community approaches to natural resource management seldom have reached down "far enough" to gain the necessary cooperation,

with game utilization projects, for example, stopping at the district level as opposed to that of the most impacted upon villages, and community forest projects paying too little attention to the involvement of individual households or kinship and residential groupings.

VIII. AID STRATEGY IMPLEMENTATION IN A HYPOTHETICAL RIVER BASIN

In the section that follows we have tried to pull together the various strategy recommendations for AID in this overview as they might apply to the phased development of a specific river basin. We believe that AID can play a major role in helping host countries develop a capability for continuous planning which moves from broad policy considerations to integrated planning, implementation, management and evaluation.

None of our recommendations really involves significant departures from AID's current efforts. Bearing in mind funding constraints, they do not emphasize major financial investments in infrastructure. Nor do they advocate a departure from AID's emphasis on particular river basins or topical interests. Their main contribution is an attempt to integrate these interests, where relevant, into a more coherent, clearly enunciated and dynamic strategy the main purpose of which is to enhance the productive capacity of small scale producers.

Though the activities that follow are time sequenced, they will tend to overlap in time, and may well vary from one river basin to another.

A. Prior to involvement in specific river basins, complete background studies on selective topics. In addition to the currently researched topics of land tenure and irrigation, we have added appropriate macro-and micro-institutions for African river basin development. Other topics also suggest themselves such as the integration of over lapping and contiguous local production systems (such as irrigated agriculture and livestock management, and rainfed agriculture and irrigation).

B. Help host countries establish appropriate river basin development policies and initiate appropriate integrated planning for river basin development before engineering designs, based on more easily transferred water management criteria, are "fixed" for major infrastructure. Such planning may have to precede the establishment of specialized river basin development agencies. The intention of this initial step is to avoid the type of situation that occurred during the 1970s in Nigeria's Gongola Basin where basin wide studies that suggested a different sequencing and design of infrastructure were carried out at too late a date to alter the implementation of the original engineering designs.

Such activities usually will require an advisory team (or teams) of expatriates, plus coordination of donor activities so that the latter are not at cross purposes.

C. Help host countries reach a decision on where to institutionalize basin development activities whether this be in existing agencies, new project management units, or new river basin development authorities.

D. Help establish an appropriate research, information processing and dissemination, planning, and monitoring and evaluation unit (or units) for river basin development purposes.

E. Help design and fund, prior to studies, appropriate training programs so that trainees can participate in study design and execution, and in data analysis and report writing. Training should include not just the relevant disciplines but also information processing and the modeling of complex data bases.

F. Help design and fund appropriate hydrological (including both surface and ground water supplies), soil, environmental, socio-economic, institutional and developmental studies, with the latter emphasizing existing production systems, and rural-urban linkages.

G. Through advisory services and further training help with the analysis of survey information and the utilization of the results through multiobjective analysis and planning.

H. At the time of implementation, help design and fund prototype pilot projects for enhancing local production systems, institutionalizing local participation, and managing natural resources.

I. At the time of implementation, help -- through advisory services and further training -- with the initiation of appropriate monitoring and evaluation activities.

J. As part of a strategy that advocates continuous and flexible planning have the capacity to help the host country deal with constraints or new opportunities as they arise, including the funding of critical infrastructural components (we end with these to show that our suggested strategy does not preclude the funding of infrastructure, although it does advocate deferring its consideration until the necessary planning studies have been completed).

REFERENCES

Adams, W. M.

1984 "River Basin Planning in Nigeria." Unpublished manuscript.

African Development Bank and the Economic Commission for Africa

1984 "Economic Report on Africa"

Agency for International Development

n.d. An Approach to Spacial Planning for Rural Development. Working Group on the Rural Poor. Washington, D.C.: AID

1984 "Mid-Term Project Evaluation Gambia River Basin Development Project (Project No. 625-0012)." Dakar: AID River Basin Development Office.

1985 Somalia: FY 1987 Country Development Strategy Statement Washington, D.C.: AID.

Biswas, Asit K.

1983 "Some Major Issues in River Basin Management for Developing Countries." In River Basin Development, edited by Munir Zaman. Dublin: Tycooly International Publishing Limited.

Christensen, C.; Dommen, A.; Horenstein, N.; Pryor, S.; Riley, P.; Shapouri, S.; and Steiner, H.

1981 "Food Problems and Prospects in Sub-Saharan Africa: The Decade of the 1980's." Foreign Agricultural Economic Report, no. 166. Washington, D.C.: Economic Research Service, USDA.

Economic Commission for Africa

1983 ECA and Africa's Development 1983-2008: A Preliminary Perspective Study. Addis Ababa: Economic Commission for Africa.

Eicher, Carl K.

1982 "Facing Up to Africa's Food Crisis." Foreign Affairs 61(1): 151-174.

Horowitz, Michael M.

1985 "Cause of Africa's Pain Must be Treated." Binghamton Sunday Press, January 20, 1985.

Johnston, B. F.; and Clark, W. C.

1982 Redesigning Rural Development. Baltimore: Johns Hopkins University Press.

Organization of African Unity

1982 The Lagos Plan of Action for the Economic Development of Africa, 1980-2000. Addis Ababa: OAU.

Scudder, Thayer

1980 "River Basin Development and Local Initiative in African Savanna Environments." In Human Ecology in Savanna Environments, edited by David R. Harris. London: Academic Press.

United States Congress: Office of Technology Assessment

1984 "Project Proposal for the Africa Tomorrow Project: Agricultural Technology and Food Aid for Africa." Washington, D.C.: OTA.

Watt, S. B.

1982 "Peripheral Problems in the Senegal Valley." In River Basin Planning: Theory and Practice, edited by S. K. Saha and C. J. Barrow. New York: Wiley.

World Bank

1978 Rural Enterprise and NonFarm Employment: A World Bank Paper. Washington, D.C.: World Bank.

1981 Accelerated Development in Sub-Saharan Africa: An Agenda for Action. Washington, D.C.: World Bank.

1983 Sub-Saharan Africa: Progress Report on Development Prospects and Programs. Washington, D.C.: World Bank.

1984 Toward Sustained Development in Sub-Saharan Africa: A Joint Program of Action. Washington, D.C.: World Bank.

CHAPTER THREE

AFRICAN RIVER BASIN DEVELOPMENT: NATURAL RESOURCE MANAGEMENT ISSUES

by

Eileen Berry
Leonard Berry

River basin development has been seen as the key to unlocking great resource potential in Africa. At the same time it has been the bane of development planners at national and international levels. Current reckoning is that these large scale projects have generally fallen far short of their promise or, at the most optimistic, that they have not yet begun to reach their potential (Saha & Barrow 1981). The apparently most successful case, that of the Nile River in the Republic of Sudan & Egypt, has evolved over more than fifty years of sequential planning and development, and even in this case there are very many current problems and unrealised opportunities (Barnett, 1977, Pollard 1981).

This paper sets out the main reasons for this unsatisfactory state of affairs with regard to river basin development, lays out models of existing procedures in river basin planning, analyses the problems associated with these procedures, and suggests a regional planning approach in which the river basin is treated as the resource unit and development planning builds on existing resource management systems. Problems of implementation are then identified.

Resource management in river basins involves several kinds of resources; natural resources of water, land, vegetation and animals, and

human resources of many kinds, as well as many different levels of management. The managers of river basins may include basin authorities, national political and technical bodies, regional authorities and many different farmers and herders. Resource management is a complex of activities involving local production systems, sub-basin regional allocation of resources and whole basin managers; the latter most frequently focusing on water resources.

There are two major approaches to river basin development in Africa: the large scale, with a single or small number of large dams, involving high investment from international donors and involving a number of member countries as the beneficiaries; and the much smaller scale of multiple dam sites, usually with a significantly lower level of funding, and often confined to small in-country catchments so that the management problems are simpler and do not cross national boundaries.

There are many examples of the "large scale dam" approach including the Sennar, Rosaries, and Sadd el Ali dams on the Nile, the Volta dam in Ghana, the Selinque on the Sankrani tributary of the Niger, the Manantali on the Senegal river and the Kariba dam in Zambia. Formal reports of the small scale approach are less common. The Machakos integrated development project currently underway in Kenya is an example. It is a project which emphasizes the provision of extra water at many different sites to be made available for garden watering, small scale irrigation, livestock and household use.

The resource management planning in respect of these two approaches is very different. In the case of the large dams, existing planning is geared to making use of the new supplies of water and power generated by the new dam. Thus the availability of new resources, in hitherto unknown quantities, determines the course of development activity. The question

becomes "We have the water and the power, what can we do with these new resources?" In the case of the smaller, multiple site, projects the focus from the beginning tends to be on land as well as water. The emphasis is often on soil and water conservation and improving agricultural productivity, and this means that some form of regional planning is already the mode, with local participation encouraged. It is clear that this experience is not directly transferable to the scale of the large international river basin but some critical lines of research have emerged from these projects that can have some part in the conceptualisation of regional plans at the larger scale.

Whatever the shortcomings of the large dam projects, they are likely to continue. Large dams attract multi-donor investment and are prestige projects for recipient governments. Often the physical characteristics of the river encourage large dam construction. Given this pattern of river basin planning, the challenge is to find ways to improve the resource management of the whole basin and bring real benefits to both the local people and the national economies of the member nations.

Existing Procedures in Large Scale River Basin Planning

As the pattern of river systems in Africa is one of rivers being generated in relatively localised high rainfall areas and subsequently flowing through drier zones, there has been a universal model of regarding water as the scarce resource to be managed, and to seek later the most appropriate complementary resources of soils, vegetation, and people.

The drainage pattern is frequently one of multiple small tributaries flowing into a long, major, trunk stream which often crosses international boundaries. There are only a small number of possible dam and reservoir

sites for each drainage basin and this has led to an emphasis on multi-purpose, integrated river basin development plans.

Technological investment of this magnitude has to stress water and power output to justify the expense to multi-donor organisations and host countries. Positive cost benefit ratios must be predicted and presented to the supranational river basin authority to rationalise the building of dams, and it is easier to base these on calculations of water and power output than it is to base them on predicted agricultural or industrial benefits, often mentioned only in very general terms. Agricultural and industrial projects also require complementary inputs and come under the purview of the member states, which adds to the difficulty of accounting.

Existing financial planning for large scale river basin development, therefore, allocates large sums of money to water engineering and management (dams, reservoirs, aqueducts, pumping stations, canal and pipe networks and the physical infrastructure for irrigation), that is, to the structural and mechanical aspects of water management, while allocating a very small percentage of the total funds to agricultural and other supplementary projects. For example, in the case of the Kagera Basin Program, some US $75 million were allocated to agricultural development, plus a further US $19 million for afforestation, out of a total projected budget of US $6.3 billion. Given this emphasis, it is the availability of the water that leads to the formulation of plans for industrial, agricultural and service investments in infrastructure, which have become technologically feasible but not necessarily socially or economically feasible (KBO, 1982).

In eastern Africa, many of the river basins are scarcely populated and remote for many miles of their courses from major population centers

and routeways, thus the opportunities for large scale industrial development are small. The major opportunity consequently lies with agriculture. In western Africa, the situation tends to be more varied. The Volta (Ghana) and Bandama Kossou (Ivory Coast) dams are quite close to major population centers and consequently have greater potential for industrial developoment. Others like the Manantali in Mali are more remote.

Generally, irrigated agriculture appears to the donors and basin authorities to present the greatest opportunities for modernization and development. In line with the already mentioned need to justify the high investment costs in river basin development, the expense of installing irrigation facilities calls for a return in high value export crops. Such projects are national projects rather than regional projects, with benefits accounted at a national level. The fact that irrigated agriculture of this type becomes technologically feasible does not mean that it always fits in with the member countries' individual plans or that there are available complementary resources of labor, skills, management potential, access markets, or other investment capital.

Issues of management and allocation of land resources in the basin are often very important. If basin development includes irrigation, questions of land use and changing land use figure particularly prominently. The construction of the dam itself frequently involves a change in use of valuable land. In one formal large scale irrigation project in N. Nigeria, the following land use changes took place around the project site:

TABLE 1

Bakolori Reservoir

Newly Irrigated Land Gained by Dam	30,000 ha
Irrigated Area Not Used in Agriculture	7,500 ha
Total New Land	22,500 ha
Cultivated Area Lost Under Reservoir	7,200 ha
Net Gain	15,300 ha
Area Downstream of Dam with Loss of Productivity	15,000 ha (est.)

Thus the quite productive irrigated land created by the project has to be offset by the loss of land in agriculture due to project activities and negative effects on other land. In this unfortunate case the outcome appears to be negative (Bird 1984).

An additional factor is that territorial control of the land under irrigation is important to the success of the project (Chambers and Moris 1973) and the process of tenure change to achieve that control may be difficult. If farmer user rights are either compensated or ignored, or if on the other hand, territorial control is not obtained, difficulties of water and land management are likely to occur (Bird 1984).

Beyond the immediate concerns of the irrigated area, the land area of the whole basin needs some new level of management. One purpose would be to increase the productivity of the area in the spirit of broader regional development. Another important purpose is to manage critical basin areas to reduce flow of silt into reservoirs. Some quite large dams in Africa have a life expectancy of a few tens of years because of high rates of silt deposition (the largest being the Kashmel Girba dam Sudan).

It can be argued that in some cases and in some respects the new

resources of water and power released by large scale dam construction serve to distort national economic planning aims. Where complementary resources are lacking, especially the labor and skills needed to operate large scale irrigation projects, the results are often poor and outputs way below targets. Expatriate staff, at high cost in salaries, are required for management and the returns to local people are seldom high. In fact the construction of a large dam has often meant the relocation of many local people. Where local people are involved they have been brought into highly disciplined agricultural management schemes where their rights as tenants are often limited and their livelihoods disrupted. Poor planning on the part of scheme authorities leads to this situation where local systems of resource management have been ignored. The results show up in poor levels of participation and the emergence of many off-scheme occupations.

The usual concession to local concerns is the newly required environmental impact statements demanded by some donor agencies, and the even newer, but harder to evaluate, social impact statements. These are generally couched in optimistic terms and call attention to projected benefits from agriculture and fishing that will eventually be realised if all goes well.

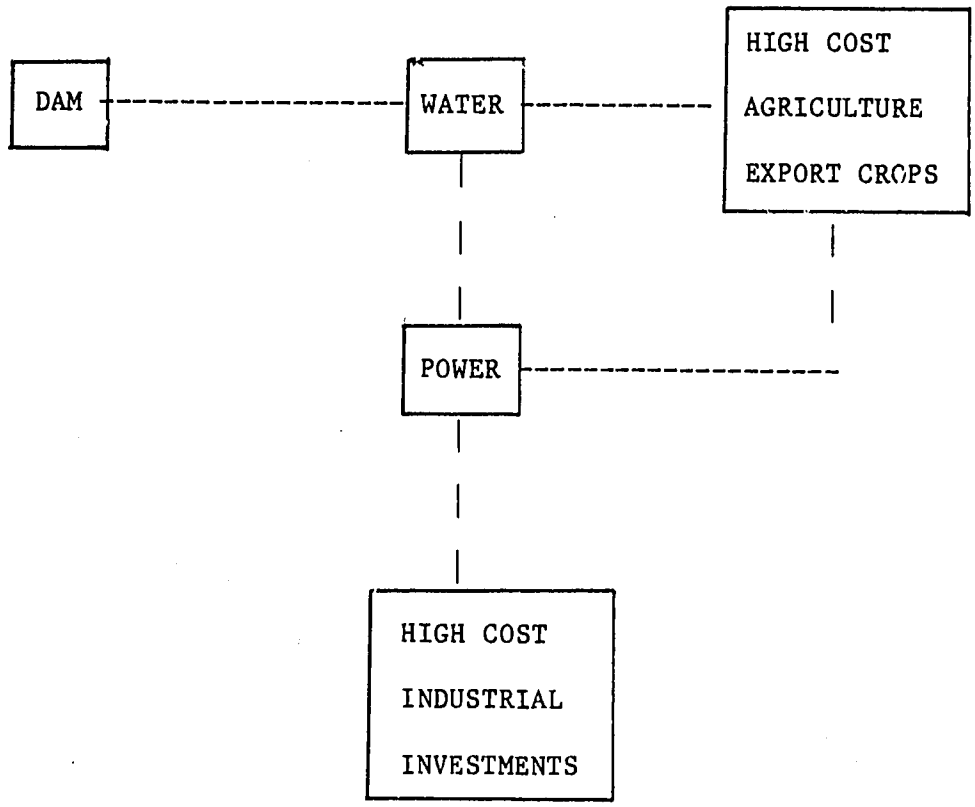
This has been the existing pattern of major river basin planning, a model inherited from colonial models of the French and the British. A major difference between those and the later schemes is the existence of well known and well organised markets and marketing procedures, which assured returns that are no longer so assured. International markets and market movements adversely affect the agricultural producers in developing countries in this decade.

There has been little practical change in the planning procedures or in the ways that major river basin development is conceived in Africa since Independence. A new emphasis by the member governments of such river basin organisations is on food production rather than on such export crops as cotton, in line with the present vital concern of all African governments with the problems of food deficits. Self-sufficiency in food crops has become the number one target of national planning. Thus the stated aims of the member states of the Kagera Basin Organisation include food self-sufficiency. However, while this makes a sensible departure in targets, it does not resolve any of the questions related to planning procedures and financial and management issues. At the core of the problem is the fact that in the case of large river basins undergoing development planning, water is managed internationally while land and labor are managed nationally and locally.

While there are particular problems in the case of international river basin planning -- large scale projects within a single country do not necessarily succeed any better. The record remains poor in most cases for Africa with the Gezira Scheme (Sudan) and the Mwea Scheme (Kenya) representing the most successful projects for diverse reasons. Both are internationally well known and the object of several technical and social studies aimed at emphasizing the reasons for progress (Chambers and Moris 1973; Gaitskell, 1959; Barnet, 1977).

The existing planning procedures can be summed up in the following diagram.

FIGURE 1



Recommended Planning Procedures

In another paper in this series (Major) the multi-objective paradigm for planning which focuses on the economics of alternative plans, in terms of effectiveness and distributional effects rather than on the total economic costs and benefits from river basin project, is discussed. This is a more useful approach for understanding the real costs, with likely outcomes of the transformation in land and water use and their consequences for local populations, than the crude cost/benefit ratios which can only serve as rough estimates for comparisons, mainly with alternative uses for the capital costs. Given the far reaching nature of these projects and the long term needed for any realization of the potential developments, and given also the inadequate nature of much of the economic data, conventional cost-benefit analysis is scarcely warranted. Resource allocation is in any

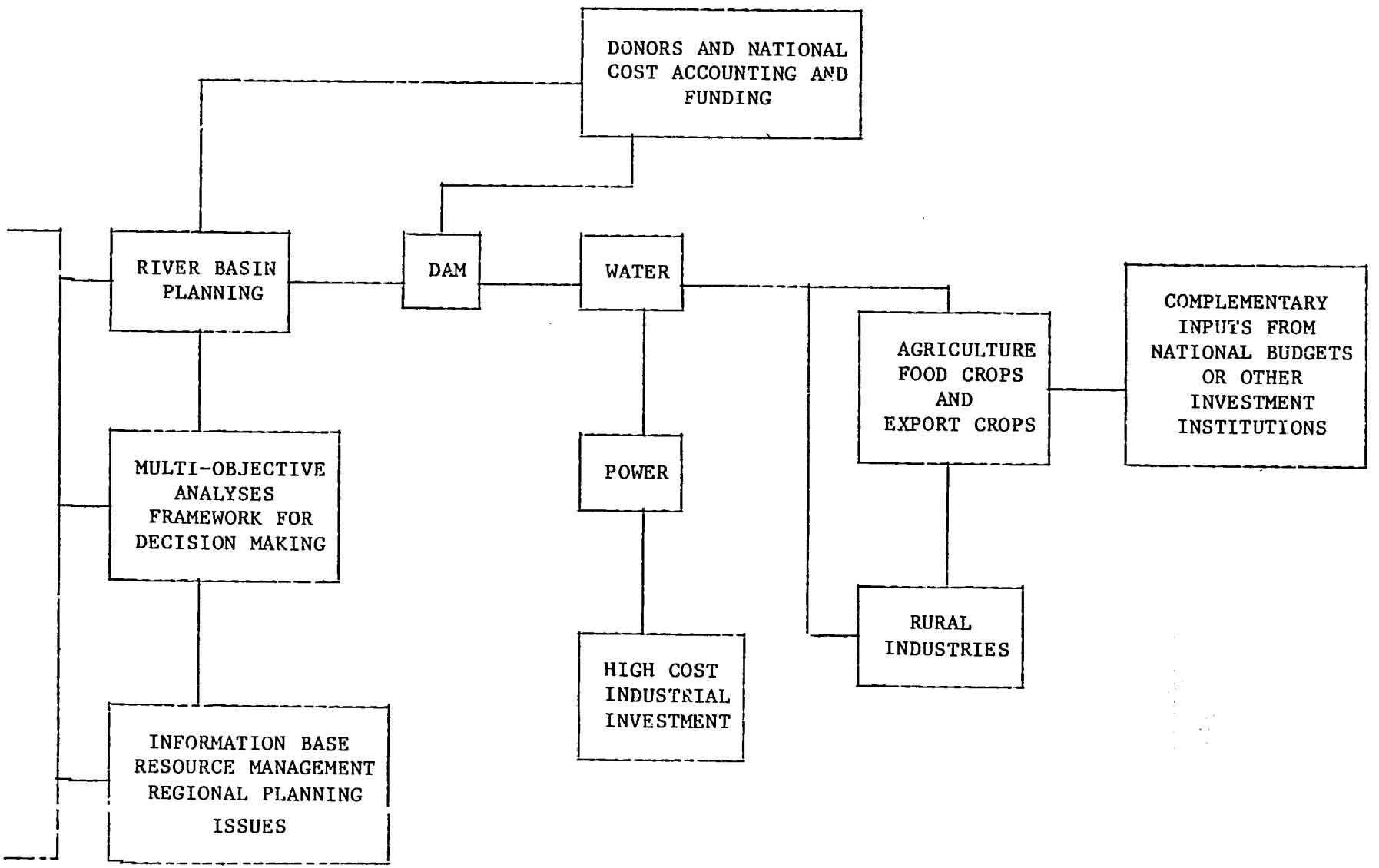
case a function of political economics rather than of straightforward economic criteria.

Within the multi-objective framework, the environmental impacts of particular plans, the alternate uses of resources -- land, water, vegetation, the gains and losses in terms of arable and grazing lands, and the gains and losses to specific groups of people and communities can be examined. A broad range of emphasis can be encompassed and multiple alternate goals envisaged. Issues can be identified in a basin-wide context, whether relating to technical feasibility (hydrological unit), interdependence of effects in an environmental sense, or coordination of management in a regional plan.

Modifying the existing planning procedures as summed up in Figure 2 on the next page, therefore, three planning stages are envisaged before the dam construction begins. These are the setting up of an information base and the multi-objective analyses which together form the basis for the river basin planning procedures (see Schwarz -- the engineers and the "others"). It is also recommended that two increased investments be made in the use of land and water for agriculture (irrigated or dryland). These are more attention to food crops, either for local consumption or for sale to urban populations, and more investment in rural agricultural processing industries. Given the present African food crisis, these policy changes are critical for development and there is presently a political will to make these changes. Complementary financial resources may have to be found for these agricultural and rural industrial investments either from national budget or from other investment institutions. The figure illustrates the recommended planning procedures. By paying particular attention to the social and environmental costs of project development before construction

FIGURE 2

RECOMMENDED PLANNING PROCEDURES
(The Plan Before the Dam!)



CLARK/IDA CONTRIBUTION (Details on Diagram 1)

begins, more effective management of the physical basin may be achieved and a more secure foundation laid for long-term development by building on the real potentials of the local people to adapt their productive systems to the new opportunities.

Analysis of Management Issues

The management of any set of natural resources is normally complex, involving many different levels from national and local government officials and private corporations to private farmers and herders, and, in Africa, also including subsistence households depending on farming, fishing and livestock. Management of the resource development of a large scale river basin, especially if it traverses international boundaries, is immeasurably complex (Haynes & Whittington 1981). Some of the important issues, which can only be summarised here, are:

1. The nature of the basin planning authority as a separate entity that lies outside the regular administrative and reporting channels and tends to be staffed mainly with expatriate technologists, representatives from member states having a role chiefly in terms of their responsibilities to their respective governments. This high degree of autonomy also exists in cases where the river basin lies within a single country, such as the Tana River Basin Authority in Kenya.
2. While the terms "integrated development" are often used in describing the planning strategies, the fact is that these planning authorities depend heavily on external sources of capital, technology, and management personnel, which ensures a focus on hydrology and water development except for a few, scattered, high cost, large scale investments in irrigated

agriculture which depend on external markets.

3. Irrigated agricultural schemes also require heavy investment costs per worker and per hectare of land, plus layers of management and organisation that lead to production costs for crops which may be above the international purchase prices. Even though profitable, the benefits may be highly localised, involving selected tenants.

4. Development of other types of agricultural and forestry projects within the river basin are likely to be under the responsibility of national line ministries, with agricultural and forestry experts reporting directly to their respective ministries. Thus these vary from one country to another, being subject to different national priorities. The "bankability" of these projects is then evaluated at the level of local funding institutions, either private or governmental, and coordination is at a minimum if existing at all.

5. Within the member states, the provincial and district authorities are not usually involved in project selection and design and may not be in any way involved in the process of development planning. Local interests are not, therefore, represented, although the execution of the projects will depend on local participation.

6. Construction of the major hydrological works is the responsibility of the contractors, who in turn, are responsible to the donors and to the river basin authority, legally empowered to act for the national governments. Once engaged, the contractors are entitled to proceed without any further consultation regarding development

concerns, such as the possible increases in run-off or other negative impacts, unless this is specified in the contract. In many cases, back-up funding to take care of adverse impacts that arise in the course of construction is not budgeted for.

7. Funds are seldom allocated in sufficient quantities for research into either the land resources of the basin (soils, slopes, climate, environmental potential), nor into the existing local resource use and livelihood systems that will be affected. The need for maximum returns on invested capital leads to the emphasis on new forms of irrigated agriculture requiring new skills from local people rather than building on existing experience and knowledge of the local environment. In terms of people, overall development objectives are scarcely realised by the resettlement of a few thousand families on agricultural schemes, preference being given to those displaced by dam construction, and the neglect of the majority of the basin population.

A river basin is clearly a hydrological unit with a physical water system that can only be managed for development purposes by a comprehensive planning authority, which in the case of the large international river basins in Africa must represent the interests of member states. The interrelated effects of water control and the need for high levels of maintenance and management of the structural and mechanical aspects of the system demand this level of operation. For obvious reasons no single management authority can control the land and people of such large areas in development projects. Nevertheless, in all river basins there are parts, sometimes very large parts of the basin, the management of which is vital to the management of the water itself and the schemes and projects that

depend upon it. Coordination within the basin is vital to catchment control and for the minimisation of negative environmental effects of impounding large bodies of water behind dams. Loss of agricultural land in one part of the basin may be compensated for by increases elsewhere, but the two regions may be under different national systems. Health problems associated with irrigation in tropical countries respect no national frontiers, nor do the effects of using chemical fertilisers on these schemes which affects water quality. Not least the construction of large dams alters the whole way of life for river people, often depriving them of fishing and dry season grazing for their animals (Ackermann et al 1973, Balon 1978). Given this interdependence of effects within the basin, this paper suggests a regional planning approach to river basin development, based on coordination, in which the basin is the resource unit as well as the hydrological unit.

Regional Planning Approach

The regional planning approach advocated here is one that treats the river basin as a major resource unit so that multiple and productive resource use strategies can be coordinated to bring, as far as possible, benefits to local people as well as to national budgets. This means building on existing land use and farming systems and introducing irrigation and hydropower at a scale that can be coped with by local management through training and other forms of support.

A key feature of this approach would be the willingness of donors to go beyond the totals of current investment and provide a larger share of capital for agriculture and forestry. These vital activities, which in the end provide the only real rationale for African river basin development at present, given the low potential for industrial growth in most parts of

sub-saharan Africa, are relegated to the status of subsidiary or supplementary benefits to the large scale water development project under the existing procedures. It is coordinated use of all resources, of water, soils, vegetation and the relation of resource use systems to bio-physical processes, that can help to avoid the ecological problems leading to poor production results which currently plague so many capital intensive water management schemes for African river basins.

This is not to advocate some form of comprehensive planning for the whole basin as an economic unit, which would be impractical. It is to put the case for seeing the resources of the river basin as a whole from the perspective of development, so that interrelated effects can be anticipated and monitored and major investments coordinated to produce the most effective use of land and water, taking into account the existing context for national planning among the member states.

Three very practical lines of research might be considered critical:

(1) research into environmental problems;

(2) potential research into the benefits of linkages among development projects;

(3) research into the economic basis of rural production systems as base line data for improving the productive capacities of local people, without whose active participation all schemes are useless.

Figure 3 summarizes the steps we suggest in a region based analysis. In the first box the region is identified as the focus of the study. While the river basin may be the primary physical unit, the study area will likely include more than the basin in order to incorporate the needed regular administrative and planning units. It is also indicated that the

FIGURE 3

Region-Based Approach to Natural Resource Management

APPROACH

1. Make Region the focus
2. Plan to effect beneficial linkages
3. Emphasize Management content especially of local production systems

FRAMEWORK FOR PROJECT DESIGN AND APPLIED RESEARCH

A. Identify problem - regional and ecological scope.

B. Investigate area resource endowment - current status and trends.

C. Relate existing area resource - use systems* to bio-physical processes.

D. Investigate rationale of area's resource - use systems, including effects of external factors.

E. Present findings - identify critical and major constraints to improving resource management and sustained productivity.

* These include farm-households, tenants on schemes, commercial farms, government managed areas, etc.

PROJECT OUTPUT

- Regional Resource Use Plan
- Guidelines for Natural Resource Management
- Regional Data Center

ACTION PLAN: IMPLEMENTATION STRATEGIES AND MONITORING PROGRAM (IN CONSULTATION WITH LOCAL PEOPLE)

- Guidelines for plan implemtation
- Proposals to deal with specific management problems -relating technical knowledge to local needs and capabilities
- Initiate pilot activities
- Set up system for on-going data collection

goal will be to identify the key beneficial linkages for the development of the area, not all the possible productive activities. The box also highlights the approach of using management systems as well as physical systems.

In Box 2 the framework for project design and applied research is set out in five stages. The purpose of the five-stage approach is to build up a picture of the resource endowment with its problems and opportunities in the context of current and future resource use in the area.

While not at all ruling out the need for transformation of some resource systems, by irrigation for example, it places the emphasis on the important step-by-step evolution of current resource systems. Important linkages such as marketing and infrastructure will be incorporated at this stage. Three important parts of the output from this analysis are: (i) an action plan; (ii) working guidelines for the implementation of the plan and the continuing management of the key resources of the basin; (iii) a data collection system that allows improvement of an understanding of the systems involved. While this process is one that can be followed for the development of natural resources in regional or national contexts additional problems occur when international issues have to be addressed as they must be in a high percentage of African basins.

In this case, and in some degree in all cases, an interactive process involving sequentially the whole basin concept and the national part of the basin concept, is needed. Although several interactions will be necessary the process might be conceived as follows:

1. Preparation of an indicative basin plan:

   This involves:

a) the general principles of allocation of water resources between parts of the basin.

b) the responsibilities of the different nation-states in maintaining the water flow including catchment control, types of agricultural development, etc.

c) general allocation of the benefits from water control, for example energy benefits.

d) an overview of the possibilities of land and vegetation resource development in keeping with the principles of basin management.

2. Articulation of the Basin Plan with the current status of resource management and the local development plans for parts of the basin. Local people, from national officers to provisional and district officials and community leaders, should be part of the process. The questions should include the following:

a) How can the management of basin resources improve agriculture and rural industry in the area concerned?

b) How can any available energy resources improve rural or urban development?

c) How or should, new water and energy create new farming systems? How can these be articulated with current systems?

d) What management and other infrastructure is needed to provide the necessary linkages?

e) What key catchment control activities need to take place to control excessive soil loss and subsequent silting of dams?

3. Reassessment of the basin plan in the light of various nation sub-regional responses resulting from step 2.

4. Agreed allotment of resources within a national and international framework, including the identification of sequential stages of investment in each of the areas.

Problems of Implementation

It is not too difficult to set out a model of planning and development of the resources of river basins in Africa. It is, however, much more complicated to follow through with this in the face of a multinational, multi-donor matrix of institutions. The evolution of a strategy along the lines suggested above was invoked in connection with the Gambia river basin (Ross 1982). This case can be used to illustrate some of the problems involved, but also to suggest that they can be overcome under the right set of circumstances.

The Gambia river basin is shared by three countries, Senegal, Gambia, and the Democratic Republic of Guinea. A river basin commission was set up (OMVG) and planning missions worked with the commission. Ross (1982) reports on the sequence of events which followed from 1977 to 1981-82, by which time the agreed upon plan for the whole basin had been completed. Of course implementation and funding had not been completed at that time.

The problems that were encountered were as follows:

1. The length of time needed. Five years seems a long period although, in terms of the importance of the effort and the probable ten to fifteen year implementation period it was not unreasonable.
2. The mission started off with a very broad mandate, and an unfocused data collection system was all that was initiated in the first year. (Our approach would hopefully reduce this problem.)

3. The mission comprised various donor groups. While it involved the prospective financers of projects it also brought a number of new perspectives and constraints to the task. In some cases the extra time and effort was judged worthwhile; in others not. It is hard to determine this in advance, and it seems that the extra time and effort was on balance worthwhile.
4. Not surprisingly, the reviewer comments that both the African countries and the donors were protective of their own decision making autonomy. Sometimes tensions occurred between the countries over relative allocation of resources. This seems inevitable and a basic part of the process. Recognizing the priority for bilateral aid by some donors is clearly an important part of the process. A final basic plan should allow for both cross national and national projects.
5. Language, as so often is the case in Africa, was a problem not only in the fact that documents had to be translated but also because miscommunication and misunderstandings arose.
6. There was some unreality in the overall development objectives posed by the mission for the countries. Objectives of food self sufficiency and maximizing rural income were not compatible, at least in the short-run. That this realization occurred in the planning process and was hammered out between the mission and the governments was in the end a benefit.
7. Data limitations greatly reduced the accuracy of the forecasts of benefits from particular projects and may have reduced the validity of the final plan.

The Gambia river planning process followed in general terms most parts of the model suggested above. The major conclusion to be drawn is that very considerable effort is needed to work through the various stages, but in so far as this is successful in bringing the various resource managers into the process, and in so far as the final strategy reflects fairly the interests of the different parts of the basin, it is not only worthwhile but essential.

In summary, basin planning should become the primary element in the organization of resource development of the area concerned. Such development will need to be preceded by appropriate levels of investigation of the key elements of the resource base. Upgrading of the use of resources needs to be tackled in a linked set of activities all targeted on benefits to local and national groups. A long time period, probably a decade, will be necessary to get such a process underway and the unfolding of the optimum pattern of resource use may well occupy fifty years. This will be time and money well spent only if it can result in a real transformation of resource use systems.

Conclusion

The management of the resources of a river basin for sustained increased productivity is a complex and difficult task under most circumstances. The most effective starting point for this task is consideration of the existing conditions in the basin, not only the existing physical conditions but the current management systems and practices. Effective river basin planning will be best achieved by coordinating a selected number of diverse activities throughout the basin to bring about improvements in both soil and water management, and these must be geared to a variety of pastoral and

agricultural systems together with a consideration of market access.

But hydrological, political, economic and even emotional considerations may result in many future decisions to build large dams and radically transform production systems as part of river basin development without prior attention to regional plans. In these cases, there needs to be special attention given to the broadest cost-benefit considerations. Changes in the style of the management of resources cannot be brought about quickly and if most investment is to be placed in a small part of the basin, as is common where irrigation is a major objective, the critical other investments needed to make the project effective have to be identified. The natural systems involved have to be recognized and the critical components of these brought under management. The key questions for river basin development remain the same whether adequate pre-construction planning takes place or not. These concern the identification of the resource managers, from basin authorities to local farmers and herders, and the coordination of their uses of the natural resources of the basin. The hydrological unit of the river basin is also a natural resource unit in the sense that there will always be consequential changes resulting from changes in use. For this reason, it has to be considered as the only rational planning unit if such changes in use are to be positive.

Planning budgets will always reflect priorities and it is how these are determined in the basin that can be practically assured by pre-construction river basin planning. It would be naive to assume that priorities will necessarily be set to achieve equitable social and economic returns but, nevertheless, the need for planning rests on the fact that without it, there can only be long-term environmental problems on one hand and economic failure through poor participation on the other. Ultimately, even the

largest, most technologicl capital intensive project depends upon natural resource management and people.

Footnotes

[1]Another paper in this series (Major) deals with this issue of accounting costs and benefits in multiple units.

[2]At present it is estimated that some 96.3 million tons of soil are being washed from the catchment area of the Sabi Valley in Zimbabwe, mostly from the communal lands, and a further 4.2 million tons are lost from the commercial farms in the region. The magnitude of the problem is a cause of grave concern because it affects the yields of crops, amounts to a loss of valuable agricultural land, leads to a loss of productivity on irrigation schemes and an increase in maintenance costs, and directly affects the livelihood of the poorer farmers in the communal lands whose ability to produce even subsistence level yields is threatened. Pressures on the grazing and woodland resources which are an essential part of the subsistence economies also contribute to the soil loss problems. Government concern relates to all of these issues, but is especially directed towards the threats posed to the irrigation projects by the silting of the riveres. It is said that the newly proposed Condo Dam in the river west of Mutare will be useless if the siltation problem is not solved. Erosion prevention techniques are being studied and there are proposed research efforts aimed at reaching farmers through the extension services, but there is a need for a comprehensive and thorough examination of the nature of the problems, to determine the extent of the natural processes of soil erosion and downstream siltation and in what ways these are exacerbated by the land and water management practices of farmers and other resource users in the basin.

[3] See, for example, the case of Aswan in Sudan or Manantali; in West Africa, Sorbo 1977, Gannett, et al., 1983.

[4] See the report on the Senegal River Basin to USAID Gannett, et al., 1983.

[5] These both owe much of their success to the favorable physical condition on the sites. The MWEA scheme, for example, lies close to the heaviest rainfall zone on Mt. Kenya and taps two of the three main rivers flowing out of that region which are remarkably free of silt, because of the protected forest reserve catchment. The relatively flat gradient makes it simple to lay out a low cost canal system using gravity feed and the almost uniform topography allows for standardization of field units and water control. The small tributary river systems aid drainage and reduce salinity which is a common problem on other irrigation schemes in Africa where evaporation rates are high. In summary, the natural conditions of the site meant low cost of the physical construction work and a higher chance of project success from the beginning. Other major social economic factors have also played a part in the scheme's success. These are: tight managerial organizations, the exercise of complete territorial control, the existence of road and rail connections to urban centers and an assured market for the major crop, rice. The MWEA scheme provides an example of an African River Basin where intensification of land use, increased yields of rice, and efficient marketing have resulted in cost recovery and profitable operations and since these are rare in Africa, it is worth studying. An important corollary of the role that natural resources play in this success

must be emphasized. Where site conditions are so favorable, the lessons to be learned may not be transferable to other basins. High construction costs associated with less favorable sites mean higher capital outlays from the start and generally mean low returns for many years after, as ecosystems radically altered rather than modified require greater management. The MWEA scheme is not a general model for the development of African River Basin as far as natural resources management is concerned. Similarly, the Gezira scheme owes much of its success to its location on a former delta with rich, well-drained, easily watered soils. Such sites are rare.

[6]The paper by A. Utton "International Legal Issues" part of this series addresses the many complex legal concerns involved in international river basin development.

[7]For example, in the Kagera River Basin, proposals for agriculture projects, out of total basin farming population in Rwanda of 613,000 families only 2,704 families will be served by the "Cuvette de Rusumo" project plus a similar number, unspecified, in the Bugesera Irrigation project (KBO 1982).

REFERENCES

Ackermann, W.C.; White, G.F.; & Worthington, E.B. 1973 Man-made lakes: Their Problems and Environmental Effects. Washington, D.C. Amer. Geophysical Union.

Adams, W.M. and A.T. Grove 1984 Irrigation in Tropical Africa: Problems and Problem Solving, Cambridge African Monographs, No. 3.

Balon, E.K. 1978 "Kariba: The Dubious Benefits of Large Dams." Ambio, Vol 7, No 1 pp. 35-48.

Barnett, T 1977 The Gezira Scheme; An Illusion of Development, London, Frank Cass.

Bird, A.C. 1984 "The Land Issue in Large Scale Irrigation Projects: Some Problems from Northern Nigeria" in Adams & Grove 1984 Irrigation in Tropical Africa, Cambridge African Monographs, No. 3.

Chambers, R. and Moris J. 1973 "Mwea An Irrigated Rice Settlement in Kenya" IFO --Institut Weltform -- Verlag Munich.

Gaitskell A. 1959 Gezira: A Story of Development in Sudan, Faber and Faber, London.

Gannett, Fleming, Corddry & Carpenter, Inc. 1983 Assessment of Environmental Effects of Proposed Developments in the Senegal River Basin. Synthesis. O.M.V.S. Dakar.

Haynes, K. E. & Whittington, D. 1981 "International Management of the Nile--Stage Three? Geographical Review Vol 71, No 1 pp. 17-32.

Kagera Basin Organisation 1982, Development Programme of the Kagera Basin, Final Report Executive Summary, U.N.D.P.

Pollard, N. 1981 "The Gezira Scheme--A study in Failure." The Ecologist Vol 11, No 1, pp. 21-31.

Ross, C.G. 1982 "The Development of the Gambia River Basin" Mimeo.

Saha, S.K. & Barrow, C.J. 1981 River Basin Planning: Theory & Practice New York, John Wiley.

Sorbo, G.M. 1977. How to Survive Development: The Story of New Halfa Khartoum Development Studies and Research Center.

CHAPTER FOUR

RIVER BASIN DEVELOPMENT-THE WATER MANAGEMENT (ENGINEERING) ISSUES

by Harry E. Schwarz.[1]

I. Introduction

With water being one of the prime needs in agricultural production, and agricultural production a prime need of African countries in the 1980s, the pressure for the development of major irrigation schemes must be accepted as a foregone conclusion. It is, however, an accepted fact that the capital costs of major water development projects cannot be carried by irrigation alone. Hydroelectric power generation for urban, rural, and most of all industrial use is the usually accepted carrier of the economic burden of water development. A river, being a hydrologic unit within its drainage basin, must for obvious reasons be considered as a whole when a large water management scheme is planned. This then leads to the concept of RIVER BASIN DEVELOPMENT as a strategy for economic and social development on a large scale. This is the way it should be. Why then have river basin projects, especially in Africa, failed to provide all the benefits that had been expected from them during the planning phase?

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1 Professor Schwarz is Professor of Environmental Affairs, Clark University. Formerly Supervising Hydraulic Engineer with the U.S. Army Corps of Engineers for 26 Years, he was project manager on the Potomac River Basin Comprehensive Study, the Susquehanna River Basin Study, the North Atlantic Regional Water Resources Study, and the North Eastern United States Water Supply Study. He has also been advisor to the Corps of Engineers on the United States Navigation Study and advisor to the State of New Jersey Water Supply Master Plan.

Traditionally, river basin planning and development has been the domain of engineers and economists. Most African river basin development plans were made under large consulting engineer contracts, by engineering firms based in the developed world, and with economists looking at national benefits. In most cases the need for water and its services for hydropower, irrigation, and navigation was accepted as given, and the charge to the consultant was -- give us a plan to develop the water potential of this river -- not serve the social and economic needs of the basin or region. With such a charge the proper approach was to look at the full and most economical development for water management from a national economic and financial viewpoint. The largest possible output of electricity and irrigation water that was economically and technically feasible was normally accepted as the goal of development. In almost all cases a large dam and reservoir project became the centerpiece of the river development plan. Little input came from the areas directly affected by the development, and other professionals were involved only on the periphery of decisionmaking even if major funds for ancilliary studies were allocated. Decisions were made by the expatriate professionals and the national authorities in the developing country. River development plans implemented on the basis of such plans provided, at least initially, the water and energy outputs expected. Yet, equally as often, they have not produced the economic and social benefits envisioned, especially over longer time spans, and they have had serious negative side effects. While the use of river capability as the basis for initiation of

planning may often be the right approach, it must not be considered the only one. The individual water management features of a plan must emerge from broad multidisciplinary studies, not guide these studies.

The planning and management of river basin development projects must therefore be a team effort involving individuals from a wider range of professions and from donor organizations and from several levels of government in the receiver country. In the remainder of this paper we will, after some definitions of terms, look at the roles engineers should play in river basin planning, and describe some issues that appear particularly important from the engineering viewpoint. Finally, this paper will make some recommendations that may be used to improve river basin planning and management. Many of the issues and the related recommendations are focused on problems in the developed world, as the engineers and the engineering consulting firms engaged in river basin planning are most likely coming from there.

II. Definitions

Water management in the context of this paper includes all activities that collect, store, transport, treat, or distribute water. Thus, it includes small as well as large dams and reservoirs, aqueducts, pumping stations, treatment plants, and the canal and piping network that brings water to its points of use. It also includes the removal of water as well as the collection treatment and disposal of liquid wastes.

Water engineering is the planning of the structural and mechanical features of water management, their construction, the technical phases of their operation, their maintenance, and their periodic inspection and updating.

Engineer as used here may indicate an individual or a group of engineers performing a task. It includes civil, mechanical, environmental, and electrical engineers.

Authority as used in the paper represents any management organization, but is not meant as a specific form of management agency.

III. The Engineer's Role in River Basin Development

In the scheme here proposed for good river basin development the engineer takes on six roles that are distinct and different and in most cases should be carried out by different individuals. These are:

1. technical advisor to the local, national or international authority supervising or contracting for the development;
2. planner of the engineering works;
3. estimator and evaluator of the physical effects of river development;
4. supervisor of the construction of engineering works and the training of planners, engineers, managers, operators and maintenance personnel for these works;
5. evaluator of the continuing operation and maintenance of the works;

6. technical advisor to research and development efforts that update river basin plan and management to increase benefits and efficiency.

The chart attached to this paper represents the flow of activities in river basin development from the viewpoint of the engineer. Thus, it emphasizes engineering activities and aggregates the work of others into single boxes.

1. The Engineer as Advisor to Overall Management

The overall management of a river basin development project must be in the hands of an authority that represents the users of the development benefits. This authority must be capable of evaluating the entire development task and be sensitive to the needs on the local, regional, and national level. In practice it has been a ministry or agency charged by a national government with the development task. In most cases foreign donors have considerable influence on such an agency and must carefully weigh their own national and financial interests with those of the receiver countries when using this power. It is this agency that contracts with foreign and local consultants for most of the professional work involved in the river basin development. As the work of an engineering consultant is prescribed in detail in the contract, and consultants must stick to contract specifications, these specifications are the key to a good engineering plan. If the wrong question is asked, the answer will likely be wrong too. Therefore, the contracting agency must have a thorough understanding of the river basin development process and, in the case of the

water management and engineering contract, of the capability, role, and guidance needed by the engineers involved in the contracted activities. A competent planning group within the managing authority is the preferred organizational unit for this task. The planning unit must be multidisciplinary, staffed with people experienced in their task and in the region under study, and report directly to the chief executive of the authority. A competent and experienced engineer must be a member of the planning unit.

This individual must be an employee of the authority with loyalty and responsibility only to the authority. When possible a local engineer with the required experience would best fill this position, for he would have knowledge of local conditions whether they be site or climate peculiarities, social and cultural characteristics, or economic and political features. If such an individual is not available (a common situation), an expatriate in no way connected with the engineering contractor or with the donor but having extensive local experience should be employed. This person, either the local engineer or the expatriate, should be retained on the staff of the authority as a permanent staff member through all the phases of planning, implementation, and operation.

The duties of this engineer will be: to see that the broad social and economic objectives of development are spelled out before any attempt is made to plan or contract for planning of the water management phase of a river basin development plan; to provide the professional expertise needed to properly scope the

engineering contracts; to insure the engineering practicability of decisions made by the authority; to evaluate technologies proposed to insure that the most appropriate or those which can be operated and maintained in the context of local capabilities, and not necessarily the latest state-of-the-art technologies, be used; to maintain liaison with the engineering contractors; to assist in the development of a proper balance between engineering and other studies; and to provide engineering advice to all partners in the development effort.

2. The Engineer's Role in Planning for River Basin Development. The engineering effort in the planning phase must be integrated with the effort of other professions throughout the planning period. This can be done by inclusion of major subcontracts in the prime contract or by the parallel execution of engineering and other planning contracts. In either case proper coordination, scoping, and funding is vital to the accomplishment of the goals of basin development. The planning unit in the authority should supervise the tasks of the engineering planners.

The specific engineering tasks in planning are defined in more detail here:

a. Determination of the water related quantities that are needed to achieve the goals established. In this task engineers analyze the social, economic and environmental objectives given to them and the locations and times where and when they are to be achieved. They then translate this

information into water needs identified by specific quantities, qualities, location, and time of need. In this work the water requirements of existing downstream users must be considered equally with irrigation and hydro-electric requirements. This activity requires a clear definition of the social, economic and environmental goals by other members of the river basin development team, a good understanding by the engineers of the relationships between goals and water requirements, and complete knowledge of local conditions. At this time it would also be the function of the engineer to point out unreasonable goals that are not within the realm of practical achievability. An iterative process will result in one or more sets of water requirements for one or more goals.

b. Determination of technologies of water management that are applicable in the area of study. Those technologies that for geographic, climatological, cultural, and socio-economic reasons are not usable should at this time be eliminated from consideration. For example while it is obvious that seawater desalinization is not a feasible technology in a landlocked country, it is less clear which technology is not applicable for cultural reasons, for social conventions, and for excessive costs, energy, maintenance, or managerial demands. The technologies selected for further consideration should cover the broadest range possible within the established constraints. They should not be limited by the conventional experience in the developed world or in past development in Africa. For instance flood recessional cultivation made

possible by major temporary releases from a dam may be a valuable adjunct to irrigated agricultural production. Such a scheme, for at least a transition period is contemplated on the Senegal River. Design provisions for such an operation would require larger low level sluices, or in a relatively low dam, properly sized tainter gates. A compromise, however, will be needed as water released for downstream recessional cultivation will not be available for irrigation. Operational studies made as part of the engineering plans should take into consideration the variations in water requirements over time and insure that water not initially needed for power or irrigation can be made useful for fisheries or other beneficial uses.

c. Development of a provisional concept of riverbasin development. Based on the needs established, the technologies judged applicable, and the general knowledge of the basin to be developed, the engineer should arrive at a generalized conceptual model of what the basin development could look like. Widely different models should be prepared and discussed with all other members of the river basin development team. These models should consist only of broad descriptions of development alternatives and emphasize the questions that must be answered in more detailed studies for the decision process. The purpose of these alternative conceptual models is to guide the data collection effort towards the data that will be needed to answer the questions and eliminate unneeded and costly data assembly. Models

considered must include not only the developments under consideration but also the effects of the developments on the water and related resources above, at and below the points of development. Care must be exercised at this stage that no decision on the development is made which would preclude full exploitation of multiple development options.

d. Collection of physical data. Data on geology, climate, and hydrology are often located in different ministries, capitals of former colonial powers, local and foreign universities, and offices of individual researchers and firms. These should be assembled before new field data are collected. Further economic, ecological, and social data should be collected by professionals in their respective fields. Specific data needs will depend on the extent and location of the project and the range of decisions required during planning and operation. Paucity of data can be expected in some areas and should not be used as an excuse for inaction. In such cases designs must provide for the unexpected by increased margins of safety.

e. Analyses of the resources. Particular emphasis must be placed on the survey and analysis of the surface and groundwater in the basin under study. All four attributes of water must be considered. They are quantity, quality (chemical and biological), spatial distribution, and temporal (seasonal variations and frequency) distribution. Another part of the resource inventory is the selection of possible small and large dam and reservoir sites, including the possible sites

for major water transfer and distribution works and their appurtenances. The inventory of dam and reservoir sites is especially important as there is only a limited number of good sites available in a basin, and therefore such sites must be considered a rare and valuable natural resource.

f. Preparation of alternative plans. In this phase alternative plans to balance the inequality between demands and supplies of water are developed. Plans that provide additional water to fullfill demands, as well as plans that reduce water requirements, and combinations of these approaches must be developed and their direct social, economic, and environmental effects estimated. A "no action" plan should always be prepared at this stage to serve as basis for effect and impact evaluation. During this phase the coordination and interaction between the engineers and other professionals and the representatives of the local people and institutions is especially important. Usually more than one iteration of plan development, effect and impact assessment, and plan adjustment will be needed. When possible mathematical modelling, both programming and simulation models, should be used. Such models, which must include sufficient portions of the basin so that downstream effects can be evaluated, are very helpful in guiding planning towards optimization and toward better understanding of the sensitivity of the proposed systems to various policy and development options. It must be understood that model results are aids to good judgment not a replacement for judgment.

g. Final design and operation. After decisions as to the preferred plan are made, the engineer's task is the preparation of final designs, specifications, tender documents, and operation instructions for the structural and mechanical phases of the river basin plan. In this phase many of the studies prepared during the development of the alternative plans are repeated in greater detail. Site investigations, including field surveys and detailed subsurface studies, are part of this phase. The use of models is again a major help towards good design and near optimal phasing of development.

In all of the above planning phases the use of computer models has been mentioned as part of the work. Interactive models are especially useful to demonstrate the effects of policy or site choices to all members of the planning team and the client in the plan selection stage; such models are of major importance in the development of operating policies and the preparation of operation instructions. The use of this relatively new technology should be encouraged, and its introduction into LDC planning will have additional useful effects. Their use, however, is only fully exploited if the modelling work and the use of the models is not restricted to expatriate engineering contractors working in foreign offices but is fully integrated into the work of the country team. Training of local engineers, planners and technicians is therefore of great importance. While most of the computer training is hands on in the host country, some will require

more formal training in the developed world. A number of available river basin models are listed in the references included in the Appendix.

3. The Engineer's Role in Estimating and Evaluating Physical Effects of Water Development

All changes in water regimen, both natural or through engineering works, have effects on the natural and manmade environment. These effects will have impacts on the physical, social, and economic environment. It is one of the engineer's vital tasks to forsee these effects and to estimate their magnitude, location of occurrence, time of occurrence, and the degree of certainty of their occurrence. It is the task of the social and biological scientist, the agronomist, and the economist to determine the impacts of these effects. In the African context particular emphasis must be placed on the impacts on the local population both sedentary and nomadic. The engineer, therefore, must have the cooperation and professional support of all the other disciplines involved in the development of the river basin. A number of techniques of effect and impact assessment can be found in the literature, ranging from simple checklists to matrixes and sophisticated overlay and numerical methods (see References). An environmental base study made by geographers, biologists and anthropologists is the beginning of this task. The completion of the task, the translation of physical effects into impacts on the social and natural environment, is again the task of social and natural scientists with the engineer as a contributor.

4. The Engineer's Role in Construction and Training

After contracts are let for construction activities the engineers provide supervision and inspection of works. Such inspection assures the quality of work performed and its conformity with plans and specifications. Further, the engineer must be involved in the preparation of design modifications needed by changed circumstances found during construction. During the construction period continued coordination with other professionals is needed to insure parallel development and unity of purpose when modifications are made.

An additional and extremely important duty for the engineer in this period is to train or arrange for training of indigenous technical management personnel both at academic institutions and on the job. Training must also be provided for local people as operators and maintenance personnel in all needed crafts. While some management and supervisory training can be accomplished in the donor country at academic institutions or at the consultants' offices, most of the training, especially all the operation and maintenance training, should be done in Africa, if possible on site of the development. Senior management and operator trainees should, if possible, be included in the construction staff to make them completely familiar with the built works. Good coordination with the management agency that will eventually operate the works is needed to reduce turnover in local personnel and to insure that the trained people really become members of the operation and management team.

The final responsibility of the engineer in the construction phase of the river basin development project is a complete site inspection of all engineering works, their interrelation with other phases of the development plan, and the certification of completion.

5. The Engineer's Role in Evaluation of Operation and Maintenance

Periodic evaluation of the river basin project is an essential function of management. This evaluation, carried out at intervals of 2 to 5 years, should be made by an interdisciplinary team that includes personnel from the operating authority, the goverment of the country or countries in which the river basin is located, and experts from outside. Engineers should be part of this team - - in the operating authority group and among the outside evaluators. The engineer's role in these inspections is twofold: first, the evaluation of the conditions of the works, their maintenance, and the operating efficiency; second, the evaluation of the output of the works to its users. Deficiencies should be noted, brought to the attention of the operating authority, and remedial plans prepared.

6. The Engineer's Role in Change

Needs, technologies, and external conditions are certain to change during the planning and implementation phase and during the operational life of a river basin project. Continued research and development and the application of its results to adapt the works

and their operation to changing conditions and demands, and/or to increase efficiency of operation, is a task that should be high on the priority list of the basin authority. The engineer advising the authority is a key member in this effort and should participate in the task and serve as engineering consultant to other professionals engaged here.

IV. Summary and Issues

This description of the roles played by engineers in river basin development represents the present state of the art. A number of recent books and manuals are available that describe, in detail, the technical phases of river basin development, the data required, and the engineering studies to be made. A selected list of these publication is attached to this paper. While the referenced publications deal with engineering in the western context, the engineering principles described there are equally applicable in the African context. Judicious application, with full understanding of local conditions, by practitioners who are experienced in Africa, the underdeveloped world, and the tropics is however needed to avoid disastrous and costly mistakes.

Present actual experience in Africa has not always been positive. River basin projects, hailed as the harbingers of progress and human betterment, have often failed to live up to their expectations and sometimes have done damage to significant social and environmental values. A number of reasons have led to this situation. Many of the failures are in the area of overall

management, planning, and execution and some in the field of engineering.

Major engineering and site decisions, such as the need for large and fully developed dams and reservoirs in specific locations, have all too often preceded the social and economic studies which should set objectives. Thus, the "water management" tail wags the "objectives of development" dog. The key issue in the management of river basin development is not an engineering one but one of the overall management of the development.

One engineering problem that needs special attention is the estimation of the silt load carried into a reservoir. This has been a serious problem in a number of cases in Africa. In many situations reservoir life has been shortened significantly through rapid siltation. This occurred because the degree of upstream development and the erosion caused by this development was grossly underestimated. An example is the Kamburu Dam on the Tana River in Kenya. Erosion potential upstream, silt transport, and silt accumulation in the reservoir were seriously underestimated during planning. Erosion and silt production fueled by development, both smallholder cultivation and some infrastructure construction, in the basin above the dam exceeded nearly tenfold the estimated silt load expected. This significantly affects the output of the reservoir and will greatly shorten the economic life of this project. Engineering studies, therefore, should look towards the plans of others for development in a river basin and should in most instances assume worst case scenarios related to basin erosion.

Another major engineering problem is water loss during transmission from the source to the user. Losses occur due to evaporation, leakage, and transpiration. All those are important in the African context as most water transmission is for irrigation and therefore in arid or semi-arid regions. Evaporation and leakage in well-maintained unlined channels may average 40 percent of the water transported. Poor maintenance, such as is occurring on many canals in the Gezira (Sudan), causing the growth of heavy water-using vegetation on canal banks, will further increase losses significantly. Engineering design must take this into consideration and carefully weigh the cost of canal lining, maintenance problems, and even covered water conveyance facilities (pipes) against the cost of providing the water that is lost. In one project in an Egyptian province (Beni Suef) drain covering is expected to provide water for one feddan (1.04 acres) for each eight feddans now served. At the Miwani Sugar Estates in Kenya a piped distribution system has been successful.

Health considerations also must be part of the engineering design process. Malaria and Schistosomiasis are the major problems around African water development projects. Means to reduce water losses are often equally useful in reducing disease vector propagation. The close coordination of the engineer with the health professionals is an important step towards reducing health problems that may be created.

Other engineering, operation and maintenance problems are caused by the direct application of western and northern hemisphere experiences in an African situation. As stated previously,

engineering principles are equally applicable in all parts of the world, however, climatic conditions, social and cultural peculiarities, and educational levels are different and their impacts must be a major input into engineering decisions. The use of best available western technology (state-of-the-art technology) must be carefully weighed against the management and maintenance capabilities in the host country. For the selection of appropriate technology and the selling of this idea to the receiving nation, national leadership is a major task.

Environmental effect and impact studies must become an important and well-financed part of the engineering for river basin development. While such studies are often perceived as ways to delay or stop development, they are absolutely essential. They are mandated by law for U.S. supported development, and, even if not so mandated, they must be part of project development to insure the full range of considerations of the people and their natural and manmade environment for whose benefit the basin project is undertaken. Experience in both Africa and Asia has shown that failures in basin development projects most often stem from the failure to consider all the important ramifications of the project beyond the water control phase.

Equally, the use of models and computers should be encouraged. In many areas of the LDCs there now is the opportunity to introduce computer technology at very modest cost. Models developed during the planning phase can usually be adapted to serve as real time operational guides later. The use of computers for real time operation will require major training efforts but should pay

off with significant improvements in efficiency. The change to such operation can, however, be made only gradually as data collection and monitoring facilities develop. It can not repeated often enough that operational models must include conditions upstream and downstream of major water projects.

The need for a strong organization which combines local, regional, and national institutions in the developing countries, the donor agencies, and associated professionals is one of the key issues that must be addressed. Only if such an organization exists can engineers be assured of the quality of the information available, the requisite coordination, and the response needed for their work. If the work of the non-engineers in river basin planning is not of the quality required, and is not maintained through adequate staffing and funding the resulting plans will be deficient in one or more aspects. If the critical items needed to achieve the social objectives of the river basin plan are not implemented and only the water plan is built, serious negative impacts will be the consequences. If good continuing management, maintenance, and updating to new conditions is not forthcoming, the longer term goals will not be realized, and the project will deteriorate. In this context it is important to remember that all parts of the river basin project must be considered, and that engineering input into the social and environmental aspects of updating is equally as important as the contributions of the social and natural scientists.

Of outstanding importance is the selection and training of the engineers involved in river basin development in Africa.

Experience in the developing world combined with technical competence of the highest order and a mindset that can divorce itself from western training and experience if needed are prerequisites for successful operation. This is equally applicable to the engineer serving as an advisor to the local authority, the expatriate consultant, and the local construction and operation supervisors. The selected individuals then must receive rigorous training in the local conditions and African idiosyncracies, and hand on experience at the African location.

River basin development planning, implementation, and operation is an interdisciplinary effort, in which all parts of the development plan must be fully integrated. Each part must be designed with full coordination with all other parts. Only such an effort will be free from major flaws.

V. Recommendations

To accomplish a successful riverbasin development or to participate in one, USAID or another donor or group of donors can take a number of steps. Some of these are described here:

1. Establish a riverbasin planning group within AID. This group should probably have only a few permanent members. One of these should be an experienced river basin planner, who could be an engineer, geographer or economist. A water resources engineer or planner with LDC experience must be a member of this group. This permanent unit can then be reinforced with 3 to 5 experienced specialists to form a task

force for each specific river basin project. The charge to this group would be the overall management of the project, or at least AID's part of the project, and the selection and technical supervision of the contractor or the contractors. If such a group would not be feasible for organizational reasons, such a group should be established at least in an advisory capacity. The above recommendation to AID is equally valid for other donor organizations or groups of donors. Where possible AID should use its leverage or persuasive power to acomplish this task.

2. Three forms of technical management can be considered. They are:

(a) management of the project directly by the Task Force with individual and separate contracts for component studies such as engineering, economics, social and environmental impacts, agronomy etc;

(b) engaging a managing contractor who, under the oversight of the Task Force, selects and supervises separate contracts for component studies, contracts that are administratively handled by AID or the other donors;

(c) engaging a prime contractor for the entire project, who then farms out subcontracts for various studies based on a firm agreement on their scope, quality and effort with oversight and veto power by the Task Force.

3. Insistence on the preparation of a detailed plan of study that includes the scope of the project and the scopes of all component studies with a clear statement of the effort

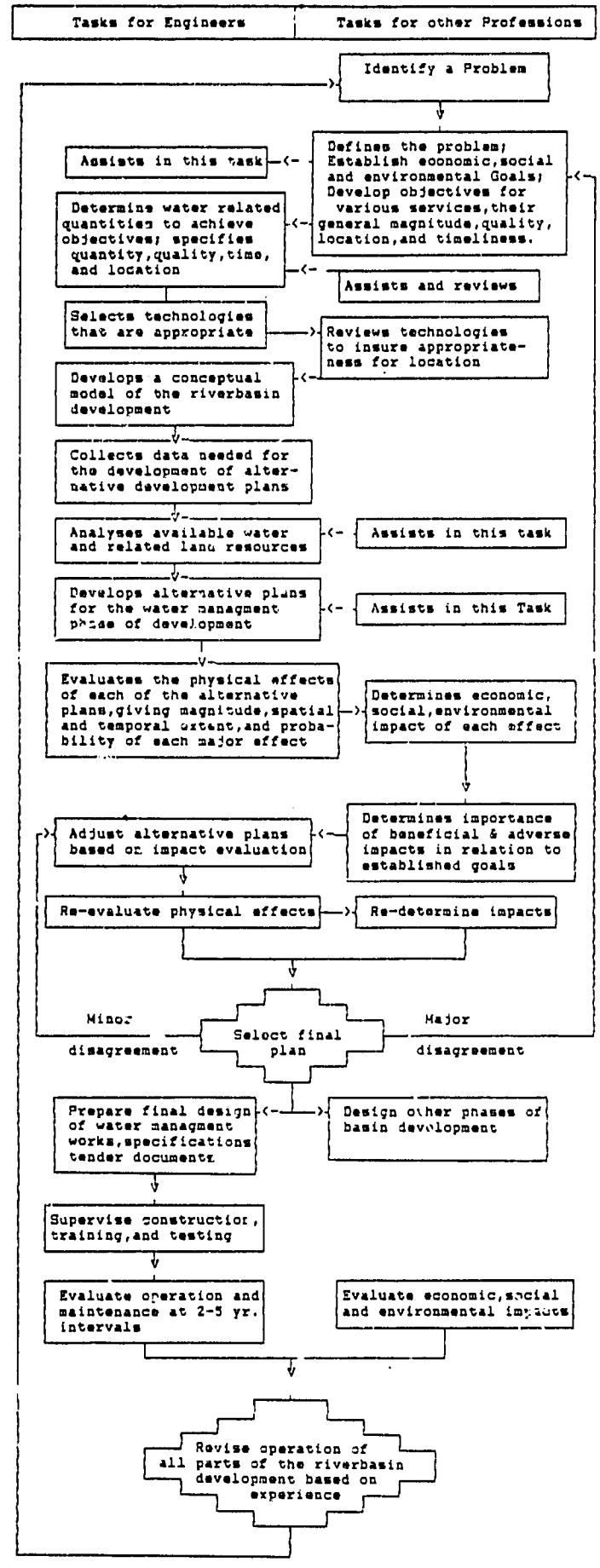
expected on each. If the project is a multi-donor one or is guided by donors other than AID, a careful review of the plan of study by the AID Task Force and their insistence on adherence to standards are recommended.

4. In the selection of engineering contractors, careful consideration should be given to the availability of the proper experienced professionals, and contract clauses should specify the amount of effort by partners and named principals on the contractors team. The contract should also include a clause that personnel cannot be substituted without permission of the Task Force. Contract modifications of any kind should be reviewed by the Project Task Force and never approved on an administrative level.

5. USAID should be prepared for long involvement in a riverbasin project. Beyond planning and implementation of the plan, involvement should continue to include operation, maintenance and most important, post audit. Financial solvency of the riverbasin development should be assured over maybe 10 years or so through ironclad agreements with the host country or by continued support by AID or other donor.

The above group of recommendations are directed to the donor ageny or agencies. This was done to highlight the point that management of the engineering effort is most often controlled from the West and that management is the most important problem related to riverbasin engineering. Specific recommendations for the engineering activity in the African context are included in Parts III and IV of this chapter.

FLOW CHART OF RIVERBASIN DEVELOPMENT ACTIVITIES
(Emphasis on the Engineering Tasks)



Legend: ——— sequence of tasks
- - - - flow of assistance

ANNEX

SELECTED REFERENCES

The list of references cited here is by no means a complete compendium of material for riverbasin development. It contains a number of relatively recent books and reports which the author of this paper has found useful in some or all respects.

Appropriate Technology in Water Supply and Waste Disposal, American Society of Civil Engineers, New York N.Y., 1979.

Buras, Nathan. Scientific Allocation of Water Resource, American Elsevier, New York N.Y., 1972.

Environmental Impacts of International Civil Engineering Projects and Practices, American Society of Civil Engineers, New York N.Y., 1978.

Goodman, Alvin S., Principles of Water Resources Planning, Prentiss-Hall, Englewood Cliffs, N.J., 1984.

Hufschmidt, Maynard M. and Fiering, Myron B., Simulation Techniques for Design of Water-Resources Systems, Harvard University Press, Cambridge, Mass., 1966.

Lagler, Karl F ., Man-Made Lakes, Food and Agricultural Organization of the United Nations, Rome Italy, 1969.

Linsley, Ray K. and Francini, Joseph B., Water Resources Engineering, McGraw-Hill Book Company, New York, N.Y., 1979.

Maas, Arthur et al, Design of Water Resources Systems, Harvard University Press, Cambridge, Mass., 1962.

Major, David C., Multi-Objective Water Resources Planning, American Geophysical Union, Washington, D.C., 1977.

Major, David C. and Lenton, Roberto L., Applied Water Resource System Planning, Prentiss-Hall, Englewood Cliffs, N.J., 1979.

McJunkin, Frederick E., Water, Engineers, Development and Disease in the Tropics, U. S. Agency for International Development, Washington, D.C. 1975.

Monograph on Comprehensive River Basin Planning, Environment Canada, Ottowa, Canada, 1975.

National Watershed Manual, U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1983 (periodically updated).

Nichols, Robert and Hyman Eric, A Review and Analysis of Fifteen Methodologies for Environmental Assessment, Center for Urban and Regional Studies, University of North Carolina, Chappel Hill, N.C., 1980.

Pereira, H. C., Land Use and Water Resources in Temperate and Tropical Climates, Cambridge University Press, London, England, 1973.

Planning Guidance Notebook, U.S. Army Corps of Engineers, Office of the Chief of Engineers, Washington, D.C., 1982 (periodically updated).

Rich, Linvil G., Low-Maintenance, Mechanically Simple Wastewater Treatment Systems, McGraw-Hill Book Company, New York, N.N., 1980.

Viessman, Warren jr. and Welty, Clair, Water Management Technology and Institutions, Harper and Row, New York N.Y., 1985.

Water Resources Research Problems and Potentials for Agriculture and Rural Communities, Soil Conservation Society of America, Ankeny, Iowa, 1983.

Wiener, A., The Role of Water in Development, McGraw-Hill Book Company, New York, N.Y., 1972.

CHAPTER FIVE

INTERNATIONAL LEGAL ISSUES

by Albert E. Utton

Two of the most prominent "distinguishing features" of African river basins are the fact that frequently the access of African countries "is limited to a single river basin" and "African river basins tend to be international."[1]

These two salient features raise important issues from the point of view of international law and river basin development.

These fundamental issues include:

1) Security of access to water--both physically and legally.

2) The design of institutions and mechanisms for the optimum development of water resources which are transboundary and thus shared by more than one nation.

3) Impediments to achieving agreement for joint action.

4) The conjunctive management of surface and groundwaters which is especially difficult in an international setting.

Security of one's water right is fundamental to the efficient development of water resources. Lack of security may:

1) Discourage the capital investment necessary to develop the resource;

2) conversely, encourage overinvestment in which there is uneconomic duplication in facilities; or

3) encourage hasty development, e.g., as "races to the bottom of the aquifer" to obtain one's share before one's

neighbor takes it. This, in turn, may waste the resource, both in the short and long term.

International law has dealt with the security question by first limiting each coriparian in its use of an international water resource. At a minimum, under international practice, a coriparian must be its neighbor's keeper; it cannot act in disregard of its neighbor. This rule of limitation has been refined and further developed by allocating an "equitable share" of the use of a water resource under the doctrine of equitable apportionment.

This has provided the security of a prescribed share to each coriparian; it still does not meet the issue of optimum development and use of an international watercourse. This is the second issue this paper will briefly touch on. Optimum development may well require treating the drainage basin as a unit. For example, the management of flooding may require flood control works in the upper reaches of a river in order to protect the lower reaches which are in another nation.

Coordinated planning and development are necessary to deal with physical security which may be closely connected with flood control. A frequent way of dealing with scarcity during dry periods is the building of reservoirs to store flood waters for later release during dry periods. However, in some African river basins, the reverse may be true; the building of dams may cause scarcity or physical insecurity precisely during flood time for local economies that depend on flood water farming. As has been pointed out, "local economies can be

devastated" by the failure of the annual flood, whether the cause be drought or the building of dams.[2] Riverine forests, fishing, and grazing may be adversely affected. Thus coordinated planning is required to adequately consider impacts which may be transboundary.

Similarly, hydropower may be most efficiently developed in specific reaches of a river, for use in other countries in the basin or even outside of the basin. All of this requires mechanisms for coordinated planning and development. Coordinated international development requires a broader perspective than merely allocating shares in the flow of a river.

Although coordinated basin-wide development may be an ideal, it may not always be feasible from the point of view of political reality. Therefore, a third issue discussed will be impediments and aids to joint action. A fourth issue is that of conjunctive management of groundwater. Groundwater has been largely overlooked but now, with increasing demands being placed on all water resources, the management and allocation of groundwater must be included.

I. THE ISSUE OF SECURITY

A. Trends in International Water Law

Four major theories have been developed for governing the rights of the coriparians of international rivers.[3]

(1) The theory of absolute territorial sovereignty is often expounded to justify a proposed diversion by an upper riparian. According to this theory, an upper riparian is entitled to do as it chooses with waters within its boundaries,

without regard to its coriparians. This theory is highly attractive to an upper riparian; under this theory, however, the same state has no right to demand continued flow from other states and, therefore, no security if it is also a lower riparian, as is often the case.[4]

(2) The antithesis of the theory of absolute territorial sovereignty is that of absolute territorial integrity. Under this theory, the lower riparian may demand the continuation of the full flow of the river from upstream and likewise it must not restrict the flow of the river flowing from its territory into the territory of a lower riparian.[5]

(3) The theory of limited territorial sovereignty lies midway between absolute territorial sovereignty and absolute territorial integrity. Under limited territorial sovereignty a state may make use of the waters flowing through its territory in so far as it does not interfere with their reasonable use by coriparians.

(4) Of more recent vintage is the community theory that the waters of a drainage basin should be developed as a unit, without regard to national boundaries. The coriparians would jointly carry out the development and management of the basin, and the benefits derived from cooperative development would be shared by the coriparians.

In order to provide at least minimal security of access to coriparians, the doctrine of limited territorial sovereignty has been generally adopted as a rule of international law.

The numerous treaties governing international rivers

generally are bilateral, and are not directly binding on non-signatories; cumulatively, however, they indicate that the principle of limited sovereignty is usually followed in international practice. The very act of entering into a treaty governing an international stream suggests the principle of limited sovereignty, and the universality of the principle in international practice is reflected by the large number and wide geographical distribution of bilateral treaties governing international rivers.

An early example of this treaty practice in Africa is the treaty of 1891 by which Italy and Great Britain agreed "not to construct, on the Atbara, in view of irrigation, any work which might sensibly modify its flow into the Nile."

In Asia, the Indus Waters Treaty of 1960 is a more recent example. It allocates the watercourses between India and Pakistan, and contains the following provision: "In executing any scheme of flood protection or flood control each party will avoid, as far as practicable, any material damage to the other party."

Upper riparians in over one hundred treaties throughout the world have agreed to limit their control over international streams, and it is not unreasonable to suggest that these treaties taken as a whole represent international practice from which general rules of customary international law may be deduced. International practice, as evi-denced by treaties, conventions, declarations, and judicial decisions demonstrates that the world community recognizes the general principle of

limited territorial sovereignty.

B. Limited Territorial Sovereignty and Equitable Apportionment

International practice, however, has gone beyond the minimal concept of limited territorial sovereignty and developed the principle of equitable apportionment--the principle in accordance with which the waters of a drainage basin are apportioned in such a manner as to satisfy the needs of coriparian states to the greatest extent possible while maximizing the benefits and minimizing the detriments to each. In so doing, each coriparian is provided the security of a defined share of the use of the water. Good examples of allocating shares of international rivers are the Treaties of 1906 and 1944 between Mexico and the United States on the Rio Grande and Colorado Rivers, and the 1933 Treaty between Brazil and Uruguay. That Treaty provides:

> "Article 19: Each of the two States shall be entitled to dispose of half the water flowing in the frontier watercourses."

II. THE ISSUE OF OPTIMAL MANAGEMENT OF INTERNATIONAL WATER RESOURCES

Although security of water right is one of the strengths of equitable apportionment, there is also a narrowness in the principle. Equitable apportionment contemplates independent development by each country on its own side of the border; each country is allocated a quantity of water for its own use and development. Such a settlement, by a negotiated treaty or the decision of an impartial tribunal, may be laudable. But independent development is unlikely to make the maximum use of an

international drainage basin. Instead of thinking in terms of artificial boundaries and allocations of quantities of water under theories of equitable apportionment, we must, because of the increasing demand for water, think in terms of the best utilization of the entire resource where feasible. For optimum utilization, the areal unit of development and administration must be determined by considering all relevant factors. The optimum unit may or may not be the drainage basin.

The Columbia River Treaty is a halfway house between independent development and basin development. Under the treaty the parties develop their resources separately, but Canada allows the United States to store water in Canada for the production of hydroelectric power and the control of floods. Canada in return receives compensation in the form of electricity and United States funds. There is much doubt that even under this treaty the resources of the basin as a whole will be used as efficiently as they could and should be.

A significant step forward is the Senegal Valley Authority (OMVS) which provides the institutional base for administering the river on a basin-wide basis. By developing the Senegal River as a coordinated unit, the net benefits which can be realized are greater than could be the case if independent development were undertaken by each coriparian. Coordinated development of flood control, hydropower, and navigation provides benefits in each of the participating countries of Mali, Mauritania, and Senegal.

Unlike the majority of international river organizations,

the formal authority of the OMVS extends beyond offering advice concerning projects that must be approved on the national level in order to be implemented. While purely national interests are afforded the safeguard of requiring unanimity for binding decisions, two of the three organs of the OMVS have been vested with the power to create obligations binding on the three Member States. Considerable flexibility is provided through the organization's secretariat and the organization's ability to make decisions in accordance with the most up-to-date information available, through internal resolutions that may be revised if later data indicates that revisions would be appropriate. Such flexibility in decisionmaking is in marked contrast to the more cumbersome process of research, international discussion of technical problems, referral to national legislatures, and formal international agreement that is prevalent among other international river organizations.

The treaty provision pursuant to which the OMVS was formed is Article 11 of the Statute. Since this article provides for the creation of an organization to carry out the purposes of the statute, the "primary jurisdiction" of the OMVS includes all matters which relate to the development of the Senegal River within the political boundaries of the Member States. However, Article First of the Convention-OMVS provides that the organization is also charged with "any technical or economic mission that the Member States collectively desire to confer upon it." This appears to extend the general jurisdiction of the OMVS to areas other than river development, without limita-

tion. As for the general powers of the DMVS, the following are perhaps the most significant: (1) the power to create obligations which are binding on the Member States; (2) the power to promote and coordinate both studies and working projects for the development of the river; (3) the power to accept grants as well as technical assistance; and (4) the power to borrow money.

The organization plays the central role from planning to operations. It defines the joint work program for coordinated development and defines priorities for harnassing the river. The High Commissioner is responsible for coordinating programs for irrigation, navigation, and hydropower, as well as maintenance.[5]

"This power is exceptional in the sense that ... supervision of such projects was formerly exclusively in the province of national development organizations."[6] The authority also has developed advanced methods for allocating costs for the installation and maintenance of development projects.[7]

The example of the OMVS is serving as something of a model for other African river basins. For example, the Mano River Union is an organization for economic cooperation and integration between Liberia and Sierra Leone, but "plans are under way"[8] for the establishment of a Mano River Basin Authority which in the mode of the OMVS would have operational authority over multipurpose water development projects.

The Organization for the Management and Development of the Kagera was established by Burundi, Rwanda, and Tanzania. It

has a commission with authority to take decisions on behalf of the member governments. The Organization has the power to contract, raise loans, and design, construct, and operate facilities. The OMDK thus, in theory, has broad powers similar to those of the OMVS.

The Lake Chad Commission is a planning and advisory body, but not an operational agency. However, there is now movement towards development of the basin. The secretariat of the Commission has an outline basin development plan, and additional functions are being considered for the secretariat to equip it better for the tasks of development.

The Niger River commission is being replaced by the Niger Basin Authority. The intention is to establish a "True Niger Basin Authority" with responsibility for "the development of the whole of the River Niger."[9] Like the OMVS, the Niger Basin Authority has a Council of Ministers, a secretariat with extensive powers.

Thus the influence of the OMVS can be seen in a number of other river basin institutions, as the concept of development and management of the drainage basin as a whole becomes more and more accepted.

This is not to say there are not many problems, such as the isolation of centralized authorities which often may be staffed by "expatriate technologists." Often the isolation includes the failure to provide for local participation in planning. The Berrys point out that local authorities "may not be in any way involved in the process of development plan-

ning." Salem-Murdock also adds that development will be best achieved through local participation not only in potential benefits but also in the planning, implementation, and evaluation of projects.

Brokensha and Thomas also point to the potential for adversarial relations between national agencies and the river basin authority, and argue for "bottom-up" participation.

These comments indicate some of the problems that have arisen from concentration of more responsibility in river basin institutions. Nevertheless, the spreading influence of the OMVS reflects important trends toward treating the drainage basin as a unit, and an important advance in the development of international cooperative institutions.

It must be pointed out that the influence of the OMVS is not all pervasive. For example, the powers given by Sudan and Egypt to the Commission on the Nile are much more modest. The River Nile, the second longest river in the world, passes through nine countries. Egypt and Sudan established the Permanent Joint Technical Commission in order to foster cooperation by conducting joint studies and exchanging information.

The Commission has a secretariat with a small technical force in Khartoum, but all of its investigations and supervisory functions are carried out by the staffs of the respective national water agencies.

The Commission has responsibility for all projects to increase the yield of the Nile, but all other national projects are the sole responsibility of each country.

Egypt and Sudan have proposed the establishment of a more extensive Nile Basin Commission, which would treat the Nile Basin as a unit and have representattion from all of the coriparians.

The Commission as proposed would be a step toward considering the drainage basin as a whole, but its powers would be cooperative and advisory, and it would not have the decision-making powers of the OMVS.

International Administration of Drainage Basins

In the management of international drainage basins, the quest must be for a continuous policy which will make adjustments to changing conditions and new technology, provide on-going supervision and enforcement, and make the best use of the resource for the benefit of those who share it. However, international institutions have not yet reached that stage of maturity. We have escaped from the absolutism of territorial sovereignty, but we have not yet reached the stage of international management. The OMVS is a striking exception in the management of international water resources.

III. IMPEDIMENTS TO ACHIEVING AGREEMENT FOR JOINT ACTION

There are many factors which may serve as impediments to the ability of coriparian nations to cooperatively develop international water resources. Among these impediments would be differences of outlook, or what has been called differences of evaluative frameworks. Different nations likely will have different priorities in the development of water resources. These different priorities may arise from different political,

social, and economic conditions in the respective countries, which in turn arise from different cultural heritages. This may make it very difficult for the coriparians to reach agreement on how to weigh the benefits and costs of water resource development.

Also, the international relations climate between coriparians is a major factor in the ability of those basin states to work together. Where the foreign policy environment is positive (United States and Canada), agreement is much easier to reach than where there are other, unresolved, foreign policy issues (Syria and Israel).

Uncertainty is an impediment to joint action. Uncertainty arises from the inability of the parties to foresee possible future effects of particular developments either because of inadequate information or possible technological changes. For example, the building of a dam is almost irreversible and once that course of action is begun it may not be possible to anticipate completely how it will limit the ability of a nation to change particular policies which might relate, for example, to flood control, irrigation development, flood water farming, and riverine forestry (as in the case of the Senegal). Since the long term consequences are not always easy to foresee, nations may be reluctant to enter into agreements which limit their options for the future.

In addition, many domestic factors internal to each nation affect the ability to reach agreement. These may include the nature of the governmental system itself, and the national

institutional mechanisms for developing policy, as well as the strength and role of interest groups and the technical and financial resources available for cooperative resource development.

Another factor not to be overlooked is the number of nations involved in the negotiation. As one study points out: "The problem of achieving agreement on joint action increases with the number of nations involved ... as the number increases, the problem of achieving agreement becomes progressively more difficult."[10]

Aids to Encouraging Joint Action

Experience suggests a number of different steps can be taken to encourage cooperative action. They include:

1) Careful attention must be given to generating information about effects on each riparian country of alternative development plans. Experience has demonstrated that "Agreement could only be achieved after basin countries were equipped with sufficient information and capable of assessing by themselves the consequences of alter-native courses of action, to permit national leaders to negotiate with confidence that the proposed endeavors really are the best available to a country."[11]

2) Possibilities should be explored for developing water resources entirely within each country, rather than through international action. This examination of the relative merits of domestic alternatives is an important step in assessing each country's interest in joint development of a shared river. Only after assessing the domestic alternatives can the national

interest in international development be properly evaluated. Only when each country is satisfied that the international alternative is the best option open to it is there a firm basis for cooperation.

For example, on the Black Volta between Ghana and Upper Volta, although both countries recognized the possibilities for joint development, studies have been made of sites located entirely within the respective countries. In this way, the merits of joint development can be weighed against the purely independent alternatives.

The Senegal River is an example of the development of a common interest in development of the river through a major dam at Manantali in Mali to regularize the flow for lower riparian countries while producing access to the sea and reduction of energy costs for Mali. The recognition of mutual advantage was a necessary foundation step for joint action.

3) <u>If a nation is limited in its ability to undertake adequate technical, economic, and social studies, international agencies and members of the international community should provide needed assistance</u>.

4) <u>Continuing communication and exchange of information at the technical level, as well as the political level, should be encouraged as a way of building mutual trust among coriparians</u>.

The exchanges between the Volta River Authority in Ghana and the Communaute d' Electricité du Bénin (Benin and Togo) are an example of trust building.

5) <u>Imaginative ways of sharing benefits and costs so as to</u>

provide necessary incentive for agreement need to be fully explored. The basic incentive for cooperation is that each nation must see that it is going to gain some net benefit. Examples of joint actions which could be cited include the projects to prevent loss of water in the swamps of the White Nile in the Sudan, which were financed equally by Sudan and Egypt since they benefitted both countries. Even though the projects were located in the Sudan, the flow of the Nile was substantially increased for Egypt. On the Columbia River, new construction of storage dams within Canadian territory produced hydropower and flood control protection downstream in the United States, and Canada received indirect cash compensation as well as hydropower. The Senegal is a prime example of the creative sharing of costs and benefits.

6) If a nation does not have the financial resources to undertake its share of a potential joint development program, international lending institutions and members of the international community can make important contributions in the provision of funds. There are many examples such as the aid of the Canadian government in financing transmission facilities linking Ghana, Togo, and Benin to permit the sale of surplus power from the Akosombo Dam in Ghana to Togo and Benin. Often, coriparian cooperation is not possible without sufficient funds to allow cooperative projects to be developed.

7) In order to minimize the potential for friction among nations involved over basin implementation arrangements, agreements should limit, as much as possible, the dependence of one

nation upon continuing actions by another to realize its share of the benefits.

Often countries are reluctant to enter into joint arrangements if projects that will be vital to their economy are controlled by another basin country. An example is that of the Indus River. The key point to the solution of the Indus controversy between Pakistan and India was to develop a plan by which Pakistan would have control over the works upon which it would be most dependent. An example on the other side is the awkward position in which Zambia found itself by not having sovereign control of the power plant for the Kariba Dam it shares on the Zambesi River.

8) Where the prospects for agreement are limited because of the number of riparian nations involved, the possibility should be explored of subdividing a water resource system into subsystems with each involving as few nations as practicable. Even though the river basin is often the most productive management unit, it is not always the most feasible unit upon which to seek agreement. Therefore, frequently, agreement can be made easier by limiting the number of countries involved in each particular agreement and subdividing the river basin into subsystems. For example, the dramatic progress made in the Senegal Basin would have been much more difficult if an agreement had been required by the fourth member of the basin, Guinea.

9) Where an international river is expected to reach a high degree of development in use, the basin countries should

give early consideration to joint planning in order to avoid conflicting claims on the resource that may arise in the future. In many cases, disputes can be anticipated and avoided if each country can compare its projected development projects and, therefore, projected demands on river resources. Often the proposed projects exceed the supply of the water resource and just as often the coriparians do not adequately know of each other's plans. It is often a "white map" problem. Each nation is shown in color on its own map, but the other nations are in white, almost as if they did not exist.

Joint planning will help to reveal the incompatibility of the future developments before disputes arise. For example, the impetus for the creation of the Niger Commission in the early 1960s came from the realization that projects being independently considered by Guinea, Mali, and Nigeria would have adverse effects on downstream projects by the 1990s.

In summary, if we were to categorize the suggestions based on the international experience we might place them in three major categories. First is the development and sharing of as much information as possible. This sharing helps each nation to better understand what its own self interest is by understanding the cost and benefits it might anticipate and what the alternatives may be so that its net benefits in the future are better understood. Also, we should not overlook that the exchange of information helps develop patterns of cooperation.

A second major point would be that frequently outside

financial assistance is a strategic facilitator that makes otherwise impossible cooperation possible.

And thirdly, there is a strong suggestion that the chances for joint cooperation are improved by reducing the number of nations involved wherever possible. This may occur by developing subsystems of river basins, rather than entire river basins, or by simply apportioning the waters of a river basin, leaving the development and management of each nation's share up to that nation. Frequently, the ideal must give way to the politically feasible.

IV. THE HIDDEN ISSUE--ALLOCATION AND ADMINISTRATION OF TRANSBOUNDARY GROUNDWATERS

The law and institutions for the management and equitable distribution of groundwaters have been slow to develop.[12] This is particularly true of transboundary aquifers. At the international level, "references to groundwaters are scant and too limited in scope to propose them in terms of customary law."[13] International practice and international law principles related to "shared groundwater resources are fragmentary"[14] at best. Groundwater has been simply a question of being out of sight and out of mind.

In regard to groundwater we are faced more with "a case of non-management than of mismanagement."[15] This striking absence of law and institutions for dealing with transboundary groundwaters is on a collision course with greatly increasing demands being placed on those water supplies by rapidly increasing populations. Estimates of world population vary,[16] and factors

which may influence that growth are numerous, but the extent of current population growth has to be the single, most salient factor affecting both water supply and water quality.

Increased population means increased competition for water. In particular, competition for groundwater supplies is increasing at a rapid rate. Already, in many countries, great reliance is placed upon groundwater. Israel relies upon groundwater for more than two-thirds of all the water used in the country, and in Europe more than three-fourths of the public water supply comes from groundwater sources in Denmark, the Federal Republic of Germany, and the Netherlands. In Tunisia and Belgium, nine out of every ten people are dependent upon underground sources, and the aquifers surrounding many major cities are becoming severely depleted as the withdrawals exceed the natural recharge of the aquifer. For example, London, Copenhagen, Hamburg, Basel, and Vienna are urban areas in Europe which face a chronic problem of falling groundwater levels.[17]

Most of the capital cities in Africa are heavily dependent on groundwater sources for their water supplies. As a result, wells in many coastal areas in Africa have been overexploited, resulting in the intrusion of sea water.

In Latin America, major cities have looked more and more to groundwater as the least expensive means of obtaining water, and shortages of surface waters (accentuated by prolonged droughts) have stimulated farmers in arid and semiarid regions to expand the use of groundwater, particularly in those areas

which do not have reliable surface water supplies. Again the result often has been the overpumping of aquifers and the consequent deterioration of water quality occurring generally when water pressure of the aquifer is reduced allowing the intrusion of overlying saline waters.

The experience in North America has been similar to that in Africa, Europe, and Latin America. Professor Hayton concludes that "the general picture is one of more recent resort to groundwater, except in arid zones, without an adequate understanding of the physics of the resource and without regard, generally speaking, for the future."[17]

A. The "Commons" of Transboundary Aquifers: Some Economic Consequences of Uncontrolled Competition

Transboundary aquifers present many of the "Tragedies of the Commons" experienced in exploiting other common resources such as fisheries on the high seas.[19] Since the resources are owned in common, that is, by everyone yet owned by no one, there is no regulation, no security of legal rights, no protection from the exploitation of others.

In the case of transboundary groundwaters, no party sharing the aquifer can have the assurance of a fair share of the waters of the aquifer or that the waters will be of a useable quality. Because groundwater is mobile, other users can take possession of the resource without regard to political boundaries. There is a strong economic incentive to exploit the resource as quickly as possible, before the mobile fluid resource is captured by others--in a phrase, there is a strong

incentive to "race each other to the bottom of the aquifer."[20]

In an uncontrolled transboundary aquifer:

> [The d]efinite property rights belong only to those who are in possession--that is, who get there the "fustest with the mostest." Every user tries to protect himself against others by acquiring ownership through capture in the fastest possible way. Deferred use is always subject to great uncertainty; others may capture the resource in the meantime.[21]

Cummings defines a common property resource as one which may be used by many different users, "none of which have any well defined rights to any specific amount in the common pool."[22] He goes on to say that in this unregulated situation the various users have

> no incentive to extract the resource at a rate that maximizes its value over time. The operative rule is simple: Use it or lose it. This rule follows from the obvious notion that if one reduces production or extraction rates today in order to have more of the resource available tomorrow when reseource values are higher, there is nothing to prevent other users from extracting the "saved" resource. In the absence of well-defined (and enforced) property rights, extraction costs impose the only limit on extraction rates--potential future uses and values are irrelevant inasmuch as future rights or access to the resource do not exist.[23]

Veeman adds that:

> in the absence of effective social institutions to guide resource use, private groundwater use can be predicted eventually to generate excessive investment and extraction costs; induce a pumping rate which is greater than socially optimal, and which may lead to irreversible depletion; dissipate economic rent or producer surplus; and in general, create economic waste and resource inefficiency.[24]

In sum the effect of unregulated human actions makes the supply less reliable for all users. There is incentive for each user to protect himself from his neighbor's actual or potential pumping by capturing as much of the "fugitive resource"

as quickly as possible. The movement of water within an aquifer does not respect political boundaries. Therefore, a state's or country's groundwater supply may be depleted, and its economic development retarded, by development in its neighbor's territory.

Thus, there is economic incentive for over-development and consequently over-investment in pumping capacity which, in turn, leads to the depletion of the resource. In the process, lift distances and, therefore, pumping costs are increased for the later user. Thus, both economic waste and resource waste are the likely results of inadequate legal protection of water rights. In addition, the water quality of the aquifer may be affected adversely by human activities on the other side of a political boundary including pumping, which can lower the water pressure allowing the intrusion of saline waters.

In order to avoid such adverse consequencs before they occur, a central challenge is laid down to design mechanisms that will:

1. insure each party a fair share of the use of transboundary groundwater;
2. encourage the prudent use of the resource over time;
3. resolve potential and actual disputes over the use of the resource;
4. protect the underground environment of the aquifers.

All of this suggests that as populations increase, as economic development advances, the need to regulate the use of transboundary groundwaters increases. Rational management requires the formulation of water policies aimed at the preser-

vation of the resource, particularly in view of its high vulnerability to long-lasting contamination or salt water intrusion and its very slow recharge and movement in many cases.

Along with new policies affecting groundwater there must be established adequate administrative machinery to carry out the management tasks. The resulting integrated management should be designed bearing in mind that there are peculiar physical characteristics of the movement and availability of groundwater that require special regulations and coordinated management with surface waters. The challenge is for specialists, working with other disciplines and administrators, to fashion legal regimes and management machinery which can prudently manage national as well as transboundary groundwater resources.

B. Developments in Transboundary Groundwater Law

Even less fully developed than national practice is international practice concerning aquifers which are divided by political boundaries. Caponera and Alheritiere, after surveying international treaty practice, conclude that "references to groundwater are scant and too limited in scope to propose them in terms of customary law."[25] They were unable to find any decisions of international courts specifically on the question of groundwater. However, they anticipate a more rapid development of groundwater law and institutions for two principal reasons: first, the nature of the resource itself makes it an ideal subject for international cooperation and second, because groundwater resources are becoming so important in

supplying the world's needs for water.

Groundwater, like surface water, often transcends political boundaries, and there are many large aquifers which are shared by several countries. For example, there is the Northeastern African aquifer which underlies Libya, Egypt, Chad, and Sudan, and on the Arabian peninsula there are the aquifers shared by Saudi Arabia, Bahrain, and perhaps Quatar and the United Arab Emirates. These aquiifers, being in arid areas, are absolutely essential for the development of industry and agriculture. Other important international aquifers are the northern Sahara Basin shared by Algeria, Tunisia, and Libya, and the Chad aquifers shared by Chad, Niger, Sudan, nd the Central African Empire, Nigeria and Cameroon. There are also the Taoudeni Basin in Chad, Egypt, Libya, and the Sudan, and the Maestrichian Basin shared by Senegal, Gambia, Guinea Bissau, and Mauritania. These groundwater basins are in arid and semiarid ares, are divided by international boundaries, and are likely to be the subject of increasing development. Yet the development of international law and legal institutions for managing the resource for resolving disputes is in its infancy.

C. Looking to the Future

Considering the increasing competition for groundwater and the admonition that "economic development presupposes the protection of adequate legal guarantees...,"[26] how do we provide users who are dependent on groundwater a secure supply? How may transboundary groundwaters be protected from contamination? Given that the UN Water Conference has exhorted countries

sharing water resources to "review existing and available techniques for managing shared water resources, and coordinate development of such resources,"[27] and yet being aware of Professor Teclaff's realism in observing that groundwater "because of the nature of its occurrence and its association with that sovereignty which has always attached itself to land, may be the very last element of the environment to be considered,"[28] what suggestions can we make to improve the security of water supply and thereby the investment of transboundary groundwater users? How can we assure that each party will receive a fair share of the transboundary resources in the border region, adequately protected so as to avert unnecessary and damaging conflict? How can we avoid what Professor Clark calls "education by disaster?"[29]

D. Some Suggestions

In approaching the task of designing mechanisms for allocating and managing transboundary aquifers, some threshold suggestions may be made:

1. There must be conjunctive management of surface and groundwater in areas where supplies are interrelated. In the mangement of transboundary groundwaters it is essential to recognize the interrelationships between surface and groundwaters which are frequently inter-connected. Contrary to hydrologic reality, the law frequently has made distinctions which separate surface water from undergroundwaters; these distinctions have failed to recognize interrelationships between surface and underground waters.

2. Legal rights should take into account the hydrologic fact that water is a fugitive resource and that therefore the legal rights are to the control and use of the water, not the ownership of the water.

3. Decisions such as the spacing of wells and the rate of drawdown need to be carried out according to a reasoned development scheme.

4. Hydrologic information needs to be developed carefully in order to plan for the use of the supply over a calculated period, to determine sustained yield, and to prevent salt water intrusion.

   a. There should be a system of measurement of withdrawals from wells.

   b. Records must be kept of withdrawals over a period of time.

5. Controls must be placed on drilling in those areas where present and future uses may be endangered.

6. Allocation procedures, including permits, must be flexible in order to anticipate and minimize conflicts and shortages, and to facilitate transfers to other uses.

7. The planning process should be flexible enough to allow for planned depletion over a calculated period by certain uses such as irrigation or municipal water supply. The planned depletion or mining of water can be justified in the same way as the mining of nonrenewable mineral resources such as oil, coal, or copper, but the decision to mine has to be made after thorough investigation, and the development must be orderly and

rational.

This is particularly so where the groundwater resource is divided by an international boundary, in view of the fact that depletion of the resource and the consequent damage to the other country cannot be easily corrected by natural recharge.

8. The management effort must include and be related to all water quality matters.

9. Management should be placed in an agency with authority which is broad enough to carry out the policies of the parties concerned and strong enough to enforce the policies designed for particular groundwater areas along and near the border.

10. The use of groundwater resources divided by political boundaries may be equitably apportioned and in that apportioning, shared groundwater may be treated in the same manner as shared surface water.

11. The amount and quality of groundwater available to the affected countries within their shared international drainage basins and from shared groundwater aquifers should be included as elements in the determination of an equitable apportionment of their shared water resources.

12. The allocation of shared groundwater should not be determined by parties acting unilaterally, but rather the parties should determine their respective rights to shared natural resources through amicable deliberations and negotiation.

FOOTNOTES

1. Scudder, African River Basins 16-17, I.D.A. (1981).

2. Id. at 19.

3. Lipper, The Rights of States in an International River: a Study in the Evolution of River Law, manuscript to be published as chapter 2, Equitable Utilization. THE LAW OF INTERNATIONAL DRAINAGE BASINS (Garretson, Hayton & Olmstead, eds.) copyright 1967, N.Y.U. School of Law International Rivers Project. See also: Van Alstyne, International Law and Interstate River Disputes, 48 CALIF. L. REV. 596, 603 (1960) and Sewell, The Columbia River Treaty and Protocol Agreement, 4 NAT. RES. J. 309 (1964). Sewell divides international river development into three categories: (1) unilateral development; (2) exclusive development; and (3) unified development.

4. For example, each of the United States and Canada is an upper and lower riparian of the Columbia River.

5. See Lester, River Pollutin in International Law, 57 AM. . INTL. L. 828, 832 (1963).

6. Experiences in the Development and Management of International River and Lake Basins (1983) (U.N. Pub.. St/ESA/120 at 144).

7. Id. at 148.

8. Id. at 168.

9. Id. at 191.

10. Fox & LeMarquand, International River Basin Cooperation: The Lessons from Experience (Report prepared for U.N. Water Conference, Mar Del Plata (1977, U.N.E./Conf. 70/A.3 at 8).

11. Id. at 9.

12. For a more complete discussion see Utton, The Development of International Groundwater Law, 22 NAT. RES. J. 95 (1982) and INTERNATIONAL GROUNDWATER LAW (Teclaff & Utton, eds. 1981). Hayton, The Groundwater Legal Regime as Instrument of Policy Objectives and Management, 2 ANNALES JURIS AQUARUM 272, 275 (1976).

13. Caponera & Alheritiers, Principles of International Groundwater Law, 18 NAT. RES. J. 589, 618 (1978).

14. Id. at 610.

15. Hayton, supra note 12 at 275.

16. United Nations, World Population Prospects, 1965-2000, as Assessed in 1968, U.N. Doc ESA/P/WR (1968); L. BROWN, BY BREAD ALONE 35 (1974).

17. Teclaff, Abstraction and Use of Water: A Comparison of Legal Regimes, U.N. DOC. ST/ECH/154 at 62 (1972).

18. Hayton, supra note 1 at 274.

19. G. HARDIN 7 J. BADEN, MANAGING THE COMMONS (1977); Hardin, The Tragedy of the Commons (Presidential Address to Pacific Division of American Association for the Advancement of Science, 1968).

20. Hansen, Economic Growth Patterns in the Texas Border Lands, 22 NAT. RES. J. 805, 819 (1982).

21. S. CIRIACY-WANTRUP, RESOURCE CONSERVATION, ECONOMICS, AND POLICIES 142 (3d. ed. 1968).

22. "Interstate Groundwater Management," 56 (paper prepared for Western Governors' Policy Office 1984).

23. Id.

24. Veeman, Water Policy and Water Institutions in Northern India: The Case of Groundwater Rights, 18 NAT. RES. J. 569 (1978).

25. Caponera & Alheritiers, supra note 12, at 618.

26. JENKS, THE COMMON LAW OF MANKIND 172 (1958).

27. Report of the United Nations Water Conference, E 77, II Annexes (Agenda Item 12) (1977) at 51.

28. L. Teclaff & E. Teclaff, Transboundary Groundwater Pollution: Survey and Trends in Treaty Law, 19 NAT. RES. J. 629, 667 (1979).

29. Clark, Institutional Alternatives for Managing Groundwater Resources, 18 NAT. RES. J. 153, 157 (1978).

CHAPTER SIX

ECONOMIC ISSUES IN AFRICAN RIVER BASIN DEVELOPMENT

David C. Major and Peter D. Little

Introduction

This chapter deals with leading economic and related issues in African river basin development. The chapter is in two parts. The first part describes the two main conceptual paradigms for river basin planning methods: traditional benefit-cost analysis, which focuses on the single objective of increasing national income, and multiobjective analysis, a more recent development that requires project and program design in terms of a range of applicable social objectives, including the national income objective. Within the context of economic planning methods, several topics are suggested where highly useful contributions can be made by AID.

The second part of the chapter takes the multiobjective paradigm and relates it more closely to the goal of improving rural economies. A number of economic issues pertinent to the realities of African economies and river basins are raised, including food security, economic diversification, revenue sharing, pricing and marketing policies, the costs of intensive irrigation, and the role of local authorities. Empirical case materials are presented in order to highlight the impact of these and other issues on river basin planning. Several areas where AID could make important contributions are indicated, including (1) the support of regional and local organizations; (2) farmer and management training; (3) support for production systems studies; (4) support for small scale irrigation; and (5) benefit-cost analyses of different development options.

Part I: Macroeconomic Planning Methods and Related Issues

Traditional benefit-cost analysis was, until recently, the sole approach to river basin planning of many international agencies. Since the early 1970s, however, it has increasingly been replaced in the US, and to a lesser extent internationally, by the multiobjective planning approach. The latter can be termed a more satisfactory method of design, permitting as it does the design of projects to reflect a variety of social aspirations, such as equitable income distribution, environmental considerations, and national food security. A review and comparison of the approaches can be found in Major (1977); other important references on the two paradigms include Eckstein (1958); Maass et al. (1962); Marglin (1967); Little and Mirrlees (1969); and United Nations Industrial Development Organization (1972). Which approach is taken in a particular case will depend on host and donor country standards and objectives; the suggestions for action given here are related to both paradigms. The two paradigms are well elaborated in theory, and there is a range of applications of each, the older benefit-cost analysis, of course, having the longer list of applications. Rather than reviewing this material, this section of the paper focuses on areas within and related to the two paradigms that appear to offer--together with work described in other papers in this series--the largest gains in effective African river basin planning and management for reasonable AID outlays.

Among the most important areas in which AID can make highly useful contributions at reasonable levels of planning expenditure are:

planning for international river basins; detailed benefit and cost estimating studies; ex post studies of impacts, including environmental impacts; and application of scheduling and other optimal investment criteria. These are discussed in turn. The suggestions made here share several characteristics relating to: the determination of which analyses might most usefully be applied in particular cases; the effective use of data; and the fact that these analyses can be applied at various stages, from initial planning to ex post studies. These too are discussed.

A. International River Basins

Very many African rivers are international, and in this lies one of the principal limitations of traditional benefit-cost analysis: it focuses on the maximization of total economic benefits from a basin rather than on their distribution, an essential consideration in international river basin planning. In the African context especially, the importance of distributional considerations is magnified because certain rivers traverse different countries that have markedly different development goals. Techniques exist for the orderly display of each country's benefits and costs for each possible alternative river-basin program. These techniques can be traditional methods expanded to include the appropriate benefit and cost accounting, or they can be based on computer processing of the same information. In either case, the objective is to increase the flow of information to national decision-makers in the form in which they will actually use it in making their decisions. There are likely to be many instances in which knowledge of the distributional aspects of a basin program will increase the

possibilities of agreement and forestall rejection of a basin plan designed for a single objective because the plan fails to address the real objectives of one or more basin countries. In the context of the total costs of a basin's development, analyses of this kind are inexpensive, and can be used either in the initial planning of a basin or at any subsequent time when decisions (e.g., on reallocation of water) must be made.

B. Detailed Benefit and Cost Estimating Studies

AID assistance can continue to be very helpful in estimating benefits and costs for various project purposes and objectives. This endeavor applies to the first paradigm for national income benefits and costs (and for the financial accounting that usually accompanies the calculation of true economic benefits and costs in this paradigm), and also to the second with respect to income distribution, environmental impacts, and other non-national-income objectives of planning. The two paradigms are well developed in theory, and--especially the first--also in terms of guidelines for practice; but nearly every application includes some benefit and cost estimates that could be made in a theoretically more correct or empirically more appropriate way. An example is the application of shadow pricing to national income benefit and cost estimates. The United States has strong expertise in this area, and it is one in which modest expenditures on staff training and studies might help substantially to improve African river basin planning. In this context one can mention irrigation benefits, benefits to small farmers (discussed in Part II of this chapter), and hydroelectric

energy benefits as having particular relevance to African conditions.

Most economic analyses of river basins emphasize hydroelectric and/or irrigation benefits. Sophisticated mathematical models have been developed by UNDP and other donors to assess, for example, the relationship between river flows and reservoir release and hydroelectric development. Within this macroeconomic framework, however, no effort has been made to model the impact of these variables (e.g., controlled river flow) on other economic uses of the basin area, including fishing, recession cultivation, small scale irrigation, livestock production, and forestry. As will be discussed later in the paper, there is an implicit assumption that the opportunity costs of alternative basin uses are minimal. Production data of the type needed to construct a multiobjective benefit-cost model have been collected for parts of the Gambia and Senegal River basins and are scheduled to be gathered for the Juba and Niger River basins. AID can assist river basin authorities in building simulation models that address, for example, the costs (in terms of reduced hydropower generation and reduced water for irrigation) and the benefits (in terms of employment generation and increased crop, livestock, fishery, and forestry production) of a controlled downriver flood and a controlled reservoir drawdown. This type of analysis gives a broader picture of the actual opportunity costs of a particular basin investment strategy.

C. Ex Post Studies of Impacts

Performing ex post studies of impacts relates to the previous topic, but is usefully discussed separately. The United

States is quite strong in impact studies generally, and many of the leading efforts with respect to environmental impacts have been made here. There is a particular point of view from which impact studies are especially important in the African context: donor interventions in river basins have usually been project-focused or single-project efforts using the traditional benefit-cost paradigm without full evaluation of multiobjective effects and impacts. Virtually no ex post evaluations have assessed the extent to which development potentials--that should be identified by multiobjective analysis--were in fact realized. Such impact studies can suggest improvements in proposed designs and measures for mitigating the negative impacts of projects already implemented. They can address, among other topics, environmental impact mitigation, income distribution effects, and the integration of existing economic uses of basins. These studies might go a long way toward redeeming some otherwise unsatisfactory situations in African river basin development, and if done in a spirit of positive cooperation might substantially improve relations with other donor nations and agencies as well as with recipient nations. While certain river basin investments (e.g., hydropower) have been the subject of impact studies, evaluations using multiple economic criteria have not been attempted and should prove highly relevant for future planning.

D. Scheduling and Other Investment Criteria

The analysis of benefits and costs described above will be quite important in many cases; equally important will be the

application of other available investment criteria that have not yet been widely applied.

One such criterion is the optimal scheduling criterion. Most river basin plans have proceeded using an application of benefit-cost analysis that does not take into account benefits and costs that change with calendar (as opposed to project) time; a prominent example has been the neglect of changes in energy prices used to evaluate the benefits of hydroelectric energy projects by the alternative cost method. Other examples are changes in exchange rates and interest rates. When such benefits and costs are likely to exist, there is a procedure by which projects can be examined for their optimal dates of implementation, instead of only for their optimal sizing, the usual case in planning at present. (Scheduling is different from simple staging to meet physical demands, which is normally done in traditional river basin planning). Attempts at such analysis have been made in the United States with respect to some hydroelectric energy projects. The importance of the criterion is that by scheduling projects optimally, countries and donors have a much better idea of how to allocate their administrative and other resources over time, in addition to reaping potentially large gains in net benefits from improved scheduling. Further, the criterion provides a clear framework for essential site option studies.

A second criterion is design of projects in terms of budget and recurrent cost constraints that, in traditional benefit-cost planning, are often neglected in the design stage and then must

be taken into account in a suboptimal way later in the choice among projects. These constraints are very important in African river basin planning. Recurrent (including operating and maintenance) costs--to which donors are usually not willing to commit resources--have been higher than anticipated for nearly all large infrastructure projects in Africa. Each donor country is likely to have implicit or explicit budget limits on project support for a basin, and recipient countries also have limited budgets. The fiscal crisis in many African countries requires a thorough assessment of the opportunity costs of capital intensive programs as they relate to budget outlays for other investments. For example, it is estimated that in Kenya the annual costs of the Bura Irrigation Scheme in the Tana River basin presently absorb more than 50 percent of the Ministry of Agriculture's annual budget. These costs, and their impact on both the national budget and investments in other sectors, were not anticipated in the appraisal stages. A basin plan designed from the start in terms of such constraints will in principle show higher benefits than a plan designed as if such constraints did not exist.

The scheduling and budget criteria are somewhat farther from routine application than the topics dealt with earlier in the paper, but they are very much within the realm of practical application (Major and Lenton 1979, ch. 8). There exists a range of other criteria (e.g., concepts of the interest rate other than simple financial or opportunity cost measures) that, while very important and perhaps crucial in many cases, awaits some initial case studies. While such criteria would be relevant for

AID and African river basin planning, it should be understood that they are in a somewhat more experimental stage than the topics dealt with earlier.

As indicated in the introduction to this chapter, all these suggestions for improved planning have certain common characteristics: the need to determine which analyses are pertinent, the effective use of data, the feasibility of applying the analyses at various stages. They are discussed here.

E. Determination of the Most Useful Economic Planning Exercises

Because the two paradigms of river basin planning are well developed, the selection of priority analyses for a particular river basin among the various analyses suggested here can be done in a relatively straightforward way. Where at least some plans and information exist (the typical case in African river basin planning), a team of three or four professionals, including a resource economist, a development social scientist (who is familiar with the production systems of the particular river basin) and an engineer/hydrologist, with some computer experience among them, can review existing plans and information (possibly with site visits, but not necessarily in every case) and suggest the most important of the topics discussed above as candidates for AID sponsored studies. "Most important" in this context is understood to mean the greatest gain in the effectiveness and relevance of project and program planning and management in terms of funds expended on the studies. These initial reviews can be done for fairly modest expenditures, and many of the studies that would result from the reviews are also doable for fairly modest

sums; in addition they would take advantage of the wide range and depth of U.S. expertise in these areas. The reviews can profitably take place at various times in a planning process; thoughtful analysis of the characteristics of a basin and the amount and type of planning information available for it will help to determine the best times. A longer-term result of the reviews suggested might well be to indicate which river or rivers would be appropriate for careful full length studies of the river basin planning process in Africa.

F. Data for Planning

A second characteristic is the extent to which data or additional data are required for any of the analyses suggested above (Major and Lenton 1979, ch. 3). It is often supposed that more complex or insightful analyses require additional data; these are often not available for African river basin planning; and thus it is concluded that additional or more insightful analyses are inappropriate to the case. This is a common misunderstanding. The methods suggested above are techniques, on the whole, for extracting more from available information, rather than methods that require more information. Where there is little information, one wishes to extract the most from it, and the approaches suggested above are designed to do this. Further, more sophisticated and insightful analyses, often using available mathematical models in the context of current computer technology, are helpful in guiding the collection of new information, where this is desirable and feasible, in the most efficient way. Thus it is not correct, in general, that the analyses suggested require more data than simpler analyses.

G. Continuous Planning

One problem in planning everywhere--and especially in a system where donor agencies and selected engineering firms finish discrete planning tasks and then exit the planning scene--is that plans are not kept up-to-date with changing factual information and changing recipient country and donor agency preferences: that projects once built are not reviewed in terms of, for example, water allocation, on a relatively continuous basis. The analyses suggested are relevant in this context, since they can be done in the initial planning process; after a draft plan is formulated; and after projects are implemented, where their use is to suggest operational changes and to learn lessons for future projects.

Perhaps it does not need saying, but the range of analyses suggested is as important for African river basins as for any others: perhaps even more so, given the resource scarcities and low incomes of Africa. It is sometimes argued that immediate action is needed, and not further analyses. While this is often the case, in the instance of large capital facilities it can be said that poorly conceived projects often languish longer in the decision process than others, and thus do not necessarily get built more quickly in any case; and that it is especially in the African context, with resource scarcities and low incomes, that additional analyses that promise large gains for relatively low costs and short time commitments are most important.

PART 2: THE ECONOMICS OF LOCAL PRODUCTION IN AFRICA'S RIVER BASINS

This section addresses economic issues that are likely to arise when the multiobjective paradigm is applied at sub-national levels. The discussion here focuses on the benefit-cost ratios for small producers and rural economies accruing from river basin investments. Several constraints limit benefits to rural areas and producers, including unfavorable rural-urban terms of trade, the high costs of intensive irrigation, state controlled marketing and production, and weak local institutions and producer organizations. Suggestions for addressing these constraints in the context of river basin development are presented in the text of the section, as well as summarized at the end of the chapter.

A. Economic Diversification and the Opportunity Costs of Specialization

River basin planning to date has proceeded as if the opportunity costs of narrowly focused programs were negligible. An overemphasis, for example, on hydropower and large-scale irrigation often comes at the expense of fisheries, livestock, dryland and recession cultivation, and other downstream activities. These other sectors usually contribute much to the country's gross domestic product and, in some cases, also help in earning foreign exchange. They provide the bulk of employment and income to producers in the basin areas. Yet river basin investments have often directly jeopardized these production activities. Welcomme (1979) notes that the construction of the

Kainji dam (for electricity and irrigation) on the Niger River in northern Nigeria reduced the productivity of fisheries downstream by 50 percent. The decline in annual flooding caused by dam construction also reduced the extent of downstream recession cultivation by more than 50 percent; decreased swamp rice yields per acre by 18 percent (Adenyi 1973:172); and reduced annual yam production in eastern Nigeria by more than 100,000 tonnes (Awachie 1979:21). The economic tradeoffs for livestock production as a result of dam construction and large scale irrigation can also be negative (Waldstein 1978; Gallais 1975). Because river basins provide important dry season grazing, the reduction in flooding and/or the conversion of basin lands to year-round irrigation reduces the viability of livestock production systems. In countries such as Mali and Somalia, that derive much of their export earnings from the sale of livestock, the effects are felt at both the local level (in terms of decreased productivity and increased environmental degradation caused by overstocking on available pastures) and the national level (in terms of reduced domestic beef supplies and export earnings).

Earlier we highlighted the importance of integrating production level data into the benefit-cost analyses usually conducted by macroeconomists. While there are scattered references to the economics of different riverine production systems, good quality production data have been collected for only a few basins. Support for production systems studies is an area where AID can make (and, in the case of Gambia, has made) important contributions. What is required, however, is that

these studies be conducted with the intention of informing basin planners as to how larger investments can be made consistent with the objective of improving local production systems, and hence rural employment and incomes. Failure to link microeconomic analyses to the larger basin planning framework may isolate production studies from the important policy makers, and thus reduce the potential usefulness and influence of the studies. It should be noted that many recommendations for improving riverine production systems are going to require macro-level investments: for example, in transport and marketing infrastructure and/or infrastructure for supplying electricity to rural industries and businesses.

B. The Opportunity Costs of Rural Labor

River basin planning continues to be based on an assumption of low (or even zero) opportunity costs for rural labor.[1] This is in spite of the fact that recent studies point to labor as the critical constraint in African production systems (see Norman et al. 1982), a factor which during much of the year has very high opportunity costs. Appraisals of irrigation development in river basins are often based on the principle of economic returns per land unit, rather than returns per unit of labor. For the smallholder, it is the latter criterion that is most important. The failure of planners to estimate properly the opportunity costs of rural labor accounts for contradictions between how farmers actually allocate their resources and how government expects them to allocate their resources (for the sociological aspects of this, see Salem-Murdock's paper in this series). The

paradox is highlighted in several river basin schemes. For example, in the Gezira Scheme (Sudan), farmers find it more profitable to invest labor in sorghum production rather than in cotton, the Scheme's crop (Barnett 1981); in the Senegal River valley, farmers find it beneficial to migrate for wage employment for part of the year, rather than to irrigate year round (Waldstein 1978). In both cases, returns to labor under production specialization have been too low for families to attain economic viability without supplemental activities.

C. Farmer Incomes

There is some evidence of increased smallholder incomes because of production-related investments in river basins, but most studies indicate decreased incomes and expanded indebtedness (cf. Salem-Murdock paper in this series). In the Senegal River valley, for example, under large, state-controlled irrigation schemes, "producers would be earning higher revenues by allocating their labor to entry-level, unskilled manual labor in the formal sector or even to itinerant agricultural day labor than by continuing to cultivate in Kassak" (Waldstein 1985:32). Farmers' debts are high and income from the scheme has been declining since the mid-1970s, although nearby small-scale, indigenous irrigation continues to be successful and profitable (Adams 1981). Similarly, on the Gezira Scheme (Sudan) the majority of tenants live in a state of indebtedness, and it is actually grain production that finances export crop (cotton) production (Barnett 1981:322). High labor requirements for cotton production contribute to the indebtedness, since farmers take out credit to hire labor. Low farmer net incomes are also

indicated in the Lake Chad Basin irrigation schemes. In 1977, net income per person day of labor on intensive rice irrigation in the Lake Chad Basin was less than $0.30, or one-ninth the productivity of labor in recession sorghum cultivation (Reyna 1978:42).

D. Price and Marketing Policies

Governments attempt to recoup their high initial investments in river basin activities by depressing producer prices. Low producer prices serve both the urban consumer by keeping food costs low and the state by allowing high market margins on export crops. In virtually all African countries that have or share a river basin, the terms of trade between the rural and urban sectors tend to work against the rural producers. At least part of the rural-urban migration trend experienced in the Senegal River valley and in the inner delta of Mali can be explained by this urban bias (Waldstein 1980). The low incomes of farmers cited in the previous section are partially the fault of policies that keep farm prices low. As we indicated earlier, the opportunity costs of rural labor are high, and basin farmers will devote attention to those activities that give the highest returns per unit of labor and, to a lesser degree, other inputs invested. While the costs of farm inputs for irrigated agriculture have increased two- and threefold in certain countries (1975-84), producer prices have almost uniformly remained low. Fell (1983:115) notes in Mali, for example, that "the producer price for rice increased 46 percent between 1974 and 1978, while agricultural equipment has gone up 200 percent and fertilizers 62

to 75 percent." Government pricing policies should be carefully examined for cotton, rice, groundnuts, and other export crops grown in river basins to insure that they reflect actual production costs. Where more than one country shares a river basin, efforts should be made to create uniform price policies in order to discourage illegal exports and resource misallocations (Dunsmore et al. 1976:383).

In addition to controlling producer prices, states often intervene in river basin activities through the establishment of monopsonistic marketing parastatals (cf. Thomas and Brokensha paper in this series). The two strategies go hand in hand and have the general effect of reducing economic returns to producers. On river basin irrigation schemes, producers are usually required to market their produce through state controlled channels, often with market cooperatives serving as intermediary links. Considerable inefficiencies occur because of the high recurrent costs of these organizations, costs that then are passed on to the producer through low prices. The presence of these organizations can actually discourage the production of the crops they intend to regulate. For example, on the Gezira Scheme (Barnett 1981) and on the Perkerra River irrigation scheme in Kenya (Little and Horowitz 1985), farmers have chosen to invest in those crops (sorghum and millet) that are not regulated by parastatals. Long payment delays by parastatals also discourage the production of crops whose marketing is controlled by public organizations. In at least one basin area--the Lake Victoria basin--payment delays by parastatals have resulted in a decline in the production of export crops (Jacobson et al. 1979).

Wherever possible, marketing activities should be shifted to private sector organizations and producers allowed greater freedom in marketing choices.[2]

E. Credit and Other Inputs

Credit is an integral component of agricultural production activities in river basins: on large irrigation schemes it is required to hire labor, and to purchase fertilizers, seed, and agricultural equipment. Often credit and these other inputs are distributed through cooperatives. Because credit is usually tied to the purchase of needed agricultural inputs, inefficiences in the marketing of inputs influence its effectiveness. In Mali, for example, delivery of fertilizers and other inputs to irrigation schemes is sometimes delayed, resulting in reduced production (Fell 1983:114). When credit is tied to the provision of production inputs, and then bottlenecks occur, the production increments that were anticipated to repay the loan are not forthcoming. This at least partially explains the poor loan repayment rates and heavy indebtedness of farmers in river basins. Up to 70 percent of farmers in the Gambia River basin irrigation programs have heavy production-related debts (Weil 1978), and most farmers on irrigation schemes in the Sudan and Senegal also have sizable debts (Barnett 1981; Waldstein 1980). The poor performance of credit on irrigation schemes necessitates some rethinking about its role in river basin development. Credit should be realistically assessed in the context of improvements in production inputs and markets and anticipated production increases (Dunsmore et al. 1976:377). This is all the more

critical in river basin development, since investments often are made in remote areas of countries where marketing and credit bottlenecks are likely to be severe.

F. Inflation

Another economic issue that has to be addressed in the context of river basin development is inflation. Distortions in the local labor market caused by river basin infrastructure projects (e.g., dam construction) can increase production costs to the farmer. In particular, a project's increased demand for both skilled and unskilled labor, which is attracted by compensation above local market rates, inflates wages. Farmers who employ laborers during the year must raise wages to be competitive with the new levels. Farmers who are unable to do so cannot compete successfully for available labor. This heightens existing inequities in local resource distribution, as small farmers are squeezed out while larger farmers, who have sufficient resources, are able to compete successfully. Annual inflation for both labor and food has been as high as 50 percent in river basin projects in Kenya, and in Mali (at the Manantali project) local inflation of 100 percent per annum has been noted (Koenig 1983:6). Although there are obvious benefits from an expansion in labor markets (e.g., increased demand for local food), the costs of this growth to local producers, particularly to small farmers, should be assessed.

G. Improved Food Production in the Context of River Basin Development

It is generally recognized that increased food production in Africa will depend mainly on the performance of small farmers

(Eicher 1982; World Bank 1984). They make up the bulk of producers in virtually every sub-Saharan African country. Since river basins provide prime agricultural land, they are integral to programs of increased food production. But what types of investments are needed to improve production? From the perspectives of improving either local or national food security, it is questionable whether capital intensive irrigation is an economically promising option. The costs of developing large scale irrigated agriculture in much of Africa exceeds $20,000 per hectare. For every investment unit of $5,000 per hectare in irrigation, a net annual return of $800 to $1,000 per hectare is required to yield a rate of return of 12 percent (Hotes 1983:136). Higher investment costs require proportionately higher returns, which, as we have argued, are unlikely to be achieved under present conditions. Lumpy investments, such as capital intensive irrigation, almost invariably compel states to seek production of higher value crops, which often means non-food crops or food crops such as rice and wheat that are oriented to a select urban market. The latter option, it is argued, is a means of saving foreign exchange by reducing food imports, although the economic benefits of this strategy are questionable. For example, in the Senegal River basin, it has been demonstrated that meeting national rice demand through large scale irrigation may actually utilize more foreign exchange (e.g., by importing capital equipment and technical expertise) than would be used to import the commodity (Ross 1977). The irony in this case is that the total commitment to paddy rice has actually withdrawn land

and other resources from sorghum and millet activities--the two most important rural food staples--destabilizing the production of these commodities (Keller et al. 1982:7).

The costs of small scale irrigation (ranging up to 400 hectares) in river basins, on the other hand, are low enough so that food production can be profitable. Initial costs per hectare are usually below $3,000, depending upon the type of water delivery system. In most cases, small scale irrigation is more productive per unit of investment than is large scale irrigation (Moris et al. 1984). Sorghums, millets and vegetables are grown profitably on many of the smaller perimeters in Niger and in Senegal, and in both cases production contributes to improved local food security (Adams 1981; Horowitz et al. 1983). Where producers are given options, they will invariably grow local food crops, as well as the export crops that are promoted by irrigation schemes. In this sense, they can contribute to urban and rural food markets. The economic advantages to the producer of pursuing this diversified strategy are several. For example, similar to export crops, food crops are also cash crops, but unlike the former commodities they can be sold at local and regional markets. Because local and regional food markets are usually not controlled by the state (as are most export-crop markets), they avoid the types of constraints, including delayed payments, indicated in the earlier section on pricing and marketing. The food crop farmer also has the option of consuming the product if market conditions are unfavorable, an alternative not available in the case of many export crops.

The contradiction in most donors' policies, including AID, toward food production in Africa is that while small farmer development is promoted in non-basin areas, the policy in river basins has been toward large-scale investments, which are often detrimental to small producers. More attention should be given to improving the potential of existing downstream food production systems that focus particularly on recession cultivation, small scale irrigation, fisheries, and livestock production. The tradeoffs in food production (at national, regional and local levels) from pursuing a strategy of hydroelectric development and large scale irrigation should be assessed. Suggestions on the types of analyses required to determine these were given in Part (I) of this chapter.

H. Revenue Sharing

River basin development has mainly generated revenues for national ministries and treasuries. There has been very little sharing of funds between national bodies and regional and local authorities and institutions, either in terms of budget allocations or earned income. Funds for development within the basin (for electrification or fisheries for instance) are vested in national organizations, and fiscal decentralization to sub-national bodies is minimal. Most of the benefits are thus siphoned out of basin areas, and they receive few allocations for development in return. Although regional and local institutions are often established in river basin development programs, they are rarely given the budget autonomy necessary to permit decentralized decision-making.

I. Regional and Local Institutions

Despite the reluctance of governments to decentralize authority and decision-making, the development of strong regional and local institutions remains critical to the integration of local economies into river basin programs, and is perhaps the most important area where donor support can make a difference. Since this topic is dealt with in detail elsewhere in this series (cf. Thomas and Brokensha), I will limit the discussion here to a few relevant issues.

An important aspect of river basin planning in Africa is the locus of technical expertise and decision-making in cases where decisions might better be made at a regional or local level, but are in fact made at national levels. Better trained African planners/economists, and the development of relatively powerful small computers with reasonably benign maintenance requirements in terms of environment and support services, will permit much more of the relevant analysis and decision-making to be done effectively at levels below the national level. The United States has a lead in computer technology, and for a relatively low cost could provide this technology to a variety of local and regional centers together with appropriate technical assistance and training. Among the valuable types of studies that would enhance regional/local decision-making are hydrologic simulation studies, riverine production system studies, irrigation allocation assessments, and sensitivity analyses on parameters and estimates. These studies relate both to the economic and multiobjective paradigms and to the engineering, environmental, social, and other analyses with which the two paradigms

intersect. Considering the period of the next five years, the furnishing of such capabilities (along with the required training) to regional/local authorities would provide one of the very highest payoffs in more effective river basin planning that is now available.

The development of strong producer organizations is also essential to river basin development. Yet it should not be limited to marketing and input cooperatives that merely cater to the purposes of export crop programs by serving as conduits for required scheme inputs and outputs. Rather, emphasis should be placed on farmer organizations that are involved with production decisions, including water allocation and crop choice (the experience of water user associations in south Asia may be relevant here). The production concerns of farmers are usually met only when--as described above--their actions (or non-actions) begin to jeopardize project goals. In the case of the Perkerra Irrigation Scheme (Kenya), farmers were allowed greater flexibility in crop selection only after refusing to plant the Scheme's crops during the 1978 season.

In at least one river basin region (the Bakel area of Senegal), however, there has been a recent effort to permit greater flexibility and participation in production planning. Keller et al. (1982:5) point out that:

> Now it appears that the GOS (Government of Senegal) is very wisely allowing the cultivators to choose those crops and cropping combinations which maximize returns under local conditions. This is far superior to the earlier strategy which had a rice fixation.

The report goes on to say that despite the new flexibility, SAED continues to provide most of its technical assistance only to monocropping (rice).

SUMMARY OF RECOMMENDATIONS FOR AID SUPPORT

Parts I and II have indicated certain areas where AID support could make a contribution to river basin programs. Below we summarize the main points.

A. Multiobjective Planning Models

AID has an opportunity to present an alternative model to single- (or dual-) objective basin planning, which is usually based on hydropower generation and/or capital-intensive irrigation. Suggestions have been made in the text for conducting broader benefit-cost analyses that examine a range of investment options, including those mainly likely to generate national income and those likely to maximize benefits to regional economies and producers. This paradigm starts with the premise that there are several potential uses and users of a river basin and that a planning framework should take account of the full range of opportunities. With this in mind, it might be worthwhile to support an ex post evaluation of a river basin program, to assess the extent to which development opportunities as defined by the multiobjective paradigm were realized.

B. The Role of Resource Economists

To some extent it can be said that African river basin planning has proceeded on the basis of work by engineering firms, in which economists and other specialists play a relatively small role. In good planning, there is a direct role from the beginning for a range of disciplines, of which the resource economist is an important one. Indeed, for some types of questions--the existence of sufficient demands for outputs,

shadow pricing of input costs--the economist is more important than the engineer in the final decision. Donor agencies should make a special efort to see that the appropriate range of disciplines is included in river basin planning in Africa. With respect to the resource economist, it is also true that this specialist is essential to the training of local counterpart personnel who are needed for the ongoing "continuous planning" that is important for good river management. Local counterpart personnel need to be trained in economic and multiobjective studies, not only to help in initial planning but to help, on a sustained basis, to make the most of existing projects.

C. Support for Production Systems Studies

AID has probably gone further than other donors in supporting studies of river basin production systems. The AID-financed Gambia research is a good example, and proposed studies for the Niger and Juba rivers are also indicative. It is still too early to ascertain how such socioeconomic studies will actually influence river basin plans and policy. Further support for this type of research is required, with greater emphasis given to modeling the tradeoffs to local production under particular investment options, including dam construction. Local fisheries and recession cultivation are two riverine systems where production data are especially lacking.

D. Alternatives to Capital Intensive Irrigation

The high costs of irrigated agriculture, with its minimal impact on producer incomes and national and regional food security, necessitates alternative production scenarios. More

effort, for example, should be placed on small scale irrigation and recession cultivation, with a greater focus on devising appropriate techniques and technologies for these activities. Where large scale irrigation remains the best development option (as is likely in some African countries), greater flexibility and local participation in production planning and marketing should be allowed.

E. Regional and Local Organizations and Training

We have discussed in some detail the types of assistance that AID could provide for local and regional organizations. For producer-oriented organizations/cooperatives, it is important that farmers be provided with training in cropping techniques, management, maintenance, simple accounting, and other subjects that would assist the groups in becoming self-reliant.

Support also should be given for training government and other relevant personnel of regional and local development institutions. Training courses and workshops could be given on small-project design and appraisal, use of microcomputers in river basin planning, production modeling, benefit-cost analysis, and other appropriate topics. For these purposes and other activities, it is important to arrange for some revenue or budget sharing between national and subnational organizations involved in river basin development.

NOTES

1. Chambers (1983) suggests that the failure to adequately assess the real opportunity costs of labor may result from a "dry season" bias in project design. Many rural development programs are appraised in the dry season, when agricultural employment is low, rather than in the rainy season when agricultural activities are at their peak. Consequently, project missions overestimate the extent of underemployent and undervalue the opportunity costs of agricultural labor.

2. Private markets frequently offer much higher prices for agricultural products than do formal market channels. In the Senegal River valley, Waldstein (1980:529) notes:

> Tomatoes grown in the SAED perimeters to supply the tomato paste canneries at Savoigne earned the cultivator a little over 6.8 cents per kilogram in the 1976-77 season while they were retailing in the village markets for five to seven times as much. . . . SAED paid the peasant just 18 cents per kilogram of paddy in 1976-77. The government-controlled retail price for milled rice was just over 38.6 cents per kilogram, while rice husked and winnowed at home sold on the parallel market for 50 to 60 cents a kilogram.

REFERENCES

Adams, Adrian
1981 The Senegal River Valley. In Rural Development in Tropical Africa. J. Heyer, P. Roberts and G. Williams, eds. London: Macmillan. Pp. 325-353.

Adenyi, E. O.
1973 Downstream Impact of the Kainji Dam. In Kainji: A Nigerian Man-Made Lake, Socio-Economic Conditions. Kainji Lake Studies, Vol. 2. Ibadan, Nigeria: Ibadan University Press.

Awachie, J. B. E.
1979 On Fishing and Fisheries Management in Large Tropical African Rivers with Particular Reference to Nigeria. In Fishery Management in Large Rivers. R. Welcomme, ed., FAO Fisheries Technical Report No. 194. Rome: Food and Agriculture Organization. Pp. 37-45.

Barnett, T.
1975 The Gezira Scheme: Production of Cotton and the Reproduction of Underdevelopment. In Beyond the Sociology of Development. I. Oxaal, T. Barnett and D. Booth, eds. London: Routledge and Kegan Paul. Pp. 183-207.

1981 Evaluating the Gezira Scheme: Black Box or Pandora's Box. In Rural Development in Tropical Africa. J. Heyer, P. Roberts and G. Williams, eds. London: Macmillan. Pp. 306-324.

Chambers, Robert
1983 Rural Development: Putting the Last First. London: Longman.

Dunsmore, J. R., A. Rains, G. D. Lowe, D. J. Moffatt, I. P. Anderson and J. B. Williams
1976 The Agricultural Development of Gambia: An Agricultural, Environmental and Socioeconomic Analysis. Vol. 2, Land Resource Study 2. Surrey, England: Ministry of Overseas Development.

Eckstein, Otto
1958 Water Resource Development. Cambridge, MA: Harvard University Press.

Eicher, Carl K.
1982 Facing Up to Africa's Food Crisis. Foreign Affairs 61:151-174.

Fell, A. M.
1983 An Overview of Irrigation Strategy and Results in the Sahel. In Aid for Development of Irrigation. I. Carruthers, ed. Paris: Organization for Economic Cooperation and Development. Pp. 108-123.

Gallais, J.
1975 Traditions Pastorales et Développement: Problèmes Actuels dans la R'gion de Mopti (Mali). In Pastoralism in Tropical Africa. T. Monod, ed. London: Oxford University Press. Pp. 354-368.

Horowitz, M., E. Arnould, J. Eriksen, R. Faulkingham, C. Grimm, P. Little, M. Painter, T. Painter, C. Saenz, M. Salem-Murdock and M. Saunders
1983 Niger: A Social and Institutional Profile. Binghamton, NY: Institute for Development Anthropology.

Hotes, F. L.
1983 The Experience of the World Bank. In Aid for the Development of Irrigation. I. Carruthers, ed. Paris: Organization for Economic Cooperation and Development. Pp. 126-140.

Jacobson, L., C. Falcke, R. Erickson, C. Lee, L. Cohen and P. Little
1979 Opportunities for Rural Marketing and Infrastructure Development in Rural Kenya. Madison, WI: University of Wisconsin International Studies Program.

Keller, J., R. Meyer, F. Peterson, T. Weaver and G. Wheelock
1982 Project Review for Bakel. Small Irrigated Perimeters, Senegal. WMS Report 9. Logan, UT: Utah State University.

Koenig, Dolores
1983 Monitoring Plan for Manantali Resettlement Project. Binghamton, NY: Institute for Development Anthropology.

Little, I. M. D. and J. A. Mirrlees
1969 Manual of Industrial Project Analysis. Vol. 2, Social Cost-Benefit Analysis. Paris: Organization for Economic Cooperation and Development.

Little, Peter D. and Michael M Horowitz
1985 Subsistence Crops Are Cash Crops: Some Comments with Reference to Eastern Africa. Binghamton, NY: Institute for Development Anthropology.

Maass, Arthur et al.
1962 Design of Water-Resource Systems. Cambridge, MA: University Press..pa

Major, David C.
1977 Multiobjective Water Resource Planning. Washington, DC: American Geophysical Union.

Major, David C. and Roberto L. Lenton
1979 Applied Water Resource Systems Planning. Englewood Cliffs, NJ: Prentice-Hall.

Marglin, Stephen A.
1967 Public Investment Criteria. Cambridge, MA: MIT Press.

Moris, J., D. J. Thom and R. Norman
1984 Prospects for Small-Scale Irrigation Development in the Sahel. WMS Report 26. Logan, UT: Utah State University.

Norman, D., E. Simmons and H. Hays
1982 Farming Systems in the Nigerian Savanna: Research and Strategies for Development. Boulder, CO: Westview Press.

Reyna, Stephen
1978 Social Soundness of Four Projects Proposed by the United Nations Development Program/Lake Chad Basin Multi-Donor, Multi-Disclipinary Mission. Durham, NH: Horton Social Science Center, University of New Hampshire.

Ross, Clark
1977 Marketing, Price Policy and Storage of Cereals in the Sahel: Senegal. Ann Arbor, MI: The University of Michigan Center for Research on Economic Development.

United Nations Industrial Development Organization
1972 Guidelines for Project Evaluation. Geneva: UNIDO.

Waldstein, Abraham
1978 "Peasantization" of Nomads and "Nomadization" of Peasants: Responses to State Intervention in an Irrigated Agricultural Development Scheme in the Senegal River Delta. Unpublished Report.

1980 Development for Whom? In Sahelian Social Development. S. Reyna, ed. Abidjan, Ivory Coast: Regional Economic Development and Services Office, AID. Pp. 507-603.

1985 Irrigated Agriculture as an Archetypal Development Project. In The Anthropology of Rural Development in West Africa. M. Horowitz and T. Painter, eds. Boulder, CO: Westview Press, forthcoming.

Weil, Peter
1978 Social Analysis of Alternative Development Strategies for the Gambia River Basin: 1976-2000. Washington, DC: Robert R. Nathan Associates.

Welcomme, Robin L. ed.
1979 Fishery Management in Large Rivers. FAO Fisheries Technical Report No. 194. Rome: Food and Agriculture Organization.

World Bank
1984 Toward Sustained Development in Sub-Saharan Africa. Washington, DC: The World Bank.

CHAPTER SEVEN

AFRICAN RIVER BASIN DEVELOPMENT: SOCIOECONOMIC ISSUES

Muneera Salem-Murdock

If river basin development efforts are to realize their tremendous potential to achieve equitable and sustainable development for entire regions, they must take those objectives into account from their inception. Cost-effective planning and implementation should focus on the river as the central element in a system of land and water uses. Concentrating only on infrastructure, whether for hydropower alone or for power plus downstream irrigation, constrains optimal development and unduly limits benefits that could otherwise be obtained. Even where some consideration is given to the socioeconomic implications of dam construction, it is unfortunately often delayed until after the purely engineering features have already been committed. Issues of relocation, settlement, and participation are then essentially limited to questions of mitigation.

This paper focuses on some of the socioeconomic dimensions of river basin development (RBD) in Africa. The attention to "socioeconomic" as opposed to "sociological" issues stems from the belief that, in the context of local production systems and the allocation of labor and resources, the sociological and the microeconomic are intertwined and inseparable. Macroeconomic generalizations can be and often are made without specific references to local sociopolitical dynamics. For credible sociological insights to take place, however, one requires a clear understanding of the local economy at the individual, household,

community, and regional levels. The discussion that follows will be guided by several assumptions and principles:

1. The major goal of RBD should be the equitable and sustainable development of a whole region. Principles of equity should be integrated in project design from the outset, since "trickle down" economics, as Ian Carruthers puts it, "has been . . . very aptly described as a trickle" (1978:305).

2. RBD must be oriented toward small producer households since they dominate the African scene numerically and will be the basis of future production increases. Examples of the multitudes of people affected by RBD abound in the literature. In Zambia and Zimbabwe approximately 86,000 Gwembe Tonga were affected by the Kariba dam, while over one million Nilotic Dinka and Nuer are affected by the development of the Sudd in Southern Sudan (Scudder 1980). Gallais (1967) observed the presence of 300,000 Fulani pastoralists, 70,000 farmers, and 80,000 fishermen in the inland delta of the Niger as early as 1950. In the Sudan alone, the construction of the High Aswan Dam in Egypt has affected about 50,000 Nubians who had to be moved to the New Halfa Agricultural Scheme in Eastern Sudan. In addition to the Nubians, the dam has affected the lives of hundreds of thousands of Shukriya and other pastoral nomads.

Early planning and development thinking should incorporate the tremendous ethnic diversity and the wealth- and class-based social stratification among river basin inhabitants, in addition to the various uses of the basin above and below the proposed dam. Because of the nature of their adaptive strategies, which

emphasize movement in search of grass and water, pastoral users of the river basins, although often the most numerous, are frequently neglected by planners since they rarely have formal legal rights to the land. Referring to the Middle Zambezi, the Sudd, and the Inland Delta of Niger Scudder observes:

> The types of riverine food-production systems described in these three examples have supported millions of people for millennia in Africa without adverse ecological effects. During periods of drought, the importance of the river and lake basins is magnified, especially for pastoralists. Although the rivers and lakes then suffer significantly reduced water flows and levels, which increase the land-use pressure on the remaining grasslands and the potential for conflict, it is hard to overemphasize the importance of the Senegal and Niger Valleys, and the Lake Chad Basin, to pastoral peoples during the most recent Sahelian drought. The same applies to the Tana River in northeastern Kenya. Used on an annual basis during the dry season by pastoralists, river and lake basins in the savanna environments of Africa presumably also played an important historical and prehistorical role in the voluntary sedentarization of transhumant herders (Scudder 1980:390).

3. RBD projects should place at least as much emphasis on nonagricultural and on pre-scheme agricultural activities of potential beneficiaries as they do on strictly commercial farming. Herding, fishing, traditional irrigated and rain-fed agriculture, and forestry should be considered in addition to proposed commercial irrigated agriculture. The generation of nonfarm employment and the potential eruption or fast growth of new urban centers should be strongly emphasized.

4. Equitable and sustainable regional development will be best achieved through local participation not only in potential benefits but also in the planning, implementation, and evaluation of projects. River basin development often benefits remote populations through the generation of cheap hydropower, but the principal costs are borne by local peoples. Even where local

populations participate in the benefits of RBD, they are also the major risk-takers. Discussing the almost total exclusion of farmers from project design in the past, Carruthers points out:

> By and large, it is my experience that most planners have a paternalistic view of their role and an unhealthy regard for the possible value of farmer participation in the planning process. Failure to appreciate and be sensitive to the socio-political realities of the social environment into which irrigation technology is to be introduced is a sure recipe for problems later (1978:304).

5.CB RBD projects should be designed, implemented, and evaluated from a regional perspective. There is enough evidence to suggest that the frequently negative assessments of settlement schemes (even those designed narrowly) might be more positive if the schemes were evaluated in a regional context instead of on their agricultural objectives alone. Those negative assessments are likely to become even less valid if projects are designed in a regional perspective. This means that the scope of feasibility studies should be expanded to include the resources and labor strategies of both on- and off-scheme beneficiaries. The World Bank has recognized the importance of a regional perspective in resettlement projects, as evidenced in the Agricultural Land Settlement Issue Paper: "Future settlement activities should be viewed within a comprehensive development framework which recognizes the need for careful use of all resources in the project area" (1978:8).

In the light of the above assumptions and principles, a number of issues will be addressed.

Organization of Production

In order realistically to assess the needs of the populations of the river basin and more effectively to plan a project that will generate equitable development of the whole region, a detailed study of the organization of production of the concerned populations--both those directly incorporated in RBD efforts and those peripheral to them--is vital. The identification of populations, both riverine (including those upstream and downstream from the proposed dam) and non-riverine, is the first task. Since, almost invariably, they become the subject of forced relocation, upstream populations risk being the principal losers from dam construction. If RBD planning is carried out knowledgeably, however, and new production opportunities (such as recession cultivation in the reservoir if the gradient permits, and reservoir fishing) and access to markets, extension, and credit are provided, the project might well improve the local economy (Horowitz 1980). But, even with improved economic conditions, increased health risks from water-borne diseases, such as schistosomiasis and malaria, are a real cost:

> Field evidence relating to malnutrition and three selected infectious diseases (viz. sleeping sickness, bilharziasis and malaria) is reviewed. In each case, the evidence is replete with examples of development interventions that inadvertently increase disease hazards. In regard to the infectious diseases, examples of such evidence are: (1) increased incidence of tryponosomiasis (sleeping sickness) along new road networks in Liberia and Nigeria; the cycling of trypanosomes by migrant labor between Ghana and the Upper Volta Republic; and an outbreak of trypanosomiasis near the man-made Lake Kariba; (2) increased incidence of bilharziasis (schistosomiasis), especially the more serious intestinal form, Schistosoma mansoni, around irrigation schemes, with examples ranging from the Gezira cotton scheme in Sudan to sugar schemes in Nigeria and Tanzania, and tobacco farms in Rhodesia, with the dangers of further spread of the disease through presently planned ag-

ricultural schemes; (3) an increasingly complex epidemiology of malaria in which, as a result of development activities and the emergence of insecticide-resistant vectors, socio-cultural factors are playing a more involved role (Hughes and Hunter 1972:69-70).

Among downstream populations the environmental impacts of RBD include a loss of flood-borne siltation, and therefore of organic fertilization of alluvial fields, and a decline in the nutrient value of the river for fishing, as nutrients tend to be caught behind the dam. Another example of environmental effect comes from Senegal, where afforestation in the alluvium is by flood-borne seeding. Where the flood is interrupted by dams or where the flood no longer contains the seeds--even if the flood is simulated periodically--there is a marked reduction in tree seedlings in the alluvial plains. Environmental impacts have clear socioeconomic implications. The negative impacts on tree products, for example, disadvantage poorer users who depend on trees for fuelwood and poles, and herders whose animals browse the arboreal pasture.

Both upstream and downstream, pastoral users of the river may lose, through one or several of the following possible effects: decline in the quality of riverine grazing, again as a consequence of the reduction in nutrient-rich flood; colonization by disease-causing worms along the slow-moving margins of the reservoir; and reduced access to riverine pastures caused by establishment of irrigated perimeters in year-round cultivation (Horowitz and Badi 1981).

Particularly in dry areas (such as much of the Senegal, the Niger, the Nile and its tributaries, and the Juba), the development of dams and irrigation works has resulted in a marked

decline in the contribution of the river to food production, negatively affecting grain staples, fish, and livestock products. Since the cost of the perimeters is so high, governments and donor organizations seek to recover their investments through the production of higher-valued crops, like cotton, sugar cane, groundnuts, and rice (the latter primarily for urban consumption). But local dwellers continue to require grain and pastoral produce for their own consumption. Hence, both herders and grain cultivators, now denied access to the alluvium, are forced onto less productive lands--dunal lands (goz in the Sudan)--where more fragile soils are subject to rapid degradation. These effects of RBD are well-known and well-documented. What is less well understood, but may be equally salient, are the effects on populations of the region who inhabit the margins of the scheme, the so-called "borderlands," but do not use the river and its resources. The organization of production should be investigated from many avenues:

Production Units. What is the unit of production? Is it the individual, the household, a group of households, the clan, the village? Do production units differ from group to group? Do they differ within a group? How? By location? By socio-economic class? What are the units of consumption? Do they coincide with production units? Who has authority over distribution?

Economic Activities. What economic activities exist in the area? Attention should be paid to all activities, including herding, fishing, forestry, wildlife, crafts, wage labor, and other nonfarm activities, as well as to agriculture (which will

naturally receive prime attention). What are the farming systems in the area? Under this we should pay close attention to the range of crops grown, the division of labor and the economic roles of women and children, methods of cultivation, and whether livestock production is integrated with farm activities or animal traction utilized. What farm practices, including farming cycles, are followed? Are manure and/or other fertilizers utilized? To what extent are crops marketed and where? What are the incentives and constraints on agricultural productivity? What kind of settlement patterns do we see, and what effects do they have, if any, on agricultural productivity? What are the labor strategies and how are time and resources allocated?

In investigating these issues, it is important to note that even local groups are not homogeneous, that their members differ in respect to access to resources, and that they operate under a range of differing incentives and constraints.

There is enough evidence to argue that ignoring pre-scheme economic activities and priorities in deciding what economic activities should be introduced can defeat what might otherwise be a reasonably successful effort. The New Halfa Agricultural Scheme in the Sudan, for example, was from its inception devoted to the production of cotton and groundnuts for export and sugar and wheat for domestic consumption. The subsistence of two-thirds of the tenants, however, was based on ruminant herding and sorghum cultivation. To maintain that base, many tenants illegally ran animals on the Scheme, with incursions of livestock especially in the poorly remunerative cotton fields, and abandoned the Scheme altogether during the rainy season when sorghum cultiva-

tion in the wadis became feasible. Some tenants actually defied Scheme management by growing sorghum directly on the irrigated fields that were supposed to be in cotton, groundnut, or wheat production, and ran the risk of having the grain plowed out by the authorities. This situation lasted for many years, at a cost of millions of dollars, while the government turned a deaf ear to tenants who pleaded that both animals and sorghum be incorporated in the legal production inventory. This diversification was finally approved in response to a World Bank recommendation arguing that the official cotton-groundnut-wheat rotation might be too consumptive of water resources, which were rapidly declining because of reservoir siltation. Had the tenants' demands been met at the beginning, ironically, more water would have been available for the export oriented crops, and there would have been a marked reduction in absenteeism and tenant dissatisfaction. But the concerns of the tenants were never effectively taken into account by Scheme management (Salem-Murdock 1979, 1984).

As we investigate the organization of production, we should keep in mind that irrigated perimeters, whether large or small, carry with them complex innovations (e.g., technology, water management and distribution, intensive methods of cultivation) that will require technical and organizational skills, labor inputs, and socioeconomic roles that might not be present in traditional systems of production. Our task thus encompasses seeing which innovations are compatible with the old and famil-

iar, and which call for new management, organizational, and socioeconomic structures.

The other important question we should ask is, what are the anticipated socioeconomic changes? One socioeconomic change anticipated in the Manantali Resettlement Project, for example, is the influx of new wealth (e.g., in the form of high wages paid to dam workers), which is likely to augment the cost of agricultural labor in the area and perhaps completely discourage volunteer labor in the form of working parties, while it increases the cost of goods and services (Koenig 1983). On the Tungabhadra Irrigation Project in Mysore State in India, the effects of the shift from extensive, wetland cultivation, according to Slattery (1979), included the rise of separate farmer and labor classes, the creation of new roles within farm families, and a shift from reciprocal to contractual labor relationships. These transformations are not necessarily negative, but they were clearly unanticipated.

Elitism, Social Stratification, and Unequal Distribution

In a discussion of contentious issues in river basin planning, Ian Carruthers observes: "Failure to appreciate and be sensitive to the socio-political realities of the social environment into which irrigation technology is to be introduced is a sure recipe for problems later" (1978:304). This failure to appreciate socioeconomic realities and the resulting problems of increased elitism, social stratification, and unequal distribution of benefits is nowhere clearer than in planners' recurrent faulty assumption of the homogeneity of the rural poor, from

which they conclude that, although equity is a vital development objective, it is not a problem when we are dealing with rural Africa, where people are more or less uniformly poor. That view is clear in the following:

> Given the very low level of national income, the question of equity has little relevance for the Niger scene at this point. While there are a few pockets of amassed wealth within Niger, those that do exist are in commercial areas which are relatively unlinked to the rural population. That is: neither exploitation of the rural poor nor accumulation of individual wealth at their expense are problems in Niger (USAID/Niger 1978:5).

Evidence, however, shows this not to be the case. Rural populations are not homogeneous--they are differentiated by age, sex, and socioeconomic and political standing. Development projects that failed to take this into account have often intensified already existing differentiations and in transformed these societies into ones where class plays a prominent role.

Increased stratification, elitism, and the unequal distribution of benefits are issues that have caught the interest of many researchers. Describing the effects of the introduction of irrigated rice in the Lake Aloatra Scheme in Madagascar, Dey notes, "The . . . scheme has in fact created a group of richer farmers dependent on migrant wage labour of men and women unable to survive on their small plots of unimproved (mainly rented) land" (1983, Annex 1:11-12). The results of an irrigated commercial rice project in the Senegal River Valley in Mauritania were similar since, traditionally, "land rights . . . [were] concentrated in the hands of relatively few men" (ibid., Annex 2:11), resulting in disputes over land allocation and a delay in the cultivation of the developed lands.

The result of the failure to take local differentiation into account can also be seen on the New Halfa Scheme. Although a land survey to provide a basis for tenancy distribution and the assignment of freehold lands was completed among the Halfawis of Wadi Halfa, such a survey was never carried out among the Arab pastoralists in the Butana, on part of whose land the Scheme was erected. Among them, tenancy allocation was left entirely to the native administration which comprised a hierarchy of tribal leaders and elders. Since fewer tenancies were available for distribution than the number of potentially eligible households, some were by necessity excluded. The process by which households were included involved the application of locally understood, nevertheless inequitable, value systems. Tenancy distribution was largely used by local leaders to expand their holdings, expand their support sphere, and reward allies and followers. Since the principle of one man/one tenancy had to be upheld, tenancies were often allocated to brothers, children, the elderly, the sick, those who were absent, and sometimes even to the dead. The unequal access to tenancy holdings led to the unequal distribution of Scheme benefits in the form of technology, inputs, and incomes, with the end result of increased socioeconomic differentiation among the pastoral nomads. Through somewhat different processes the Scheme has also functioned to increase socioeconomic differentiation among the Halfawi tenants (Salem-Murdock 1984).

Development planners cannot be deemed responsible for the elimination of social differentiation among rural populations; however, they "have a responsibility to ensure that public

finance should not be used to exaggerate income differences between different groups" (Carruthers 1983:44).

Indebtedness and Formal Credit

The unequal availability of formal credit, coupled with the very high cost of production and relatively low returns on river basin development schemes, contributes to further socioeconomic differentiation of households and increases social stratification. The situation is even more intense on small farms, where credit resources tend to be slim. In a discussion of the marketing system and credit in Kenya, Heyer observes:

> The provision of agricultural credit in Kenya is varied and uneven. There is differential access for small farms and large that runs through most of the marketing system. . . . Thus, about 75 per cent of short and medium-term credit extended in 1972 went on large farms. But if one includes long-term credit for land purchase, only 30 per cent of all credit went to large farms because settlement scheme smallholdings were so prominent in long-term lending. . . . The smallholdings outside the settlement schemes receive very little (1976:353-354).

Although credit is relatively abundant to large-scale river river basin development projects' participant farmers, the form, amount, and terms of credit highly vary in accordance with farmers' available resources. Credit, in the form of agricultural inputs usually provided by scheme administration, is extended, when available, to all participating farmers, since the success of the scheme itself will depend on the timely availability of improved seeds, herbicides, insecticides, mechanized ploughing and harvesting. Though required to pay labor and meet other essential costs, credit in the form of cash is less available. Usually provided by such finance institutions as agricultural and

commercial banks, it goes disproportionately to affluent farmers, who are considered better risks.

Although formal credit institutions discriminate against the poorest farmers--whether they are men or women--for a number of reasons, the latter are more often the object of that discrimination than the former. The most obvious reason for discrimination is women's diminished control over resources that are crucial to qualify for credit such as land and animals. Since access to credit is becoming more and more essential for increasing productivity, which in turn is necessary to qualify for additional credit, women are thrown into a "catch-22" situation that is becoming increasingly hard to escape:

> . . . the introduction of technology of whatever level of complexity implies a certain amount of capital investment. The characteristically inadequate resource condition of rural women thus places them in a disadvantageous position. Lacking the necessary financial resources they are from the outset excluded from any possibility of gaining the benefits of technology (Aklilu 1983:14).

The limited access to formal financial institutions of poor households in general, and women in particular, in the context of an increased need for cash to satisfy the ever-expanding requirements of modernized agriculture, drives those farmers to informal credit sources such as tribal elders, traders, money lenders, shopkeepers, affluent relatives and neighbors, or the <u>sheil</u> system (the payment for a crop in advance of its harvest), very common in the Sudan. Since informal credit tends to be short-term and costly, many farmers quickly find themselves deeply in debt, unable to retain their holdings. Smallholder indebtedness is frequently associated with land accumulation by affluent

largeholders, who are often the sources of credit that have brought about the demise of the small farmer.

The necessity to rely on informal sources of credit is not the only or even the major reason for poor farmers' indebtedness and the often resulting eventual less of control over land. High production costs (in the form of agricultural inputs provided by the parastatal) and low returns drive many farmers deeply into debt that accumulates year after year with devastating effects on both the farmers and the schemes themselves:

> The high cost of SAED services, the peasant farmers' low productivity, and their tendency, in the absence of subsistence crops, to consume much of their harvest themselves, combined with technical difficulties to draw the peasants ever deeper into debt. The year's debts often exceeded the cash value of the year's produce, and the debts accumulated from one year to the next; at the end of the 1969-70 season, unpaid debts averaged 20,000 CFA francs per hectare (Adams 1981:329).

On the New Halfa Scheme, tenants' 1972/1973 accumulated debt to the parastatal corporation in charge of scheme administration reached LS (Sudanese Pounds) 606,491, while the corporation's debt to the farmers reached LS 140,598 (Salem-Murdock 1984).

Position of Women/Division of Labor

As with accesss to credit, unequal distribution of benefits pertains not only to social stratification but also to sex differences. Development projects often ignore the position of women in project areas, with frequent adverse effects. The lack of involvement of women in development projects stems from false notions of household roles and functions. It is often assumed that any benefits that accrue to the household head, usually male, will benefit other members as well. Again and again

researchers have proved this is not usually the case. Men and women often have conflicting interests. Since the former are usually the stronger partners, socioeconomically, politically, and physically, women tend to be losers, as they are not in a position to protect their interests. Dey discusses women's unequal access to land in irrigated rice schemes in Sub-Saharan Africa:

> In many irrigated rice schemes development projects deliberately handed over the improved land to the male household heads even though in all these countries women had hitherto been exclusively responsible for rice cultivation and had often had independent rights to rice land. The projects did so on the assumption that the household forms a homogeneous unit and that women would automatically benefit from this land too. However, in no case did women benefit as much as the men and in some cases women actually lost some of their traditional land rights, with distressing consequences (1983:15).

Dey relates this "squeezing out of women phenomenon" in the rice schemes to the fact that as land is improved and its value increases, there is a tendency to move it from communal to private ownership. Although women are not the only ones to be squeezed out in this process, they tend to be the major losers since men "by virtue of their position as household heads, tend to extend personal control over the land. . . . Inheritance practices, whereby land passes from father to son, reinforce male control of land, often depriving even widows with young children to rights of access to adequate land" (ibid.).

Describing the impact of development projects on women should by no means imply that "women", as a category, are a homogeneous group. Like men, women are members of households with differential access to resources. In the New Halfa Scheme, for example, very few women, irrespective of their socioeconomic

backgrounds, were given the opportunity to participate actively in the Scheme. Different women, however, were impacted by the Scheme differentially. Although the pastoral Shukriya elite men have profited from their involvement in the Scheme, elite women do not seem to have profited as well. Nor do they appear to have lost as a result of their involvement. On the whole, these women were economically not very active before or after the Scheme. The poorest Shukriya women, on the other hand, seem to have gained the most. Being so poor, they were exempted from adhering to some of the restrictive norms that other women had to uphold. This allowed them to enter the wage labor market, an opportunity that was not available before the Scheme, and to get involved in petty commodity trade. The new roles seem to have functioned to raise the status of women in poor households. Women who belonged to middleground households (neither elite nor desperately poor) seem to have lost the most. These women, who were economically active in the pastoral society, with clear rights to animals and land, were rarely given tenancies on the Scheme. Following their husbands to the irrigated fields made it increasingly difficult to exercise any rights they might have to animals and land. This, combined with the new, near total dependency on men, might have functioned to decrease their social standing in the society. On the potential effects of women's decreased ability to generate independent income in Burkina Faso, Dey writes:

> Married women's loss of an independent and secure income has serious repercussions on the welfare of the family given the complementary obligations and related different patterns of expenditure of men and women. Both are expected to contribute different food items for the household and they each have important personal ceremonial

> obligations for which they are entirely responsible. It is well-known that in this Banfora region (as indeed among the Mandinka in the Gambia and Senegal) women spend a significantly higher proportion of their income on food, medicines, clothing and even school fees for their children than men do who spend relatively large amounts on themselves for such things as mobilettes, bicycles, beer or additional wives (1983: Annex 1:17).

Often planners fail to take the traditional division of labor and role of women into consideration. Although it is well-documented that women are the primary food producers in much of Africa*, agricultural projects are too often designed almost exclusively in terms of male heads of households. Men receive the land, technical and agricultural inputs, and credit. Women may receive little but increased burdens. Jennie Dey (1980) reports the impact of irrigated development projects on women in the Gambia. Although women in the project area grew rain-fed rice for home consumption while men grew groundnuts for cash, the new irrigated rice project was designed and implemented from a primarily male focus. In addition to their not receiving any direct benefits, the project decreased the area available to women for rain-fed rice cultivation and increased their work load, since men were no longer as able to help women clear their fields. Dey argues that productivity could have been much higher and costs lower had women been integrated into the project and offered credit, inputs, and technical assistance.

Jeanne Koopman Henn (1983) convincingly points out that some of Africa's food problems (e.g., rising cost of food imports; attempting to satisfy urban food needs) might be reduced if African female farmers were provided with technical assistance

that would decrease the amount of time they spend (on the average 10-12 hours daily) on food production and preparation. She says,

> the failure to recognize women's crucial roles in food production tends to produce interventions in the food sector, such as the development of state farms and the subsidization of capitalist agriculture, which can erode traditional farmers' ability to respond to the burgeoning urban demand for food and may well even threaten their efforts to adequately feed their families. Women farmers' particular problems must be addressed if African agriculture is to feed both the peasant and the cities (1983:1043).

Several researchers note that the reduction in the economic status of women in developing countries has in many instances led to a decline in their social status within households (Boserup 1970; Tinker and Bramsen 1976). In the introduction to Women and Work in Africa, Edna G. Bay states, "Again and again, field studies confirmed that . . . so-called development had lowered women's productivity relative to that of men. At the same time women's physical workload had been increased in an absolute sense" (1982:2). The concentration on cash crops in RBD schemes and the almost total exclusion of women from tenancies has also led to the evaluation of men's work in terms of cash while women's work continues largely to be evaluated in non-monetary terms (Salem-Murdock 1979). This often leads to reinforcing men's social position in households at the expense of that of women. The increased dependency of women on men might also have negative nutritional and health implications. Women's reduced ability to dispose of household resources is likely to affect the quality and quantity of foods available for their own and for their children's consumption.

Ethnicity

Since ethnic diversity and complexity are prominent features of African countries, and since African RBD usually involves the movement of large numbers of people, the likelihood that at least two major ethnic groups will be involved in any development project is great. In the Senegal River Basin, for example, approximately two million people divided into seven major ethnic groups are affected by RBD activities (USAID/OMVS 1982), while the New Halfa Scheme affects members of four major ethnic groups (who are themselves further segmented into a large number of tribes). This makes ethnic issues a vital question that should be incorporated in the design of any RBD project. In thinking about the ethnic composition of a river basin, planners should not restrict themselves to the traditional inhabitants of the region but should include all potential immigrants, who will be attracted to the basin either because of the project's need for labor skills not readily available in the region, or the need for cheap labor to perform the most humdrum agricultural tasks, like weeding. Sources of the two types of labor are likely to be different, ethnically and by class: skilled laborers are likely to come from ethnic groups with greater educational opportunities, which help them to acquire their labor skills; unskilled wage laborers, on the other hand, are likely to be landless peasants from underprivileged groups with little or no education, who are willing to work more hours, at more demanding jobs, and for less pay. The presence of two such labor classes, mixed in with the already ethnically and socioeconomically dif-

ferentiated traditional inhabitants, will tend to widen the gap between rich and poor and increase social stratification.

The ethnic issue is vital in at least two areas:

a. The assessment of the human resources of the river basin at the planning stage: ethnic groups are likely to differ in socioeconomic organization and will thereby be differentially affected by development.

b. Ethnic conflict is likely to occur in the new location, especially where people do not have established contacts with each other, as time is required before accommodating ethnic interaction strategies evolve. Conflicts are likely to increase if one or more of the groups is perceived as favored by the planners and the government (as has happened on the New Halfa Scheme between the "favored" Nubian relocatees and the Shukriya host).

Labor Availability and Shortages

Evaluations of development projects have often concluded that, at least partially, project failure was due to planners' false perceptions of labor availability and allocation of time and resources in the project area. Labor shortage is one of the severest problems that face development efforts. Hence, we need correctly to assess the labor situation in the area. Several questions arise. What is the division of labor by age, sex, ethnicity, and class? Is there a class of laborers in the area? Who works for whom?

One issue that planners often fail to consider is seasonal fluctuation in the availability of labor: projects are there-

fore designed with flawed notions of the local labor situation. During the dry season many African rural areas witness mass labor outflows to urban centers within the country or across boundaries. Since this is the time when feasibility studies and appraisal missions usually take place (Chambers 1979), planners are apt to assume that labor is not in short supply since rural areas can, at this time of the year, afford to export it. The opposite is more likely to be true. A correct assessment of the direction, time, and duration of migration is essential. On the Medjerda Irrigated Scheme in Tunisia, Vincent (1980) attributes the underutilization of water to a labor shortage, in turn attributed to three interrelated factors: the inadequacy of family labor resources; the non-competitiveness of seasonal agricultural wages compared to industrial wages received in nearby areas (e.g., Tunis); and the inability of most farmers to afford the cost of wage labor even at the low agricultural rates. Another reason he cites is competitive labor demands--Tunisian farmers migrated from the scheme in the peak irrigated agricultural season to grow cereal crops on their nearby rainfed lands. There is similar rainy season absenteeism on the New Halfa Scheme among sorghum-consuming Shukriya and other pastoralists (Salem-Murdock 1984).

In-migration is another dimension of the problem. Because of the periodicity of agricultural work and out-migration, virtually all large-scale irrigated schemes have periodic needs for labor beyond that which can be provided by tenant households. The schemes become magnets for persons from other areas--frequently from among the most underprivileged ethnic and class

groups. For example, tenancies on the New Halfa Scheme were allocated to the Arabic-speaking Shukriya and other populations indigenous to the Butana, and to Nubians relocated from Wadi Halfa. But intermittent wage labor employment on the sugar-cane plantation and on the tenancies is sought by Southern Sudanese, by persons migrating from drought-ridden areas to the west (like Kordofan and Darfur), and by Eritreans and other refugees from war-torn and drought-stricken Ethiopia. These people live in miserable camps and provide a perpetual labor reserve for the Scheme. Their political vulnerability--at least the Eritreans' and likely the Southerners'--dissuades them from organization that might raise wages and/or improve the conditions of their work and living.

Land Tenure and Land Use

Irrigated schemes, whether small- or large-scale, transform traditional land use systems by introducing new methods of cultivation, new crops, a new package of inputs, and most significantly, a new system of management. They also tend to disrupt established land tenure systems by introducing individualistic tenures that challenge joint land rights of households, thus negatively affecting cooperation in labor and finance. In a review of agricultural resettlement schemes, Palmer writes:

> In these schemes the most common system of land tenure is a simple one. Title to enough land to support one man and a modest family devolves upon the family head. This system comes into direct conflict with many traditional systems in which land is not owned by the individual, but is managed by the extended family whose elders adjust rights in land according to domestic and demographic cycles (1979:161).

The land tenure/land use issue has important socioeconomic implications in the river basin development context, especially as it relates to such less privileged users as poor tenants and women, since a person's position vis-avis the land will affect his/her status within the household and the community, as well as access to credit, marketing, technology, provision of inputs, extension, and different farmers' organizations, such as cooperatives and unions.

As we have argued in the section on the division of labor, African women traditionally tend to have open access to land, as they are the prime food producers for the household at large. Since most development projects are designed and implemented in terms of male heads of households, women's access to land tends to be minimized. Restricted access to irrigated lands in turn restricts their access to inputs, technology, credit, and other services that are introduced as part of the irrigation package. Even where men and women grow the same crops but on different lands--men on the improved irrigated fields and women on increasingly less productive plots--services are largely geared towards the males. In a discussion of women in rice farming systems, Dey writes:

> Ironically a range of technologies does exist which would greatly reduce labour time and energy used for women's work, increase their productivity and minimize drudgery, thus improving their own and their babies' health and the general welfare of their families. However, strikingly few have actually been introduced to women because of the bias towards men which most development projects have.
>
> The most obvious agricultural technologies are the use of tractors for land preparation in the swamps and irrigated schemes . . . and for haulage of crops, seeds, fertilizers, manure, wood fuel and household water supplies. . . . Sickles and threshing machines have been introduced into

> some countries (for example, the Gambia) for the men's irrigated rice but have not been made available to the women despite the fact that rice is a traditional women's crop (1983:15).

Intervening in traditional land tenure systems is not necessarily counterproductive. RBD projects can serve as an opportunity to introduce some measures of land reform and new land tenure systems that would assure equitable distribution of land among farmers, and perhaps improve women's access to land. It is very important, however, not to start from the assumption that traditional land tenure and land use systems are discriminatory and unfair and therefore need to be transformed. On the contrary, with minor adjustments and modifications, traditional systems might be well suited to developing viable alternatives to packaged solutions. Discussing peasant initiative in the Bakel area in the Senegal River Valley, Adrian Adams (1981) describes a villager's attempt to improve productivity of traditional crops and to introduce market gardening in his area. The attempt was very successful, since it was totally based on village initiative. Although the idea of collective farming was initially somewhat suspect, it was quickly adopted by other villagers as it did not drastically depart from traditional tenure, it dealt with crops they consumed and knew how to grow, and it proved successful:

> It seems that the hardest task, in that first year, was to convince the people of the river-bank villages that it was both possible and desirable for them to undertake agricultural improvements on a collective basis. More people in Jamaane joined the initial group; by early 1975, it had 270 members, 200 men and 70 women, and had organised as an association, designating as chairman the man who started the group. Soon after the French technician's arrival, he and the Jamaane chairman had visited neighbouring villages, to explain what was planned and encourage them to take part . . . . By mid-1975, groups had been formed in all the

villages along the river, from Balou, near the Mali border, to Mouderi (ibid. 333-334).

It did not take SAED long to want to incorporate these Bakel villagers' achievements within the large parastatal. The area was soon visited by the Director of SAED and the Minister of Rural Development, as well as by a USAID team. The USAID visit resulted in a 14 million CFA franc ($60,000) donation for equipment purchase. Problems developed between the village associations and SAED officials because the villagers felt that what SAED advocated departed drastically from what they really wanted. They indicated they were not against the technology that SAED was introducing; they were, however, very much against SAED's control over what and where to grow crops and how to grow them. As usual, the parastatal won, and the Bakel region was incorporated into SAED. On the effect of that incorporation Adams comments:

> The peasants, we are told, are grateful. "Many times we have observed their commitment, which borders upon fervour. [A peasant woman] told us how SAED's action among the peasants was appreciated. A young schoolboy also expressed his gratitude." But peasants as producers are invisible; they don't exist. Machinery is progress; peasants can only become worthy of machinery, hence progress, by long training. It is the 400 permanent SAED technicians, not the 30,000 peasants involved in SAED schemes, who do the work. . . . The idea that agricultural development is something which is imposed from without upon a passive peasantry is linked in the article with the assumption that the only suitable crops for development are those for which urban consumers in Senegal acquired a taste during the colonial era--rice, tomatoes, wheat; not the crops grown by Senegalese peasants for their own use. The only such crop mentioned is sorghum; and it is mentioned only because a new experimental variety is being tested in SAED's laboratories. The negation of peasants as consumers matches their negation as producers (ibid. 343-344).

To bring about equitable and sustainable change, we need first to know who owns and controls the land. Who has access to lands of different kinds? What are the conditions under which

this access is maintained? What impact do present land tenure systems have on agricultural productivity? Does field location make a difference in land use decisions and why? Is there a correlation between access to land and crop selection? Will the new land tenure systems come into direct conflict with traditional tenure? If so, how will that affect project sustainability? Is there anything that could be done at the planning stage to avoid or minimize potential conflicts? Examination of tenure should include not only agricultural land, but also pasture, forests, and water rights.

Conflicts arose on the New Halfa Scheme, for example, because, although the Sudanese government recognized the land rights of the Nubian relocatees, it paid little attention to the rainfed agriculture and grazing rights of the Shukriya. From the government's viewpoint Shukriya land was unregistered and therefore public. The Shukriya understanding of the traditional law, however, did not coincide with the government's, and their sense of being unfairly treated did not contribute to amiable relationships between them and the Nubians despite initial expressions of good will on both sides.

Settlement/Resettlement

Since RBD projects involve population movement from the river basin, into the river basin, or sometimes both, the settlement/resettlement issue becomes vital. Despite its importance, the settlement component of RBD projects is often understated or treated in isolation from the dam construction component, which receives primary attention. According to Lightfoot, referring to

Thailand, dam construction and settlement are rarely considered as parts of the same process. Among eleven externally funded dam projects that he investigated, involving 23,324 households, responsibility for the design, implementation, and funding of the settlement component fell to the host government in all but one.

> Resettlement plans have been drawn up independently of the overall agreement to build the dams, without any contractual requirement that internationally recognized goals and standards be adopted or that strategies and cost estimates be scrutinized at any stage by impartial outside specialists (1981:97).

This is not to underestimate the importance and desirability of host government participation in development efforts but to emphasize that settlement is an integral part of an RBD project effort and should be treated as such. Lightfoot notes:

> International funding agencies [referring to USAID and the World Bank] have required resettlement plans in respect of only two of the dam projects. . . . However, in neither case did the funding agency institute effective checks on the implementation of the respective plans (1981:98).

The settlement issue has several important dimensions:

1. Multi-dimensional stress associated with forced relocation. Using African examples, Thayer Scudder (1976) identifies physiological, psychological, and sociological stresses that accompany forced relocation in connection with RBD, and endure for a minimum of two years, but usually last much longer. This period is associated with increased morbidity and mortality, reduced effectiveness of local leadership, reduction in the diversity of sociocultural systems, risk aversion, and a clinging to old and familiar social organizations and traditional practices. Since relocatees are likely to be very dependent

during this difficult stage, planners should aim at achieving the delicate balance of giving them sufficient support to enable them to get through this period without encouraging long-term dependency on outsiders.

2. The compensation/host populations question. Two interlinked consequences stem from population relocation (whether forced or voluntary): (a) compensation/development for those who move, and (b) effects of that movement and compensation/development on the host population. Governments often compensate settlers, especially those with political clout, for lands and possessions lost in relocation, and offer them a variety of services in their new homes. Little benefit may be received, however, by the peoples who already occupy the land identified for resettlement and development, especially where their rights of tenure are not officially recognized. As a consequence, the potential for conflict between the settlers and their hosts is exacerbated, and may be especially intensified where the two groups are ethnically segmented. We see a clear example of this on the New Halfa Scheme in the Sudan between the relocated Nubians and the host Shukriya, with the latter resenting the planned villages, electricity, piped water, and freehold fields accorded the Nubians, whose homes and lands in Wadi Halfa were inundated by the reservoir behind the Aswan High Dam (Salem-Murdock 1979, 1984).

Rural-Urban Linkages and Functions

The immense size of irrigated schemes and the very high cost per settler household are attributes that distinguish river basin

development projects from the average, small-scale development effort in the rainfed sector. Frequently, their influence goes far beyond both the scheme boundaries and the project's stated agricultural objectives. For example, river basin development schemes usually include at least one large town that is not only the political and administrative center of the scheme but is also the locus of multiple economic activities, a considerable portion of which are likely not to be directly related to agriculture. Another attribute is that in addition to the sizable non-tenant agricultural labor population that such schemes support, they tend to attract numerous non-agriculturalists as well. For example, besides the very large tenant population that the New Halfa Agricultural Scheme supports, thousands of nonfarm employees work at the New Halfa Agricultural Corporation--the parastatal in charge of scheme administration--and in other government offices; in the different agro-industries, such as the cotton ginning and sugar factories and the flour mills; and in trade. On any day in the the New Halfa market, hundreds of small farmers, traders, butchers, and artisans sell their wares. In addition, there are hundreds of merchants who operate shops, coffee houses, and hotels in town. Although not necessarily anticipated at the design stage of the project, similar situations obtain on all large-scale settlement schemes. Considering the large number of people supported and the large volume of income generated from these activities, their integration in the design stage is likely to make their contribution to regional development even more dramatic. Planners should pay close attention to such issues as employment generation, incentives and policies needed to attract

commercial and industrial enterprises to the area, and rural-urban linkages and functions. This should enable us to predict the incentives that would attract and speed up the growth of private sector enterprises, and consequently generate more non-farm employment both on and off-scheme (Scudder 1981).

NOTE

* The United Nation's Handbook on Women (1975) shows that on average, women in all African countries do more work than men in the areas of hoeing and weeding (70%), harvesting (60%), crop transportation from field to home (80%), crop storage (80%), marketing (60%), planting (50%), and caring for domestic animals (50%). An FAO time allocation survey, which was conducted in two Banda villages of the Ouaka cotton area in the Central African Republic more than 20 years ago, shows similar results (FAO 1983). The two villages "had been chosen to represent two diametrically opposed situations in relation to modernization: Pouyamba as an almost untouched and traditional village, far from channels of communication, and Madomale, well-situated on a main road, proud of signs of modernization both in daily life patterns and agricultural techniques" (ibid.:3). The survey concludes:

> . . . Leaving aside long absences or illnesses, women work on average eight hours a day, men five hours and a half. . . Domestic tasks, negligible for men, occupy more than three hours and a half of a woman's day. In addition, women's time devoted to agricultural activities is equal--in the "traditional" Pouyamba village, or greater in the "advanced" village of Madomale--to men's.
>
> More precisely, they spend a comparable time on cotton cultivation--the same two hours in Madomale, and only eighteen minutes less than men in Pouyamba--but time devoted by women to food production represents one time and a half in Pouyamba and four times in Madomale the time men spend in such a non-cash cultivation. An indication, maybe, that money earned on cotton does not go to food purchases . . . and surely, that women provide most of the household food supply (ibid.:5).

REFERENCES CITED

Adams, Adrian
1981 The Senegal River Valley. In Rural Development in Tropical Africa. Judith Heyer, Pepe Roberts, and Gavin Williams, eds. London: MacMillan. Pp. 325-353.

Aklilu, Delawit, A.
1983 Appropriate Technology for Women in Food Production. Expert Consultation on Women in Food Production. Rome: Food and Agricultural Organization of the United Nations.

Bay, Edna G., ed.
1982 Women and Work in Africa. Boulder, Colorado: Westview Press.

Boserup, Ester
1970 Women's Role in Economic Development. New York: St. Martin's Press.

Carruthers, Ian
1983 Irrigation Development: Implications of Recent Experience for Aid Policy. In Aid for the Development of Irrigation. Ian Carruthers, ed. Paris: Organization for Economic Co-operation and Development.

1978 Contentious Issues in Planning Irrigation Schemes. Water Supply & Management. Vol. 2, Pp. 301-308.

Chambers, Robert
1979 Rural Development Tourism: Poverty Unperceived. A conference on Rapid Assessment Appraisal held at the Institute of Development Studies. University of Sussex.

Dey, Jennie
1980 Women and Rice in the Gambia: The Impact of Irrigated Rice Development Projects on the Farming Systems. Unpublished Ph.D. Dissertation, University of Reading, United Kingdom.

1983 Women in Rice Farming Systems with a Focus on Africa. Expert Consultation on Women in Food Production. Rome: Food and Agriculture Organization of the United Nations. With 2 annexes.

Food and Agriculture Organization/Food Policy and Nutrition Division
1983 Time Allocation Survey: A Tool for Anthropologists, Economists and Nutritionists. Expert Consultation on Women in Food Production.

Gallais, J.
1967 Le Delta interieur du Niger: Etude de géographie regional. 2 vols. Dakar: Institut Fondamental d'Afrique Noire.

Henn, Jeanne Koopman
1983 Feeding the Cities and Feeding the Peasants: What Role for Africa's Women Farmers? World Development. Vol. 11, No. 12. Pp. 1043-1055.

Heyer, Judith
1976 The Marketing System. In Agricultural Development in Kenya: An Economic Assessment. Judith Heyer, J. K. Maitha, and W. M. Senga, eds. Oxford: Oxford University Press. Pp. 313-363.

Horowitz, Michael
1980 Kagera Basin Multi-Donor Multi-Disciplinary Mission. Social Analysis. Binghamton, N.Y.: Institute for Development Anthropology.

Horowitz, Michael and Kamal Badi
1981 Sudan: Introduction of Forestry in Grazing Systems. Forestry for Local Community Development Programme GCP/INT/347/SWE. Rome: Food and Agriculture Organization of the United Nations.

Hughes, Charles C. and John M. Hunter
1972 The Role of Technological Development in Promoting Disease in Africa. In The Careless Technology: Ecology and International Development. M. T. Farvar and John P. Milton, eds. Garden City, New York: The Natural History Press. Pp. 69-101.

Koenig, D.
1983 Monitoring Plan for Manantali Resettlement Project Paper. Binghamton: Institute for Development Anthropology.

Lightfoot, R. P.
1981 Problems of Resettlement in the Development of River Basins In Thailand. In River Basin Planning: Theory and Practice. S. Saha and C. J. Barrow, eds. New York: John Wiley & Sons. Pp. 93-114.

Palmer, Gary B.
1979 The Agricultural Resettlement Scheme: A Review of Cases and Theories. In Bernardo Berdichewsky, ed. Anthropology and Social Change in Rural Areas. New York: Mouton Publishers. Pp. 149-183.

Salem-Murdock, M.
1979 The Impact of Agricultural Development on a Pastoral Society: The Shukriya of Eastern Sudan. Agency for International Development.

1984 Nubian Farmers and Arab Herders in Irrigated Agriculture in the Sudan: From Domestic to Commodity Production. Unpublished Ph.D. Dissertation, SUNY-Binghamton, New York.

Scudder, T.
1976 Social Impacts of River Basin Development on Local Populations in River Basin Development: Politics and Planning. Proceedings of the United Nations Inter-Regional Basin and Inter-Basin Development. 1. Budapest: Institute for Hydraulic Documentation and Education. Pp. 45-52.

1980 River-Basin Development and Local Initiative in African Savanna Environments. In Human Ecology in Savanna Environments. David R. Harris, ed. London: Academic Press, Inc. Pp. 383-405.

1981 The Development Potential of New Lands Settlement in the Tropics and Subtropics: A Global State-of-the-Art Evaluation with Specific Emphasis on Policy Implications. Binghamton, N.Y.: Institute for Development Anthropology.

Slattery, John B.
1979 Socio-economic Adjustments to Intensive Agriculture in the Tungabhadra Irrigation Project, Mysore State, India. Anthropology and Social Change in Rural Areas. New York: Mouton Publishers. Pp. 195-211.

Tinker, Irene and Michele Do Bramsen, eds.
1976 Women and World Development. Washington D.C.: Overseas Development Council.

United Nations
1975 United Nations Handbook on Women. New York: United Nations.

USAID/Niger
1978 Country Development Strategy Statement.

USAID/OMVS
1982 Integrated Development Project. Social Analysis. Vol. 2. Section 2. Dakar, Senegal: USAID.

Vincent, Linden
1980 Irrigated Farming: Debt or Profit? Underutilization of Water in the Medjerda Scheme, Tunisia. Development Studies Discussion Paper No. 69. East Anglia University.

World Bank
1978 Agricultural Land Settlement Issue Paper.

CHAPTER EIGHT

The Institutional Aspects of African River Basin Development

by

Barbara P. Thomas

and

David Brokensha

Although the technological capacities for designing water management systems may be excellent, achieving effective management which is economically efficient, socially equitable, and ecologically sound is often problematic. Several years ago an FAO report noted that successful irrigation development is as much a matter of the institutions developed for operation and administration as of the engineering for construction and design (Teelaff, 1977:3). More recently, one analyst suggests that "the human dimension is the most difficult part of a scheme - construction of dams is relatively simple in comparison" (Watt. 1981, p. 182.).

This paper focuses on the "human dimension," from the perspective of institutional issues arising at the national level and at the local level. The scale of river basins in Africa means that the major institutions that will be responsible for development must operate at the national level often with strong international linkages; but the scale also dictates that if development is going to be effective in terms of cost and efficiency, there must be an effort to involve the people affected in planning, making decisions,

managing, and evaluating their own development projects. The purpose of this paper is to explore several critical issues concerning institutional structures at both the national and local levels and their effectiveness in African river basin development.

A. Issues arising at the national level

1. Sustaining cooperative relations among nations sharing a river basin.

In Africa 57 river or lake basins are shared by two or more countries (Biswas, 1983). In fact, five rivers or lakes in Africa are shared by six or more nations. These include the Niger (ten countries), the Nile (nine countries), the Zaire River (nine countries), the Zambezi (eight countries), and Lake Chad which is shared by six nations. In any part of the world, the sharing of water resources is likekly to be a complex and competitive relationship fraught with a variety of tensions. This is particularly true in Africa because of the historical, colonial context in which most national boundaries were established. The colonial powers created states with irrational boundaries, often cutting across ethnic, linguistic, religious, or ecologically sound lines. This fragmentation has led to political fragility in which the processes of building new institutions and achieving national integration have sometimes been quite difficult. Sensitive to the centrifugal pulls and the numerous cleavages within African states, the Organization of African Unity has unreservedly supported the

principles of sovereignty of all member states, non-interference in the internal affairs of states, and respect for the sovereignty and territorial integrity of each state.

It follows, however, in terms of river basin development that there is a heightened potential for conflict among those nations sharing water resources. For example, in the Senegal River Basin, Mali is particularly interested in the benefits of power and navigation; Mauritania is especially interested in the irrigation potential and Senegal in development of the basin for both power and irrigation.

Not only are there differing political systems, varying administrative capabilities, differing orientations to development, and disparate levels of participation within these nations, but there are other potential sources of conflict characteristic of the African socioeconomic environment. Within a single river basin, land tenure rights may vary widely, with traditional communal rights operative in some instances and private, freehold in others. People from one nation may consider that they have rights to land in another, and these rights may be complicated not only by national land policies, but by river basin development plans. The movement of migrant laborers, as well as the movement of herders and their livestock in seasonal or annual patterns to find forage and water can also complicate efforts to cooperate internationally for development purposes. In the Niger River Basin, for example, the land and water use systems are not only complex but they are

intricately inter-related with complementary economic roles undertaken by farmers and pastoralists (Reyna, 1983:3). Planners must be aware of these complexities which involve livelihood patterns unrelated to national boundaries and vastly complicating efforts to implement large-scale irrigated agriculture. Moreover, in a region in which drought recurs regularly, disputes over access to and use of water during drought periods can be anticipated. For example, Watt suggests such disputes are almost certain in the case of the Manantali dam (Watt, 1981:174).

Given the likelihood that national differences over river basin policy and management will exist, two considerations are important:

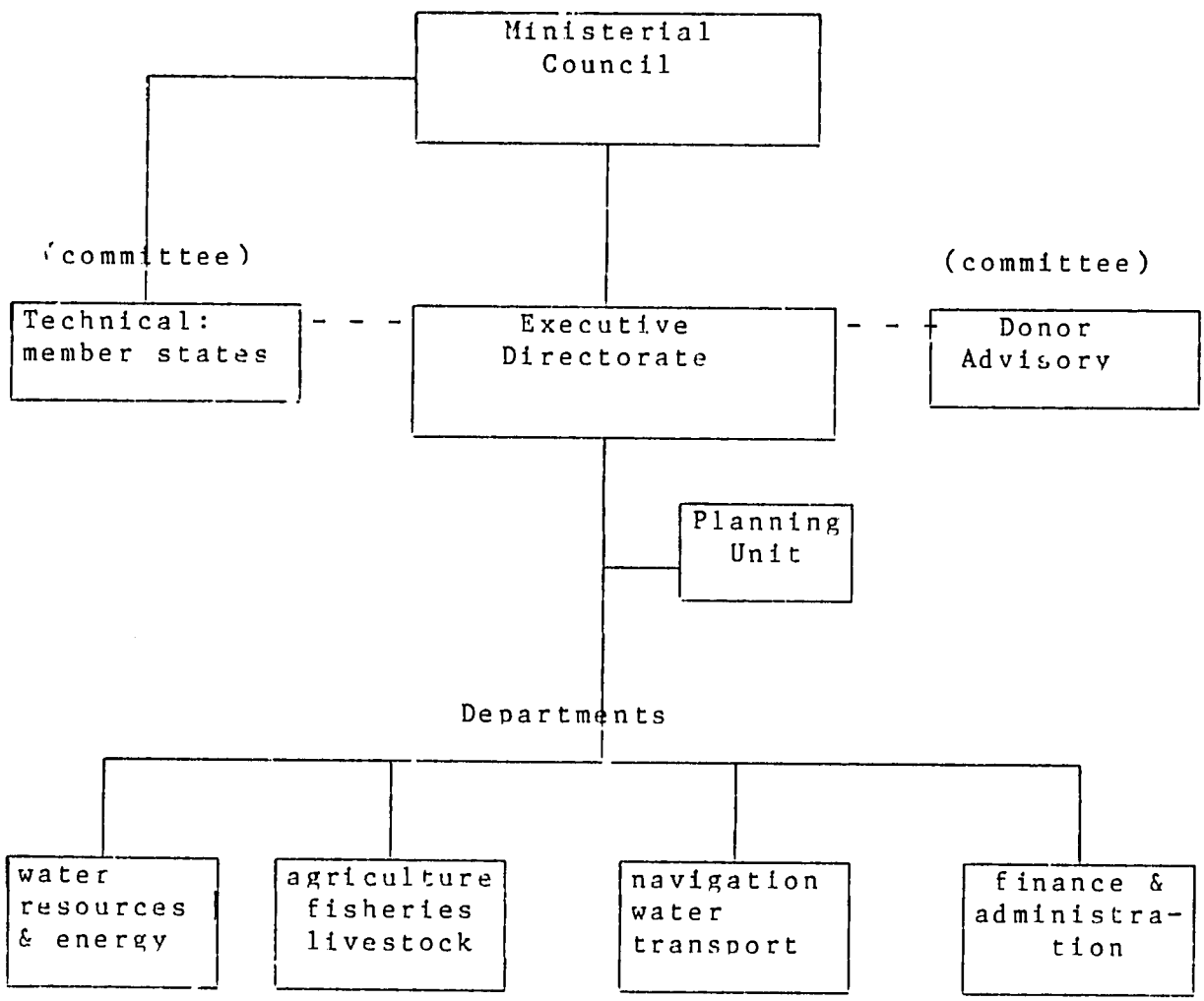
(a) the structure of the authority;

(b) the guidelines and processes established for resolution of conflict.

The structure of the authority must facilitate coordination among member states at several levels - political, technical, and administrative. Since only the authority can plan for the entire river basin system, it should have a strong planning capacity. In several instances planning units have been deficient. It has been noted that the Niger River Basin Authority initially had an inadequate planning capability and that much of the planning for the Senegal River Basin has been on the basis of very limited information or data. Fig.1 depicts a model of an international river basin authority which specifically incorporates both the coordinating function and the special planning structures.

FIGURE 4

A MODEL FOR RIVER BASIN AUTHORITY ORGANIZATIONAL STRUCTURE



Adapted from the organizational structure of the River Niger Commission

- - - coordination

_____ line of direct authority

Principles commonly established for resolving conflict include: (1) observing the community of interest of all the parties in the use of the river; and (2) excluding preferential privilege of any riparian state in relation to others, thereby assuring a reasonable and equitable share in the benfits of the water (Utton, p. 5). Cooperation involves good faith, equality, and reciprocity with each nation sensitive not only to its own interests but to those of the collective basin community. Often the key national leaders of co-riparian state are in substantial agreement on broad goals. In addition, technical experts usually agree on a wide range of technical decisions pertaining to basin development. Inbetween these two sets of actors are those who implement policy on a national or subnational level where benefits are distributed and where perception of "wins" and "losses" vary. At this level agreement on specific policies and their implementation across national borders may be difficult to obtain. Carefully designed structures, as well as procedures for conflict resolution, are important to this process.

While principles concerning equitable use, consultation, non-injury, and non-discrimination in regard to shared water resources may be respected, guidelines and a process for settling disputes arising in any scheme should be established. A large basin with several co-riparian states offers ample opportunity for interests to diverge. For example, Reyna (1983:26) points out that development along the Niger has been a national affair with Mali's Selinque Dam,

Nigeria's Kainji and Jebba Dams, and numerous other schemes of member states, all of which affect activities in other parts of the river system. Integrated river basin planning in an environment which emphasizes the mutual interests of nations in developing their shared water resource should facilitate resolution of conflict. Given its colonial background, the origins of national boundaries, and complex socioeconomic systems, the African setting is likely to make such resolution a particular challenge.

2. Finding the effective locus of power and responsibility between a river basin authority and existing national agencies

Whether the river basin authority is a national parastatal or an international authority, the potential exists for an adversarial relationship between the authority and existing national agencies. The authority is perceived by ministries or departments within the government as a competitor for resources and power. The authority and national institutions are then set up in a zero sum game in which the one's loss is the other's gain. Such a perception is divisive and potentially harmful. Project activities must support the relevant national agencies and must provide sufficient benefits that the project is not regarded as something to be ignored, undermined, or destroyed.

When possible, existing agencies should be used to manage river basin development in order to avoid unnecessary duplication of function as well as potential hostility between the authority and

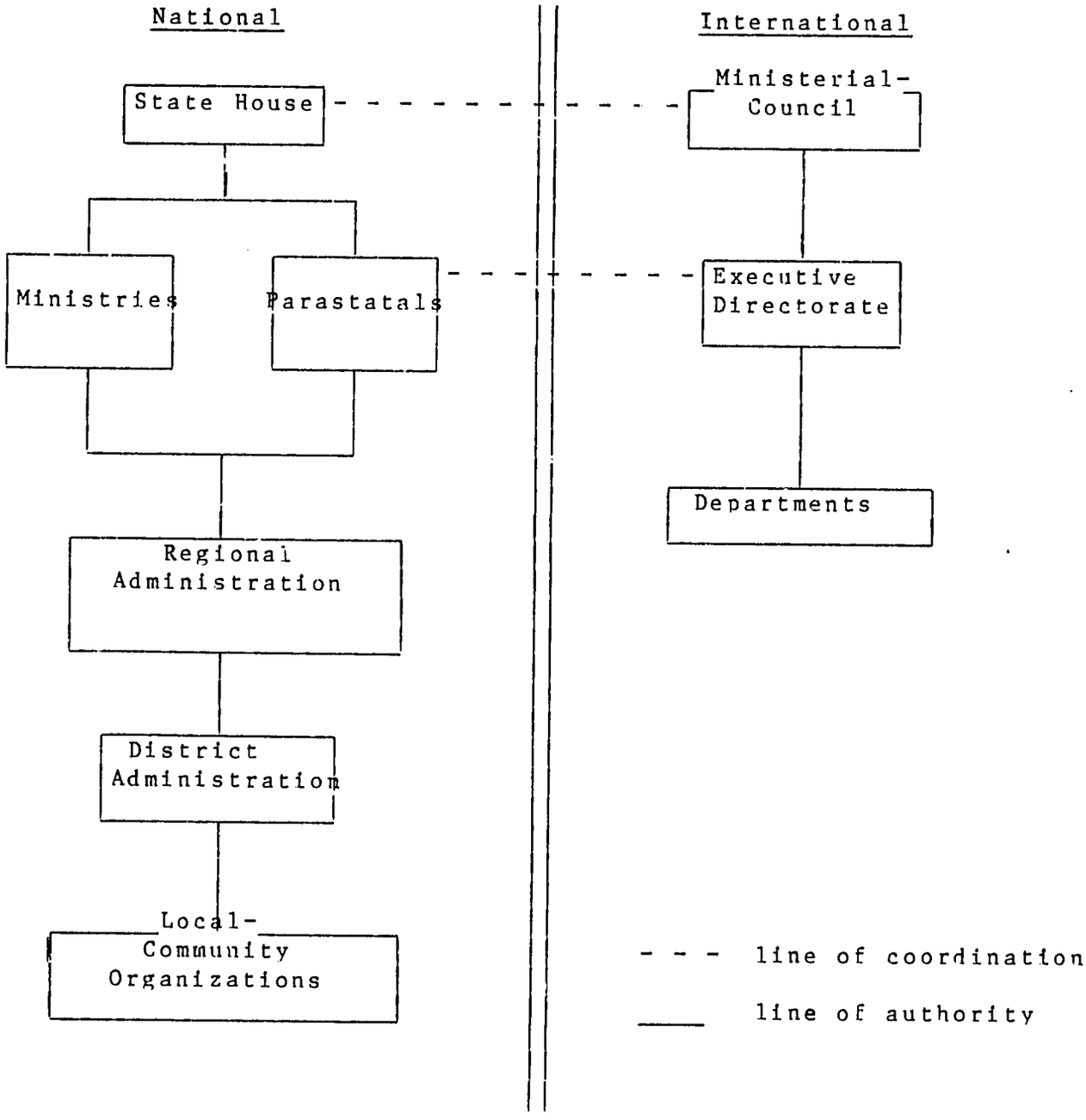
the agency. The UNDP's final mission report on the Development of the Gambia River Basin urges emphatically, "To the maximum extent possible, the national, regional, and parastatal agencies developed by the participating countries should be used for planning, executing and operating the projects" (UNDP, 1980:38).

Nevertheless, the ease of working through national agencies varies according to their character and their competence. Numerous problems may exist. There may be scarce resources and limited skilled personnel in those agencies. In Senegal's SAED (The Societe d'Amenagement et d'Explolitation des Terres du Delta et de la Vallee du Fleuve Senegal), according to a 1982 analysis of the OMVS countries, there is a shortage of qualified personnel (USAID/OMVS, Institutional Analysis, 1982:51). Mauritania's SONADER is characterized by staffing and training problems of a sort encountered in many bureaucracies (USAID/OMVS, 1982:32). The potential of existing national institutions for meeting the needs of river basin development must be assessed on a case by case basis to adjust the appropriate mix of planning, coodinating, supervisory, and operating responsibilities accorded to them as the relationship between the authority and national agencies evolves. Fig. 2 depicts potential institutional links between an international authority and national institutions operating down to the local level. Of particular importance, though not shown in the diagram, is facilitating a two-way flow of information.

FIGURE 5

River Basin Planning: Conceptualizing the Institutional Links

Across National Boundaries



3. Relations between Donors and Riparian States.

a. Finding the fit between donor and project needs

A number of issues arise in the process of meshing donor requirements and those of the river basin project. In a costly and complicated undertaking in which more than one donor is participating, there is considerable potential for friction between donors and national representatives. Multi-donor groups may present special difficulties. Each donor group may have a different set of objectives, different sets of criteria for evaluating development projects and different internal requirements for reporting, accounting procedures and decision-making. Moreover, both basin countries and individual donors may be protective of their autonomy and see themselves in a competitive as opposed to cooperative stance vis-a-vis the other groups. The Final Mission report of the UNDP on "Development of the Gambia River Basin" explores some of these difficulties. In the case of Gambia, some donors gave the "unmistakeable impression" that they preferred a bilateral aid program directed toward the individual basin government (UNDP, 1980:11).

On the other hand, bilateral aid for river basin development poses a different set of problems. Separate donor initiatives in which bilateral aid is given to a single nation within a river basin can result in piecemeal, uncoordinated development efforts. Analyses of the Niger River Basin point to some of the problems of bilateral funding and the difficulties involved in coordinating

various donor efforts. Aid may be further complicated by internal divisions within the ranks of donor institutions. For example, discussions of the Senegal River Basin donor efforts reveal differing strategies reflected by AID/OMVS and the US AID missions to separate countries. Moreover, private voluntary agencies working in the region reflect yet another perspective on development issues. The Senegal River Basin studies suggest that there has been some confusion caused by conflicting objectives of PVO's of different national origin (USAID/OMVS, 1982).

b) Recurrent Costs

While it is important to avoid creating long-term dependency of recipient countries on donors, the scale and magnitude of river basin projects inevitably require secure, long-term funding. Irrational and erratic provision of support can only diminish their viability and effectiveness. Donors sometimes finance construction of development projects but make inadequate provision for the funding of subsequent maintenance. Donor preference for large, capital and import intensive projects which are relatively quick to implement, easy to monitor, and suitable for cost-benefit analysis is well documented (Korten, 1980). When, as often happens, host countries lack funds for this purpose, the project deteriorates. In a recent study, Biswas emphasizes that the main problem in large-scale water development schemes has been water management, with insufficient provision for operations and maintenance (The Ecologist, 1984). Up front capitalization is not

enough. There must be a commitment to assuring that recurring costs will be covered. Donors may "pack up" their technical assistance teams, but they should not consider the job complete unless there is assurance of long-term finance, and the mobilization of necessary resources, whether human, technical, administrative, bio-physical, national, or international to enable the project to function effectively.

4. operationalizing effective management techniques: top down

a. Policies

On a global basis, agriculture is the largest user of water. Given recurring drought in Africa, as well as the continent's current crisis in food production, an increase in irrigated agriculture is a major objective of river basin development. Yet, 57 percent of total water withdrawn for irrigation purposes throughout the world is lost in the process. Biswas points out that "one of the most inefficient aspects of existing irrigation systems is often the section where water is transferred from canal outlets to farms. It has almost become a no-man's land due to undefined responsibility, which in turn contributes initially to improper design and later to unsatisfactory operation and maintenance" (Biswas in Zaman, 1983:18). Thus, the individual farmer is a critical link in the effective management of river basin development, and he or she must be brought into that system in ways which use his capabilities and provide him with the

necessary skills and tools. Yet there is often a conflict between national and individual or household goals. This conflict may arise, for example, in pricing policies with a government keeping the price of food commodities low in order to "stretch" the wages of a poor urban population. It may also be reflected in policies demonstrating biases against women farmers in terms of land ownership or access to resources such as credit. Sometimes a farmer is caught up in ecologically disastrous efforts to cultivate marginal lands, an activity essential to the household but detrimental to broader environmental and ecological concerns.

b. Extension and Training

One of the key problems is that irrigated water management requires a technology and social organization not often found in traditional dryland or flood recession cultivation (Watt, 1981, p. 181). That is, there are technical and organizational changes required by irrigation. Farmers, therefore, need effective agricultural extension and training in water management in ways which are sensitive to traditional livelihood systems and which link them effectively with the services and opportunities available. One factor often overlooked is that in many Sub-Saharan African countries women are responsible for growing most of the food crops. They do so with the simplest of technologies - the hoe - with virtually no access to the modern inputs which would improve productivity. Any river basin scheme in a region in which women are the primary agriculturalists must be attentive to the ways in which

technolgy, services, and skills are made available to women farmers (Henn, 1984; Dey, 1980).

Assuring that these technical skills and organizational skills are introduced is an important management function. It requires open lines of communication with information flowing in both directions. It suggests a need for social data as well as physical data in the planning, implementation and evaluation processes. It also suggests the relevance of appropriate incentives for achieving community and individual farmer support, whether these incentives are in the form of favorable pricing policies, subsidized inputs, or other benefits. The introduction of effective water management techniques at the level of the individual farm will not only facilitate farmer effectiveness in agricultural production, but will also go a long way toward assuring that the objectives of the river basin development scheme are met.

B. Issues arising at the local level

1. involving local residents in development projects

In the previous section some top-down approaches to increasing management effectiveness were discussed. At the local level, however, it is important to reverse the flow and look at issues from a "bottom up" perspective. Particularly important are issues of accountability and responsibility. "Where the organization reaches down to local levels, is accountable to local people, and is involved with rural development, it has been found that the objectives of rural development have been more successfully accomplished" (Johnston and Clark, 1982:155). This statement is typical of the findings of many individuals and groups that have recently done extensive studies of rural development and its constraints. There is, on the one hand, a growing recognition that, as the Berg report stated, most large-scale, government-operated projects have dismal records; on the other hand, there is an increasing awareness that indigenous institutions, perceptions and knowledge constitute both a valuable resource, and an indispensible foundation for any proposed development (World Bank, 1981). Other analyses which have come to a similar conclusion include: DAI, 1976, in an examination of a series of development projects supported by AID; the HIID survey of cooperative agreements, 1983; much of the current farming systems research; and a series of studies inquiring into indigenous knowledge and institutions. Underhill (1984) quotes a 1982 World Bank report that stresses "the need to build up

farmers' organizations from the start, and to encourage participation in design and management." Thayer Scudder adds formidable endorsement of this view in his comprehensive studies in several fields including settlement, fisheries, and river basin development itself.

The consensus is that local communities have shown themselves to be flexible and adaptable, possessing an unrivalled knowledge of their environment and its possibilities; local people usually show considerable entrepreneurial skills, and the ability to establish themselves in new niches; the literature on African fisheries, for example, shows how fishermen are always seeking new opportunities. For example, innovations such as improved nets, or motor canoes, are quickly adopted by those who can afford them. In a recent paper, "Putting People First," Michael Cernea of the World Bank, insists that carrying out this maxim is indeed cost effective (Cernea, 1984).

None of the proponents of local ways and institutions has claimed that local ways are invariably appropriate for present circumstances, nor that local institutions can manage on their own without outside assistance from the government or other agencies. Indeed, the major aim of this section of the paper is to explore ways of <u>linking the two indispensible parts of the development process - the local and the national level</u>. In saying this we have to recognize that the linkages are bound to be asymmetrical, as there are many areas where national institutions must have

precedence. In thinking of local participation in river basin development, we should be emphasizing productive activities, particularly the management of natural resources, of soil and crops, range and water, fish - and also of the associated resources of land, labor, and capital.

In looking at the history of the management of natural resources at the local level in Africa, a fairly consistent picture emerges in whatever sector one chooses. In fisheries, for example, there used to be, in most areas, some system of limited access; men gained fishing rights either through membership of a localized kinship group, or, if they were outsiders, by payment of tribute to the chief or elders of the controlling group. There was usually some sort of system of sanctions to ensure that the resource was not over-exploited, whether this was done by deliberate or incidental means. More recently both colonial and the independent governments have encouraged, either explicitly, or (more often) implicitly, commercialization of fish and other natural resources, and also have supported individual as opposed to communal rights and responsibilities. The result has been that access to the commons has been expanded, that old sanctions have become ineffective, and that the state has not developed alternative agencies to manage the resources effectively. A further result has often been that in the process of commercialization, a small number of people have emerged as rural elites, while there has been a growing marginalization of the poor and landless, and of those without rights or access to resources.

2. Participation by whom?

This is a key question that needs to be addressed in terms of what sorts of local institutions can be usefully involved in the development process. We should first consider the probability that some "traditional" groups have survived in such form that they can become involved in new tasks. This may be the case in relatively few communities as the growing power of the central government, from colonial times on, has effectively reduced the power of local groups in many areas. Traditional irrigation systems in the Inland Delta of the Niger appear to be surviving, and should be thoroughly investigated. Examination of particular local details is necessary to ensure that we know what sorts of traditional institutions do exist. There are also a number of newer groups, including church members, women's groups, and ad hoc groups like irrigation committees or forest management committees. Scudder and Conelly (1984) propose, in relation to inland fisheries, the formation of what they call "Local Participatory Shareholders Groups," an ingenious alternative that may be worth trying in some circumstances. In other cases, a transition from traditional to modern groups may be encouraged, particularly when modern interest groups seem to be more appropriate.

In Kenya, the government has achieved an impressive degree of decentralization through promoting the District Development Committees (DDC's), which have received more funds and more power.

But two major problems arise: first, the districts are huge, averaging 250,000 people; second, DDC's inevitably tend to be dominated by officials and elites. There are development committees at lower levels, and these should be encouraged by allocating them both funds and specific responsibilities. The sub-location, the lowest administrative level, is the only one which is truly "grass-roots," as the sub-chief comes from the area and knows the sub-location and the people well.

In looking at candidate institutions, it is important to include NGO's, as often church and other groups are remarkably effective. Peter Little, for example, mentions the role of the Catholic Church in the Diocese of Machakos, in promoting rural water development. It is interesting that the church requires local people to submit formal applications, with details and with a fee, before they will consider any action (Little, 1984). This means that local groups must carefully consider alternatives, and make specific proposals for what they would like, rather than passively accept what an outside agency proposes will be in their best interests. Such procedures are not appropriate for all levels, as they require a certain minimum of homogeneity, income and commitment to development and cooperation . In some cases formal cooperative societies might serve useful functions, but because there have been so many failures of co-operatives in Africa, these must be approached with caution.

3. Encouraging participation

(a) research

We need to say at the outset that we are not proposing any grandiose research projects, but specific studies of two different sorts. First, there is a need to collect what relevant information is available for the river basin. There exists quite a range of surveys, papers, and reports, but this tends to be scattered, ephemeral and inaccessible. As an example, Thomas Price has just started, for FAO, a survey of inland fishing in the River Niger, as part of a large scale review. Part of his charge is to review the literature relating to the topic and area, and within a few months he will, no doubt, be a mine of useful information for anyone interested in river basin development on the Niger. He will be informative on local groups and institutions, and will be in a position to recommend very specific intervention strategies, designed to give local people a greater stake in their own development.

The second type of research should consist of a series of village or community surveys, in which local people could be encouraged to participate, with appropriate outside assistance, the extent of which would, of course, depend on the resources and skills of the community. What is needed is the presentation of guidelines for such surveys, and the provision of such outside technical help as needed, for example, in measuring pieces of land. What these surveys should cover are the resources of the area, as is being done

in the ujamaa villages of Tanzania, on a limited scale. Here, the village councils are given quite specific guidelines on how to map and describe their natural resources; some villages, at least, have responded with impressive and competent basic surveys. In such surveys, it is important to include information on households, and not just on the village as a whole, because of the growing internal inequality in rural Africa.

Research should be connected to extension activities and to training, training of both officials and local farmers or resource managers. Such training should include innovative approaches such as the use of simulation models, which "encourage participants to learn for themselves and to appreciate different points of view" (Burton and Franks, 1984). It may be necessary to create a new class of facilitators in order to encourage villagers in solving their own problems, and to take part in making decisions about their future. The idea of "facilitators" or change agents, or "animateurs," which goes back to the hey-day of Community Development in the 1960's, is now making a comeback, and some successes are reported. The basic idea is that such people help local residents to help themselves, to recognize their resources, opportunities and constraints and to begin to make decisions for themselves. It is important to include officials and to have them working with local people, in an effort to gain some insights into local perspectives. This may sound visionary but similar projects have been undertaken in various parts of the world, with some

success. (e.g., The Gaun Sallah, or Village dialogue, started in rural Nepal.) The HIID report also recommended another sort of research on people-centered management of natural resources (HIID, 1983).

The types of activities in which institutional capacity and natural resource management merge are: (1) irrigation and water management; (2) resource conservation and management; (3) soil conservation, from catchment protection to terrace maintenance; and (4) social forestry. The concern is with understanding the range of possibilities and problems that characterize water user associations, forest use committees, local forest enterprises, soil conservation committees, range management associations, bridge committees, and so on.

What is needed is objective, location-specific research on current resource exploitation and types of local organizations that can promote community management of natural resources. "Action research" or "learning model" approaches to the organizations and local institutions are recommended. Particular attention should be on developing guidelines for understanding: (1) traditional rules that govern access to and conservation of local land, water, pasture, and forest resources; (2) the best structures and support strategies for local organizations: (3) the role of "catalyst agents" in promoting local development capacity; (4) the use of paraprofessionals in resource management; and (5) the need for stimulating "bureaucratic reorientation" on the part of local development ministry field agents and their headquarters supervisors.

(b) problems

What are some of the problems that face any attempts to involve local people in effective roles in rural development? In the first place, the African countries with which we are concerned have all witnessed a dramatic commitment to public enterprise, to a degree that it is often assumed that this is the only option and that there are no alternative modes. Promoting private action for dealing with development problems may not be considered.

In addition, any suggestion of decentralization may be seen as a threat by some officials, as a potential diminution of their own authority. They may be reluctant to surrender power, especially if they genuinely believe (as many do) that the local people are simply incapable of taking an active part in their own affairs. As a corollary to this viewpoint, it is not surprising that many local people have a poorly developed view of themselves and lack confidence in their own abilities to play active roles. Local people will not want to become involved unless they can perceive some clear and definite benefits for themselves. They may assume that most of the benefits will be captured by the rich villagers, as has often been true in the past. Nor is it only the rich versus the poor. Where communities are ethnically polarized, as is common in many parts of the Sahel, the subordinate group may be excluded. "In an inegalitarian peasant society, it is difficult to ensure genuine representativeness of members elected to local bodies" (Shepherd and el Neima, 1983:63). Local people are likely to have

more rights than outsiders; descendants of the founding lineage do better than those whose ancestors came later; and, only too often, males fare better than females (see Moris, WMS #26, 1984:xii). Yet, evidence suggests that they will respond when benefits are likely to be obtained. Farmers may try to minimize risks and maximize security, but they are also capable of seizing new opportunities when the advantages are apparent (Popkin, 1979).

A problem of a different sort relates to the informal nature of many indigenous groups, that might be capable of participating. There is a real dilemma here, as the groups' strength may derive in large part from its casual and informal nature, while the demands of bureaucracy insist that there be a degree of formalisation and institutionalization. But this very formalization might prove too much for the group, which could be unable to deal with the extra burden.

There must be careful attempts to calculate how much, in terms of extra demands, local institutions can cope with, without collapsing. To begin with what is needed is "an error embracing adaptiveness" (Johnston and Clark, 1982, p. 200). This is difficult to achieve when the bureaucracies tend to rigidity and a heavy handed allocation of responsibility.

So we return now to the initial question of how to link local organizations with the government structure. In the first place, we need to clear one misconception: although it is often said that

African river basin development authorities (RBDA) are modelled on the TVA, one commentator has said, "I do not know of any RBDA in Nigeria that has its eyes fixed on the proper use, conservation and development of the valley's natural resources, or on the need to care for the economic and social well-being of the people, or to provide agricultural and industrial development, by bringing experts to the farm and people" (Griffith, 1984:11).

However, despite the dissimilarity (which exists in other African countries) we need to ask what organizations can serve. Very few water-user associations exist in Africa, in contrast to Asian countries such as Sri Lanka or the Philippines. There are some community managed systems in Senegal, and a recent report from Zimbabwe gives encouraging news of the irrigation management committees, set up "to enhance farmer participation in management anfd decision-making at the local level, and to prepare farmers for a complete take-over of management functions." This report emphasizes the need to "tap farmers' innovativeness and incentive" (Pazvakavambwa, 1984). What is needed is a model of water users' associations, with specific details (varying according to locality) of how they are formed, and what functions they would have (Moris, WMS, 1984:xv).

The main emphasis should be on matters of farm production - which crops to grow, and how to manage water at the local level. If farmers fail to respond to a proposed new crop or farm system, "they are probably right" (Griffith, 1984:12). Therefore the planning

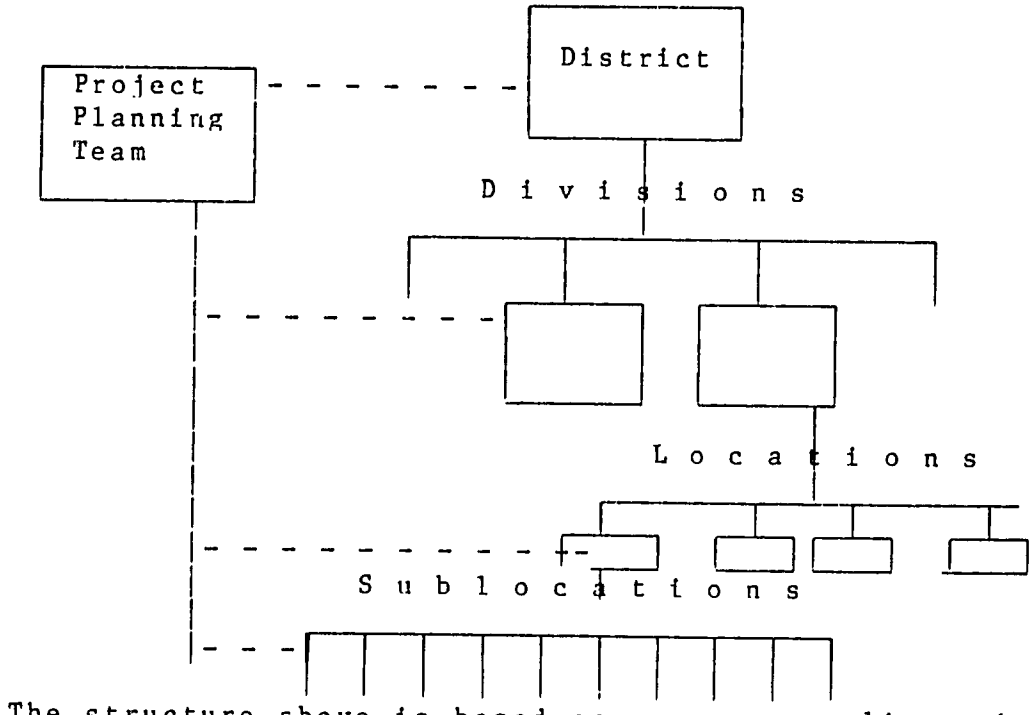
authority should listen to the local people before imposing plans from above. (See Figure Three.) Certain functions should not be given to local people, at least initially: maintenance of complex machinery is one example. (If pumps are always breaking because farmers are not trained, it means the officials spend most of their time on short-run repairs, and do nothing to create long-term local capacity (Moris, 1981:255).

Mary Tiffen has noted (1984:71) that it is difficult to delegate functions to farmers in large-scale schemes, and she recommends dividing large blocks into small units, claiming it will be worth some extra expense in canal lay-out. Large-scale irrigation schemes are often "inappropriate and disruptive" (Bird 1984:83). What is needed is a "greater inter-penetration of desirable features between small-scale and large-scale types" (Moris, WMS, 1981:ix). The key is in clear planning and effective definition of agency responsibility.

As Adams and Grove (1984:163) have said, "political structures and means of communication that would enable the needs and desires of local people to be expressed at the national level, or even at the project management level, are usually inadequate." What they recommend is that the irrigation planning disciplines have to give social science a chance; the latter must then come up with some solutions." (1984:144)

FIGURE 6

PROJECT PLANNING: ACHIEVING VERTICAL INTEGRATION



The structure above is based on Kenva's administrative system.

- - - lines showing coordination and information flow

——— lines showing authority

4. Recommendations for action

In light of the above discussion, it is possible to make some specific recommendations:

(a) Try to build up local capacity to solve problems, but start on a small-scale, with pilot projects. Avoid grandiose and untested schemes. "Too dramatic a reorganization wrenches the social fabric upon which the existing capacity for collective action depends." (Johnston and Clark, 1982:161) Sometimes the dramatic wrenching is caused by government institutions making too many sudden demands on locals, assuming that they can instantly "become adequate managers, accountants and mechanics without adequate and sustained training." (Underhill, 1984:15) It is ironic that officials, who usually under-estimate peasant capacity, sometimes go to the other extreme.

(b) Find out what resources and strengths the community has; this should include any existing or latent institutions that might be enrolled in development efforts.

(c) Determine what outside support is required, in terms of funds, technical assistance, supplies, training and general advice and encouragement.

(d) Remember that there will be no one model. We need to devise location-specific strategies because of the great variations - social, economic, physical - between different areas. It would be unrealistic to offer highly specific prescriptions purporting to cover enormous areas, when we do not yet know enough of the existing resources and how they are being managed.

C. Concluding Observations

Development strategies are plagued with uncertainties. What is certain is that we must seek ways of fusing national plans and local skills and opportunities through appropriate institutional infrastructures. Nowhere is this more evident than in river basin development. The ultimate success of such development depends on increasing productivity, which, in turn, depends on the thousands of individual decisions made by farm families regarding their productive resources. Local people must be enabled to play an active part in determining their own future. With the current emphasis on private enterprise at AID, it is surely appropriate to urge that one particularly strong sort of private enterprise - the skills and entrepreneurial capacity of local African farmers, fishermen, traders and others - be given all the support possible.

These local residents, however, function within a national and an international context. Only insofar as other issues operative at these levels are resolved will local people gain the benefits of river basin development and build the appropriate institutional capacity for managing new resources. The broader issues include recognition of the arenas of potential conflict between African nations sharing water; assuring complementary relations between river basin authorities and national implementing agencies; and facilitating, as necessary, the appropriate donor support not only for the construction of highly visible projects, but also for the "human dimension," the long-term operation and maintenance of such projects which ultimately assures their success.

BIBLIOGRAPHY

Adams, W. N. and A. T. Grove (eds). Irrigation in Tropical Africa: Problems and Problem Solving. Cambridge: African Studies Centre, 1984.

Bird, A.C. "The Land Issue in Large-Scale Irrigation Projects: Problems from Northern Nigeria" in Adams and Grove, op. cit., 1984.

Biswas, Asit K. "Some Major Issues in River Basin Management for Developing Countries," in Zaman, Munir (editor) River Basin Development. Dublin: Tycooly International Publishing Limited, 1983.

Blackie, M. J. (editor). African Regional Symposium on Small Holder Irrigation. Harare: University of Zimbabwe, 1984.

Burton, M.A. and T. R. Franks. "Simulation amd Modelling for Training in Irrigation Management," in Adams and Grove, op. cit., 1984.

Cernea, M.M. (editor) Putting People First: Sociological Variables in Development Projects. London: Oxford University Press, forthcoming.

Development Alternatives, Inc. Strategies for Small Farmer Development: An Empirical Study of Rural Development Projects. A report prepared for the Agency for International Development, Washington, D.C., 1975.

Dey, J. "Gambian Women: Unequal Partners in Rice Development Projects?" in Nelson, N. (editor) African Women in the Development Process. London: Frank Cass and Company, 1981.

Goldsmith, Edward, review of Long-Distance Water Transfer, a Chinese case study and international experiences, edited by Asit K. Biswas, Zuo Dakang, James Nickum, Liu Changming. Dublin: Tycooly International Press, 1984, in The Ecologist, vol 14, #2, 1984.

Griffith, W. J. "Madness of Fowl, Marriage with Cat." in Adams and Grove, op. cit., 1984.

Harvard Institute for International Development, Survey of Cooperative Agreements, 1983.

Henn, J. "Feeding the Villages and Feeding the Cities: What Role for African Women Farmers?" World Development, January, 1984.

International Bank for Reconstruction and Development (IBRD), Accelerated Development in Subsaharan Africa: An Agenda for Action by Elliot Berg et al. Washington, D.C.: IBRD, 1981.

Johnston, B. F. and W. C. Clark. Redesigning Rural Development. Baltimore: Johns Hopkins University Press, 1982.

Korten, D. "Community Organization and Rural Development: A Learning Process Approach," Public Administration Review, 1980.

Little, Peter D. Local Resource Management in Kenya, (position paper prepared for the Ministry of Finance and Planning, Kenya) unpublished docuyment, August, 1984.

Mascarenhas, Adolfo, River Basin Management - Rationale for Establishing a River Basin Authority. paper presented at the second annual conference of the development of the Rufiji Basin resources, March, 1984.

Moris, Jon et al. Prospects for Small-Scale Irrigation Development in the Sahel. Washington, D.C. USAID (Water Management Synthesis Project, WMS Report #26, June, 1984.

Palmer-Jones, R.W. "Mismanaging the Peasants: Some Origins of Low Productivity in the North of Nigeria," in Adams and Grove, op. cit., 1984.

Pazvakavambwa, in Blackie, (editor). African Regional Symposium on Small Holder Irrigation. Harare: University of Zimbabwe, 1984.

Popkin, Samuel L. The Rational Peasant. Berkeley: The University of California, 1979.

Reyna, S.P. "Social and Economic Analyses for Niger River Basin Planning," unpublished document, report to USAID, 1983.

Scudder, Thayer and Thomas Conelly. "Management Systems for Riverine Fisheries," (report prepared for FAO) Binghamton, New York: Institute for Development Anthropology, March, 1984.

Shepherd, A.W. and A. M. el Neima, Popular Participation in Decentralization of Water Supply Planning. Birmingham: Institute of Environmental Studies, University of Birmingham, 1983.

Teelaff, L. Legal and Institutional Responses to Growing Water Demand. Rome: FAO, 1977.

Tiffen, Mary. "Human Resources in African Irrigation," in Blackie, (editor), op. cit., 1984. Underhill, H.W. et al. Small-Scale Irrigation in Africa in the Context of Rural Development. Rome: FAO, 1984.

Underhill, H.W. et al. Small-Scale Irrigation in Africa in the Context of Rural Development. Rome: FAO, 1984.

United Nations, Multidisciplinary Multidonor Mission, "The Development of the Gambia River Basin," prepared by Clark G. Ross, 1980.

United Nations, Multidisciplinary Multidonor Mission, Final Mission Report, Executive Summary, "Development of the Gambia River Basin,", 1980.

USAID/OMVS. Integrated Development Project. Institutional Analysis and Social Analysis, Vol. III, sections 2 and 4. Dakar, Senegal, 1982.

Watt, S.B. "Peripheral Problems in the Senegal Valley," River Basin Planning: Theory and Practice, edited by S.K. Saha and C.J. Barrow, New York: Wiley, 1981.

Zaman, Munir, (editor-in-chief) River Basin Development. Dublin: Tycooly International Publishing, 1983.

CHAPTER NINE

RECOMMENDATIONS

by Thayer Scudder

1. Because of AID's current involvement in several African river basins and because of Mission and AID/Washington intentions to continue and quite possibly expand involvement in the years ahead, AID should have a river basin development policy that combines both Mission and AID/Washington concerns.
2. As a next step to formulating such a policy, as soon as possible, AID should create a viable mechanism within the agency to assess and synthesize the materials presented at the April 18 - 19, 1985 workshop (and on earlier occasions) and to develop policy options for consideration by the US/AID administration.
3. Assuming that a policy is formulated, its implementation should be supported by an appropriate "secretariat" within the agency.
4. Given current funding levels, AID-financed river basin development interventions need to be carefully articulated and systematically followed up through time at the different stages of the project cycle.
5. River basins should be broadly defined as natural resource units and subunits, including land, water and human resources, and including the interface between rainfed, recessional and irrigated agriculture, livestock, fishing and other uses of the resource base in terms of both farm and non-farm employment, and including the production, marketing and other linkages between rural and urban sectors.

6. On a country-wide basis, AID's river basin development policy should be closely integrated with other projects/programs presented in Country Development Strategy Statements (and especially with policy-oriented programs dealing with producer incentives and rural/urban terms of trade). On a basin-wide basis, AID's river basin development policy should be closely integrated with host countries and other donor policies for that basin.

7. At current funding levels, AID's emphasis might be primarily restricted to two areas of priority. The first would be agricultural development within the context of African conditions (agriculture here includes cropping systems, livestock management, fisheries, agroforestry and the management of relevant water, soil, rangeland and forest resources). Under this priority we recommend that special attention be paid to water resource and soil surveys, to socioeconomic studies of existing production and marketing systems, to agricultural research (dealing with both farming and marketing systems), and to extension services.

   The second priority would be institution building for the planning, implementation, management, and monitoring and evaluation of river basin development, with appropriate institutions running the gamut from international river basin authorities to national parastatals, line ministries, local governments and such local producer and marketing organizations as water user associations and marketing cooperatives. AID-financed studies for planning and other purposes should be better designed to provide more relevant and better training to host country nationals and to improve host country institutional capabilities to design, execute, and evaluate appropriate studies, and to develop policy-options for decision makers. At the

regional and parastatal level, emphasis should be placed on creating effective planning and evaluation units that combine, among their functions, data on generation, storage, analysis, and policy option dissemination. At the local level, there is a critical need to institutionalize sustained producer capability for the operation and maintenance of different types of irrigation systems and of other modes of production.

8. There is need for a first reference compilation of major works on international and African River Basin planning and development, reflecting the experiences of the major organizations involved in such projects. Special emphasis should be placed on what are considered to be the most successful projects, there being too much emphasis to date on schemes that have failed. Follow-up field studies of "success stories" should follow such a review.

9. For all work in river basin development, or any part related to it, a clear objective statement should be prepared that gives the social objectives and states, "what," "where," "for whom," "how much," and "when." It is particularly important to state clearly from the outset the often unstated assumptions and principles that guide river basin development projects.

10. Master plans should be basin-wide and multiobjective. Planning should be continuous with feedback through monitoring and evaluation. Percepts and concepts from regional planning theory can provide useful guidelines for improving river basin development strategies (because regional planning focuses upon the interrelatedness of events and sites, as a first step in river basin development this planning exercise would serve as a blueprint for subsequent actionable programs and investments).

11. Large basin-wide plans are needed at a "framework" level. Implementation then should follow more detailed plans for geographic subregions. These are needed to make plans real for local participants who would not be interested in national master plans but need to be involved in their own destinies. Special attention should be paid to pilot projects, provided the total project area is carefully mapped out ahead of time, with attention paid to how pilot projects would be incorporated within the larger project area on a building-block basis. This means that engineering design need be carefully integrated with local participation at turnout, at D-channel, and at branch, main canal, and project levels.

12. Economic analysis within planning should be carried out from two viewpoints, that of the donor or national authority and from the viewpoint of the individual/household recipients who may, for example, place very different values on their time and labor than would national planners. There is need for in-depth comparative and longitudinal research on aspects leading to divergence between household and local organization interests and those of the irrigation scheme or river basin authority.

13. In addition to studies already mentioned, there is need for a wide range of further studies, including: further socioeconomic studies into the dynamics of local production systems; alternatives to capital intensive irrigation; appropriate organizations for sustained local involvement under African conditions as involvement relates to natural resource management, production, and marketing; comparative capacity studies of the strengths and weaknesses of river basin authorities and national parastatals under African conditions; and comparative dynamics of the impacts

of existing African dams on local production systems both above and below dam sites.

14. AID sponsored studies, on the one hand, should relate to the capabilities and needs of host country planning units and, on the other hand, to US strengths as they relate to hydrological modeling, soil and groundwater surveys, environmental studies, farming and production systems analysis, including off-farm employment, marketing systems, rural-urban linkages and urban functions, and water user associations and other forms of local participation.

15. In river basin planning and development, priority should be placed on the beneficiaries with the natural resource base and their local production systems as the starting point. Special attention should be paid to forms of development which do not undermine the resiliency of existing communities.

16. Priority should be placed on small-scale producers, and, here, net incomes, disposable income, and both farm and nonfarm employment generation become crucial. Emphasis on employment generation and multiplier effects means that conventional social benefit/cost analysis and other appraisal techniques need be supplemented with methodologies more able to assess multiplier effects (because marketing centers and communications are often underdeveloped in African river basins, it cannot be assumed that multiplier effects will duplicate those in other areas at similar levels of investment).

17. AID should facilitate strong coordination between donors combined with close collaboration with host country institutions through consultative

committees. Donor leverage may be essential for encouraging host countries to implement policies favorable to river basin development.

18. At present levels of funding, serious consideration should be paid to concentration of AID's effort on a small number of river basins (or subbasins) through selective financing of projects associated with all stages of the project cycle.

19. Where rehabilitation is financed, both physical infrastructures and organizational structures should be included, with adequate attention and resources provided for building or rebuilding appropriate organizations.

20. Natural resource management in river basins should be closely linked to local participation to the extent that individual households and communities have an economic stake in implementing management strategies.

APPENDIX

AFRICAN RIVER BASIN PLANNING AND DEVELOPMENT

An Indicative Bibliography with Special Reference to the Gambia, Niger, Senegal and Juba River Basins

by

Ophelia Mascarenhas

1. Introduction

River basin development schemes have come to be considered as one of the most visible strategies for development in Africa, especially in those countries most affected by drought, such as the Sahel or the Horn of Africa. However, over the past six decades, the strategies for river basin development have created as many problems as they have tried to resolve. There has, therefore, been a continuous process of critical evaluations and attempts to develop a more appropriate approach to river basin planning and development.

The present bibliography attempts to reflect the policies and thinking of the past decade and a half. Even so, it is only an indicative bibliography, claiming neither comprehensive coverage of the field nor the four river basins that have been selected as case studies. It began as an exercise to provide source materials to members of staff of Clark University and Institute of Development Anthropology (IDA) that were involved in preparing papers on African river basin planning and development for USAID. As such, a first working bibliography and supplement were prepared using mainly published materials; and as many examples of African river basins as available.[1]

Subsequently it was decided to restrict the coverage to the four river basins that USAID was already involved in, namely, the Senegal, the Gambia, the Niger and the Juba river basins. It was also decided to emphasize the original planning documents. Such documents were not available in conventional library collections; and the few that were located through inter-library loan services were out-dated for the purposes of the IDA/Clark University papers which were concentrating on the experiences of the last 10 - 15 years. Computer searching of key data bases both in the U.S. and Great Britain also revealed few recent key planning documents.

It was found that the best sources of such materials were likely to be of three types:

--- organizations that were involved with the development of African river basins such as USAID, the World Bank, the United Nations especially UNDP, FAO and WHO, OECD, Club du Sahel, and CILSS;

--- local institutions involved with implementing and/or overseeing the development of river basins in the host countries, e.g., the OMVS; the Ministry of the Juba Valley Development in Mogadishu, Somalia; the River Basin Development Office of USAID in Dakar, Senegal, etc.

--- universities and academic institutions that have been involved in large-scale studies and consultancy work on river basins, e.g., Michigan University, the Land Tenure Center at the University of Wisconsin, Cornell University, etc.

Other important sources were likely to be the consulting firms themselves but initial attempts to obtain such material through correspondence brought little response.

As a first step, the bibliographic search was extended to cover sources at USAID and the State Dept. Both places have formal libraries. However, the need for comprehensive coverage and the usual difficulties of libraries in obtaining "official documents" meant that the libraries did not have the most recent key planning documents of USAID itself--let alone those of other organizations such as the FAO, UNDP or World Bank. Even the computerized data base of USAID project documents was not up-to-date and I was advised to see the various desk officers for the countries involved. The best sources proved to be the documentation room in the Sahel and West Africa Affairs Section of the Africa Bureau, State Dept., and collections of key personnel responsible for USAID's projects in the four river basins.[2] Two weeks were spent locating, selecting, obtaining originals or photocopies of as many key documents as possible to be brought to Clark University for detailed study and annotations. Where extra copies were not possible or the documents were too bulky for photocopying, the annotations had to be done at source.

While in Washington, D.C., a search was also made of the collection at Library of Congress which was good for general official documents on African countries but disappointing for the specific type of material for which I was looking. Even the United Nations collection of the library did not have the relevant UNDP/FAO documents listed in the United Nations publication

entitled: Water Resources, Planning and Management: A Select Bibliography, 1977. Attempts to obtain access to the World Bank documents on the topic, particularly their evaluation studies, failed during both trips to Washington, D.C. An official request made through Rickie Sanders of Africa Bureau, has so far had no response. It was a first hand lesson on the difficulties of information sharing and underscored the recommendations of several writings on the need for a greater accessibility to the experience of various organizations (Ackerman, 1973; Carruthers, 1982).

Another source that was explored was the Sahel Documentation Center, Michigan State Libraries. This center has a substantial collection on the Sahelian countries and issues a quarterly publication entitled Sahel: Bibliographic Bulletin/Bulletin Bibliographique. The center collects a wide range of materials including books, articles, papers and documents dealing with various aspects of socioeconomic development in the Sahel. The focus of the collection is the eight member states of CILSS (Comite Permanent Inter-etats de Lutte Contre la Secheresse dans le Sahel). In the absence of an opportunity to visit the center, I tried to obtain some relevant material through Clark University's inter-library loan service but was restricted by the prohibitive loan cost of $8.00 an item! It was not possible to visit the other major source mentioned above and after a meeting of the Clark/IDA authors' in October 1984; it was decided to reserve such visit for a possible future phase of the bibliography aimed at an expanded coverage of topics and river basins. I was therefore asked to

concentrate on a working, indicative bibliography as a first phase.

The selection of materials of this present bibliography is aimed at identifying the main trends in river basin planning over the last 15 years and to focus where possible on major documents and published works that reflect or discuss such trends. As far as possible, planning documents have been selected from various development agencies and consultancy firms in order to depict as wide a range of policies and practices as possible.

1.1 Trends.

Single purpose dams like the Kariba in Zimbabwe or the Kamburu/Gtaru in Kenya are now no longer in vogue. Most river basin development schemes are multi-purpose as suggested by several authors (Ackerman 1973; Lagler 1968; Odingo 1979). The Gambia Barrage Scheme, for instance, has as its goals: irrigation, prevention of salt water intrusion into the upper basin, river navigation, and vehicular transport across the river.

However, integration is a complex issue, as USAID's Integrated Development Project for Senegal River Basin has clearly indicated. Evaluations and discussions about integration range from not enough attention being paid to this aspect (e.g., Carruthers 1982; Scudder 1981) to whether complete integration of all sectors or development of the entire basin is feasible (Lagler 1968; UNDP 1970). Integration becomes particularly difficult in those river basins where the interests of several nations are

involved. In this respect the recommendations of UNDP for the Niger River Basin development are perhaps the most honest, realistic, and appropriate (UNDP 1970).

Another theme that comes through from the recent planning documents is the alternate srategy approach, perhaps best exemplified by UNDP's development strategy for Gambia (UNDP 1980). In principle this approach appears to take into account ecological differences and timing aspects. However, the top-down approach adopted by this strategy and the lack of attention to existing sociological conditions (see particularly Weil 1977) shows the full potential of this approach has not yet been realized.

A number of USAID's documents focus on the policy of building up local management capacity [USAID (Gambia) 1981; (Somalia) 1983; (Senegal) 1983]. The aim appears to be to provide a greater data base to facilitate choices of strategies and to build institutional capacity for planning and implementation. However, the concentration appears to be on large-scale organizations. The latest evaluation of USAID's Integrated Development Project for the Senegal River Basin questions the ability of monolithic institutions to meet the needs of the local people (Stephenson 1983).

The debate between large-scale versus small-scale projects is also reflected in other writings (notably, Adams 1981; Waldstein 1974; Gunn 1982; IBRD 1981b). These studies show that management aspects are crucial and that the involvement of the farmers is imperative to the success of river basin development. The World Bank evaluation of the Terres Neuves Scheme shows how such aspects as intra-household allocation of resources can affect a scheme,

while the success of indigenous schemes in the Senegal is used by Waldstein to recommend small-scale projects at least in the initial stages of development. The need to examine indigenous schemes is stressed by several studies (Coward 1977; Adams 1981; Goldsmith and Hildyard 1984; Brokensha 1978) particularly as it is now becoming apparent that good management practices are the key to successful river basin development.

The issue is, however, far from resolved as schemes still continue to over-emphasize construction and engineering aspects that are costly to maintain and inherently inefficient (see especially Biswas 1983). Improvement of existing schemes is also stressed by Berry et al who assert that improvement of soil, water, and system management could double the productivity of land currently under irrigation. This is supported by such studies as the World Bank evaluation of the New Halfa Irrigation Scheme in Egypt.

Finally, recent USAID project documents show an increasing trend towards resolving the management issues through recommendations of privatization of several key sectors such as marketing, agricultural extension and distribution of inputs. Parastatal organizations all over Africa exhibit management problems in these sectors, but it is not yet clear if private commercial firms will better meet the needs of farmers.

Scope for Expansion of the Bibliography

There is indeed a great scope for expanding the bibliography in order to make it a work of first reference for evaluators, planners, and researchers. As indicated, some major collections have been practically untouched. The USAID River Basin Development Office, Dakar has compiled a listing of over 1,000 documents pertaining to the Senegal River Basin (Sectorial Bibliography of the Senegal River Basin - regional studies and specific studies on Mali, Mauritania, and Senegal). In 1970 an UNDP mission identified a similar number of documents for the Niger River Basin and the number must have grown considerably over the last 15 years. In Somalia, Dowhan identified about 180 studies on the Juba Valley based on the holdings of USAID/Somalia and the Ministry of Juba Valley Development (see U.S. Fish and Wildlife Service, Juba River Valley Development Project Environmental Assessment: Preparatory Phase, 1984).

The aim, however, need not be a full coverage which is perhaps neither feasible nor even desirable, particularly if the material has to be annotated beyond a description entailing one or two sentences. Nevertheless, if the goals include a reflection of the present experiences in planning and development of African river basins, a better coverage of the three major types of sources identified above will be necessary.

Footnotes

1. River Basin Planning and Development - A Bibliography (19 pp. 78 items.) June 1984; and Supplement. July 1984.

2. In this respect the assistance of the following people is especially acknowledged: Helen Soos; John Heard; Paul Holmes; Wayne King; Henderson Patrick and Keith Simmons.

GENERAL STUDIES

1. ACKERMAN, WILLIAM C; WHITE, GILBERT, and WORTHINGTON, E.B. 1973. Man-made Lakes: Their Problems and Environmental Effects. Washington, D.C. American Geophysical Union. 847 pp.

The 113 technical papers drawn from the International Symposium on the Man-made Lakes concern themselves with scientific and policy issues raised by massive human intervention in the environment, as an aid to managing present and future dams. The papers are clustered into four categories: case studies of major man-made lakes; physical systems; biological systems; and man-made lakes in relation to man.

The summary and conclusions chapter emphasizes the need to consider alternatives to large dam construction as a first priority. If dams are considered as necessary, planning must be seen as a process that should not stop after the dam is built. Four stages are identified in the creation of the new ecosystem: the period of determining the economic, social and political feasibility of the project; the design and construction phase; reservoir filling and initiation of change; the stage of stabilization and adjustments towards long term evolution.

It points out that no feasibility studies can assess all the possible effects. In these circumstances planning should not be a single act of investment. If properly carried out, it should include monitoring mechanisms for preserving options and alternatives for the timing, sequencing and scale of subprojects that may alter the direction of change in the last stage.

Management of man-made lakes must be carried out in close cooperation with activities upstream, downstream and "areas that are linked by social and physical impacts."

Among the recommendations made are the following: assessment of alternatives (to dams); canvas of impacts; consultation with people affected; criteria for impact statements; an early warning system; a clearing house of information; training and scientific cooperation. With respect to the last, the book asserts that "knowledge can be translated into effective policy and design only with the help of scientists who have been exposed to integrated approaches."

(obtained through Inter-Library Loan)

2. BERRY, L., FORD, R., AND HOSIER, R. 1980. The Impact of Irrigation on Development: Issues for a Comprehensive Evaluation Study. Worcester, MA: Clark University. 70 pp.

The main focus of the report is a discussion of the issues and phases that need to be considered in a comprehensive evaluation of irrigation projects. Five such issues are identified: economic viability, efficiency of resource use, effectiveness of water delivery systems, environmental quality, social soundness of the new system.

These issues are discussed against a review of USAID's current (1980) practice and policy for project evaluations. It finds that such evaluations focus almost entirely at the initial stage of the project and lack mechanisms to utilize the findings to improve project management.

Recommendations include a longitudinal study approach to evaluation; a clear statement of the purpose of evaluation; an explicit provision of feedback for improving project management. Furthermore, the report emphasizes that evaluations must consider the needs of the Agency, the host government and the users of the system with appropriate feedback to each.

(available at Clark University)

3. BISWAS, A.K. 1983. "Some Major Issue in River Basin Management for Developing Countries" in River Basin Development edited by Munir Zaman. Dublin, Tycooly International Publishing Limited, pp. 17-27.

Points out that engineering and management techniques in major irrigation schemes is so low that "less than 25 percent of the water reaches the crops" and losses of 20 to 50 percent appear acceptable levels to engineers and planners. The author asserts that cheaper alternatives are available which can be implemented by simply improving existing systems, using the indigenous labor force and expertise.

(available at Clark University)

4. CARRUTHERS, IAN D. 1982. Aid for Development of Irrigation. Report of the Development Assistance Committee Workshop on Irrigation Assistance held in Paris, September 1982.

The main conclusion of the workshop was that despite evident problems of irrigation investment, "reliable, timely, well-managed water-supply and its effective use are among the most crucial requirements for high-yielding agriculture but that haste, gigantism and incompleteness" have dogged irrigation projects and detracted from their full potential.

The workshop also concluded that irrigation development was very complex and needed to be treated in an integrated manner. Present feasibility studies still tended to neglect social, environmental and management aspects. Furthermore, irrigation needed to be looked at from a long term perspective and, where necessary, immediate returns should be reduced to cover costs for long term benefits.

Specifically for Africa, it was agreed that "irrigation should not generally be promoted until existing schemes were shown to be productive and until well-tested technology and comprehensive plans had been prepared." Donor agencies were invited to carry-out "more evaluation studies and to distribute the results more extensively to potential users" (p. 18).

The work is divided into three sections. Part I discusses the main conclusions of the workshop and recent trends in aid to irrigation; Part II is concerned with major issues in this aid such as neglect of provisions for operation and maintenance; Part III describes the experience of individual agencies (World Bank, Inter-American Bank, European Economic Community) in assistance projects.

(available at SWA-Africa Bureau)

5. CHECCHI and COMPANY. 1979. Pattern Analysis of Small and Medium Scale Irrigation Projects. 79 PP.

Analyzes 15 medium and small-scale irrigation projects funded by USAID and examines AID's evaluation methods and procedures. For each aspect a number of weaknesses are identified and recommendations made to rectify the situation.

For instance, the paper shows that the assumption that farmers will always be able to make sufficient inputs in a timely manner to an irrigation project involving farming and investment innovations is "dubious." The study recommends that the capability of the farmers must be carefully assessed and projects tailored to realistic contributions by the farmers.

The paper finds USAID's evaluation methods and procedures very complex and not clearly understood by the personnel concerned. It also finds the evaluations to be less objective because of the tendency to use in-house evaluators.

(available at Clark University)

6. COWARD, E.W. 1977. "Irrigation Management Alternatives: Themes from Indigenous Irrigation Schemes."

This paper discusses irrigation management alternatives based on cases of indigenous systems that exist around the world. Three organization themes are selected from the local systems: accountable leadership; mini-unit organization; canal-based organizational units. Finally, the paper suggests situations in which these themes may be especially relevant.

(available at Clark University)

7. GOLDSMITH, E., and HILDYARD, N. 1984. The Social and Environmental Effects of Large Dams. A report to the European Ecological Action Group. Wadebridge Ecological Centre. 346 pp.

This comprehensive survey of the effects of large scale water development schemes acknowledges the attractiveness of such schemes for obtaining food and energy but concludes that the array of problems resulting from these schemes is too "staggering" and "widespread" to justify continuing with this planning strategy.

Among the problems identified are: massive ecological destruction; social misery; increasing ill-health; and impoverishment of the very people the schemes are supposed to help.

The survey also includes a review of past and current traditional irrigation practices and the lessons that can be obtained from them.

(available at Clark University)

8. LAGLER, K.F. Ed. 1968. Man-made Lakes: Planning and Development. Rome, FAO.

The sudy asserts that project justification and related economic planning of man-made lakes or reservoirs are based almost entirely on the attainment of some primary objectives such as the provision of hydroelectric power or flood control. Many secondary effects may be overlooked or ignored resulting in economic loss and human suffering. The study identifies 12 problem areas and related technical fields which must be considered during the earliest stages of reservoir planning.

The author also recommends that the value of the project will be greater if it involves the entire watershed of the dammed river but recognizes that "simultaneous integrated development of all the resources of an entire river basin is likely to be impossible." He therefore suggests that component parts of development may be carried out through "individual projects on a priority

basis" leaving it debatable as to who should decide on the priority and whether such decisions will ever go beyond the primary objective.

(available at Clark University)

9. LOWDERMILK, MAX K. 1978. Farm Management in Irrigation Systems: the Crucial Role of Farmer Organizations. 60 pp.

Describes an approach to irrigation development in which the central aspects are "the crucial role of management and the role of farmer organizations in the maintenance of farm-level irrigation schemes" (p. 1).

The approach embodies a framework of key concepts; essential components and a 4-phase implementation program. Concepts include on-farm client focus, host country involvement; management orientation and action research. Planning components emphasize interdisciplinary team collaboration, client involvement, institution-building and linkages, monitoring and evaluation.

The paper also reviews selected literature on the "sociology of water management."

(available at Clark University)

10. MORIS, JON, et al. 1984. Prospects for Small-Scale Irrigation Development in the Sahel. Logan, Utah University. (WMS Report No. 26) 160 pp.

Describes the current status of irrigation schemes in the Sahel with particular emphasis on Mali and Niger.

The report finds that there is scope for both large and small-scale irrigation schemes, but that important issues have to be addressed in order to achieve the full potential of each type. The main problems of large-scale schemes are identified as "technical, reflecting poor design, and bureaucratic/sociological" (p. xiv).

With respect to small-scale irrigation, the report asserts that there is considerable scope for expansion but cautions that "being small does not guarantee success" (p.xi). A number of recommendations are made in order to make this sector more viable. They include: improvement of small-scale technology; better delivery system to transport water to the farmers' fields; an acceptable model of water users' associations; a study of bottlenecks in productivity and on-farm management problems; and a greater attention to utilizing local expertise in managing traditional irrigation schemes.

The main plea of the report is the need for a "greater interpenetration of desirable features between small-scale and large-scale" schemes. For instance, it sees no reason why "modern" technology must be large-scale/capital intensive; while large-scale schemes could benefit greatly from greater farmer participation in management, which is characteristic of small-scale schemes (p.ix).

The report also has case studies of small-scale irrigation schemes in the Niger and Mali and an extensive bibliography on irrigation and associated aspects.

(available at Clark University)

11. SAHA, S.K., and BARROW, C.J. Eds. 1981. River Basin Planning: Theory and Practice. New York, 357 pp.

The introduction gives a useful overview of the current practices and results of river basin planning in the Third World. Among the issues highlighted are distortions in the planning attitude and gaps in the transfer of knowledge about river basin development.

Planning, the editors argue, has been for planners and professionals; for construction firms and consultancy organizations--and not for the people. Even the United Nations' major documents on "integrated river basin development" and on the institutional and legal aspects of managing international rivers affect the same technocratic approach with an over-emphasis on the construction aspect.

The editors argue that river basin planning must embody the principle of regional development. To do this succesfully two components have to be included: (1) planning linkages between construction and the needs of the population; (ii) planning measures to correct dislocations in ecological balance caused by the construction.

Another aspect that needs attention is how to transfer knowledge, training and research facilities to the countries where such development is to take place so that the countries can "screen" the advice they get from consultancy firms.

The major part of the book consists of papers categorized into four sections: (1) Theory of River Basin Planning; (2) Environmental Issues; (3) Socioeconomic Issues; and (4) Case Studies. There is also a chapter on "Appraisal of a Large Multipurpose Water Resources Project." The case studies are taken from Asia and Africa.

(available at Clark University)

12. SCUDDER, THAYER. 1981. African River Basins. Background Paper for an Africa Bureau Strategy. 55 pp.

Argues that in the past, river basin development was heavily pre-disposed towards water-management and recommends instead a transformational approach in which an integrated development of each basin's human, land and water resources has multiplier effects on social equity, rising living standards and enhancement of natural resources.

A strategy for achieving such a development is suggested, the key components of which are:

(1) diversification of agricultural systems, (2) provision of large-scale infrastructure, (3) spatial development of human settlement that links villages to service centers, rural towns and urban areas, (4) multisectoral development, (5) management structures that combine central and local participation, and (6) favorable rural-urban terms of trade.

The paper also uses case studies to illustrate the complexities of the nature of resources and activities in African river basins as well as current organizational and institutional practices.

(available at Clark University, IDA)

13. STANLEY, M.F., and W.P. ALPERS (eds.). 1975. Man-made Lakes and Human Health. London, Academic Press. 495 pp.

Working on the premise that "Man-made lakes are examples of human inteference with ecosystems that have evolved slowly and are now subject to profound disturbances," this collection of a series of articles presents a case for a greater recognition of the interdependence of human ecology and human health and for a more effective and integrated national and international planning in the construction of very large dams.

The first section describes the ecological background of five diseases: schistosomiasis, malaria, leptospirosis, filariasis and arbovius infections. Specific geographic areas are also examined and for Africa, these include the Kariba, the Aswan, the Kainji and the Volta dams. The last section discusses the effects of migration and resettlement in excerberting the spread of diseases.

The general conclusion of the book is that the effect of the dam on the river system is inevitable but that many unnecessary mistakes could have been avoided by closer collaboration between

the life scientist and the engineer. Examples of how such collaboration could have avoided mistakes are given.

(available through Inter-Library Loan)

14. UNDERHILL, H.W. 1984. Small-Scale Irrigation in Africa in the Context of Rural Development. Rome, FAO. 56 pp.

The paper, in the author's own words, "sets out to examine the problems of and prospects for small-scale irrigatio development." Small-scale irrigation schemes are described as those schemes which are under local responsibility, controlled and operated by the local people in response to felt needs (p.2).

The first part of the paper (Part A) discusses the role of small-scale irrigation in rural development. It also presents an overview of the irrigation scene and experience in sub-Saharan Africa. This section concludes that "provided the opportunities, and the problems, are understood and programmes designed accordingly, the prospects for successful and significant irrigation development in the small-holder sector are good" (p. 22). Recommendations are made as to how governments, international donors/ agencies and national and local non-governmental organizations can contribute to this form of development which emphasizes the concept of "development from below."

Part B of the report discusses eight stages involved in the process of planning, implementation, operation, and management of an irrigation scheme. The aim is to offer practical advice and guidelines and therefore the approach used involves a focus on key questions; definition of terminology; nd discussionof the questions. Some of the aspects covered appear to use a "top-down approach" in contrast to the approach recommended in Part A. The author admits this but counters by saying that th aim of the guidelines is to show how to apply the principles of Part A for aspects of Part B and in doing so show how to "work with (author's emphasis) the people as partners in development" (p. 30).

(available at Clark University, SWA)

15. UNITED NATIONS. 1976. River Basin Development: Policies and Planning. (U.N. Resources Natural Water Series no. 6). New York. 2 volumes.

This report is the result of a seminar attended by 72 participants from Africa, Asia, Middle East, Europe and the Americas. Papers and discussions covered technical, engineering as well as socioeconomic and management aspects. Specifically, the papers are arranged in the following sections: (1) Integrated development of river basins - overview and recommendations; (2) River basin development for socioeconomic growth; (3) Decision-making and planning, including ex-post construction evaluation; (4)

Cooperative management and development of international rivers; (5) Environmental implications - including water quality; and (6) Current issues and approaches of river basin development in some countries.

(available at Clark University)

16. U.S. MAN and the BIOSPHERE PROGRAM. 1981. Environmental Guidelines for Irrigation. Prepared by Robert E. Tillman. New York, 74 pp.

Environment is described in a broad sense and includes management aspects and social and political considerations. The guidelines are checklists of data that is needed for environmental impact assessment or to prepare "specific terms of reference for environmental studies for planning or funding environmental studies."

(available at Clark University)

17. WALDSTEIN, ABRAHAM S. 1974. "Government Sponsored Agricultural Intensification Schemes In The Sahel: Development For Whom?" Paper prepared by USAID's Papers on Sahelian Social Development. 114 pp.

Surveys large-scale as well as small scale irrigation schemes and concludes that "...only the rarest of large-scale agricultural schemes can hope for economic viability under present circumstances." The paper describes some successful small-scale works in the Bakel and Matam regions of the Senegal and recommends such schemes as "most appropriate" during the initial phase of irrigation development.

The main economic argument for small scale scheme is the fact that the debt burden to the farmers and the nation is smaller and therefore more recoverable -- $2,000 per hectare compared to $6,000 or more on the larger schemes. External inputs are not discounted; in fact, they are considered essential. Nevertheless, the emphasis is on information, training and low cost inputs rather than on massive capital works dependent on external management and finance.

Socially, too, small-scale schemes are more appropriate because they are more feasible to local participatory management - a crucial component for successful irrigation schemes. Participating farmers have to feel that the scheme answers their needs and is at least partially under their control. In this respect, the author recommends the use of management principles underlying indigenous schemes. Five such principles are identified (p. 62).

Although emphasizing small-scale schemes, the paper does not completely dismiss medium or large-scale but underlines the fact

such schemes can only be successful when the local farmers feel the need for them and can manage them on the same basis as the small-scale schemes.

(available at USAID Library, Rosalyn Plaza)

18. CLUB DU SAHEL/CILSS. 1979. Development of Irrigated Agriculture in Gambia: General Overview and Prospects - Proposals for a Second Programme, 1980-1985. Paris? 65 pp.

The report identified constraints to irrigated rice production in Gambia and makes proposals for a program of studies and work to be implemented in 1980-85.

It stresses that the basic constraint is the intrusion of salt water, and the proposed program is, thus, predominantly concerned with dams to regulate the flow of the Gambia river. The report also reviews existing small perimeters and their problems--some of which would question the report's main premise about basic constraints to irrigated agriculture in the country.

The program itself consists of four main components: the construction of the Yelitenda anti-salt barrage and associated three pilot irrigation projects ($139.5 million); surveys and studies including feasibility studies for two other dams ($8.7 million); technical assistance and training ($2.9 million); and completion of first program ($35.3 million). Although the last category includes rehabilitation of the existing perimeters, this aspect forms only a minor element; the largest proportion ($29.5 million) is once again scheduled for large-scale development of 2500 hectares where the production of a second crop is contingent upon the construction of the anti-salt dam.

(available at Clark University)

19. GOODE and PARTNERS. 1979. The Gambia Estuary Barrage Study - Stage II. London, 5 volumes.

The Gambia Estuary Barrage is a multi-purpose scheme designed to increase irrigated land by 24,000 hectares, prevent salt water intrusion upstream, provide a vehicular crossing across the river while at the same time allowing ships and lighters to pass through. Another important provision is the supply of freshwater for traditional recession agriculture.

The study covers the following aspects: engineering, agriculture, environment, transport, economic and financial evaluation. It concludes that the project is feasible from an economic point of view and estimates a return of 8 percent per annum. It also concludes that the opportunity for increased agricultural production through irrigation and improved transport facilities will act as a stimulus for the development of the region.

However, it has very serious reservations and uncertainties that seem to contradict these conclusions. The study emphasizes

that the rate of return demands high inputs from "management and the farmers" (vol. 1, p. 54). It is also uncertain about the ability of the project to safeguard traditional agriculture and adds that "these uncertainties must be assessed against the proposed rate of return."

Obviously, more studies are required and these are recommended. Nevertheless, the proposed studies do not appear to address the uncertainties described above.

(volumes available in SWA.)

20. ROBERT NATHAN ASSOCIATES. 1978. Alternate Development Strategies for the Gambia River Basin. Washington, D.C. 40 pp.

Critiques the alternate strategies approach of the UNDP Multi-Disciplinary Multi-Donor Plan for the Gambia Basin and offers conceptual and methodologicl modifications.

The main criticisms of the UNDP approach appear to be: (1) the differences in the three alternatives (options) are based on differences in the scale of inputs and not on differences in the composition, or phasing of projects, policies, or institutions, which are crucial for the supply of inputs; (2) the options reflect a lack of integration between the findings of the sectoral reports and those of the infrastructure; (3) there is insufficient data on the impacts of packages on related sectors.

The modified approach aims to lay more emphasis on alternate size, composition and timing of projects as well as on training, institutional strengthening and changes in policies. It also hopes to pay greater attention to intesectoral impacts and trade-offs and seek packages that will remove exising constraints at the same time as increasing productivity and output.

(available at IDA)

21. ROSS, CLARK G. 1981. "The Development of the Gambia River Basin." 15 pp.

The study describes the planning methodology and objectives of the UNDP study for the Gambia Basin (see item #21); summarizes the key salient features of the strategy and offers an evaluation of the planning process. The evaluation addresses itself to two major questions:

--- Why did a simply conceived development planning effort become a self-consuming and arduous task?

--- Was the comprehensive multi-donor, multi-country planning effort successful and should it be duplicated in other Third World countries?

The first question is answered by describing seven problems that the mission encountered and which the author categorizes as either "avoidable" or "inherent" to Third World development. The second question is ambiguously answered. Statements like "...actual development of the basin such that benefits are received by the ordinary rural citizen, seems years away" (p. 10) conflict with the conclusion that "In an atmosphere completely void of political pressure and manipulation, a sound development plan was designed" (p. 14).

(available at Clark University).

22. UNITED NATIONS DEVELOPMENT PROGRAMME. 1980. Development of the Gambia River Basin. Multi-Disciplinary Multi-Donor Mission. Final Report. New York. 2 volumes.

The principal objective of the mission was to devise programs for developing the land, water and human resources of the Gambia River Basin giving particular attention to the goal of raising the per capita income of the rural population. Other goals to be addressed were: increasing crop and livestock production, stimulating employment opportunities in the rural areas, agro-industrial development and a more equitable distribution of wealth and income.

The main element of the planning framework is the presentation of technical packages (TP's) and options. The TP's differ mainly in their degree of capital intensity relative to labor inputs. Options are defined as alternate rates of adoption of new TP's. The purpose of this approach is to facilitate the drawing up of plans that can use a mix of strategies taking into account "intersectoral complementaries and competing demands for land, labor and financial requirements."

The report has five chapters. The first two chapters describe the background; the country's development objectives and key problems to be addressed. Chapter III presents the analysis of the four subsectors: rainfed agriculture, irrigated agriculture, livestock, and forestry. For each subsector there is a description of the current situation; likely development up to the year 2,000 without interventions (base case scenario) and developmental effects of the various TP's and options. The effects are calculated in terms of increased output and rates of return to capital investment. Chapter IV discusses "non-quantifiable" impacts--economic, environmental, health, institutional and infrastructural--while Chapter V presents a development strategy selected by the Basin delegates using the options.

The alternatives approach is restricted strictly to the four subsectors. There is no attempt to integrate the technical proposals for increasing grain and livestock output with specific requirements for training, institutional support or extension services -- all of which are discussed in general terms. Environmental effects such as soil depletion; health and social aspects are also discussed in general terms, without reference to any particular package or option. The options and TP's are therefore based on many major assumption about the availability of labor, credit, supply of inputs, the willingness of farmers to take up dry-season cultivation instead of migrating to towns, etc.

The report also highlights the complexities of calculating costs and benefits. For instance, the mission finds irrigation costs per hectare as ranging from $1,070 to $4,700 based on five consultancy studies concerning this aspect in the Gambia River Basin.

(available at USAID Library, SWA, IDA and Clark University)

23. USAID. 1981. Gambia River Basin Development. Project No. 625-0012. Approx. 300 pp. Includes bibliographies.

Describes a USAID project designed to develop OMVG'S technical expertise to prepare and implement a long term strategy. The project involves a grant of U.S. $13.4 million to be spent between 1981-86 on technical assistance, training and funds for preliminary studies.

Three types of training are envisaged: overseas M.Sc. level for four technical staff, short-term middle level technical training, and long term on-the-job training for OMVG personnel to become planners. Three types of studies will be funded: land classification, agricultural systems, environmental impacts of the proposed dams on public health, wildlife and vegetation. The purpose of the studies is to provide OMVG with an information base for planning.

The project reflects USAID's policy to build up local institutional capacity for river basin planning and development.

(available in DIU and Clark University)

24. USAID. GAMBIA. 1984. Mid-Term Evaluation of the Gambia River Basin Development Project. (625-0012) 94 pp. Bibliography.

USAID has granted OMVG about $14 million in the form of technical personnel, fund for studies and training of local personnel (see item 22)--to create a planning capacity within the organization.

The evaluation team found that the timeliness and quality of maps and studies will be satisfactory. However, it found that the studies would be more useful if the four sectoral reviews: socio-economic; river resources, wildlife /vegetation and public health could be combined and incorporated into a model, and involve OMVG as well as the member states in the process.

The team, also, found a serious gap in the planning component of the project. Technical assistance, training and equipment had not reached the level of competence necessary for the planning process. The gap would seriously constrain OMVG'S capacity to consider alternatives, costs, benefits, impacts, etc. in order to make decisions on development actions of major importance. Some recommendations are made to rectify the situation.

(available in DIU and Clark University)

25. UNIVERSITY OF MICHIGAN/HARZA ENGINEERING COMPANY. 1983. Gambia River Basin Studies Work Plan. Working Document no. 4. Prepared for USAID/OMVG. 171 pp.

Describes the workplans of four socioeconomic and environmental teams for collecting and analyzing data in Phase II of the University of Michigan Gambia River Basin Studies. The purpose of these studies is to help the Gambia River Basin Development Organization (OMVG) and its member states to prepare for changes that will occur in the basin after the construction of dams at Balinglo (the Gambia) Kekreti (Senegal) and Kougoufoulle, Kouya, and Konkoure (Guinea).

The four teams are designated as: Socioeconomic, River Resource, Public Helth, and Wildlife/Vegetation. For each team's work plan there is a description of the objectives, methods, personnel plans and time-frame.

The framework for gathering and analyzing data has several interesting elements. As a start it will use a model which will emphasize trade-offs between socioeconomic and environmental objectives, both long-term and short-term. The University of Michigan research teams and OMVG will decide on data for the model. The research teams will then use the trade-offs identified by the model to complete their analyses and make recommendations.

The research teams will consider the river basin as an entity but subdivided into five to seven ecological segments or subsystems. For each subsystem there are 36 possible scenarios consisting of a combination of technological packages, crops, levels of irrigation development and realization of yields. Each scenario will be subjected to benefit/cost analysis and ranked according to its "net present value."

Statistical analysis will be done using microcomputers at Banjul and mainframe installations at Dakar. The analysis will be

used to suggest mitigative measures which will themselves be subject to economic considerations. (It is not clear how the mitigative measures will be ranked).

The teams will cooperate with other teams in the area involved in the more physical aspects of the dam construction.

(available at Clark University)

26. WEIL, P.M. 1977. Social Conditions in the Basin in Relation to the Report on a Development Programme for the Gambia River Basin. University of Delaware. 48 pp.

The study begins by a critique of the sociological sectorial report prepared for the UNDP planning document on the Gambia River Basin. It claims that the report has "factual errors and absence of relevant data compounded by ethnic myths." An accurate baseline is only weakly established and thus both the planning and analysis of the effects of the proposed interventions are undercut."

The present study attempts to fill the data gaps and correct errors. Based on its survey of the social conditions in the basin, the study recommends that proposals be built on an assumption of high aspirations at the nuclear family level and must include "overt rewards for women" as members of the unit and as individuals. The return from agriculural development options must be significantly higher than current farming activities and must involve no capital investment at least at the initial period. Other recommendations deal with consideration of leisure needs, land tenure issues and more appropriate technology than provided for in the UNDP proposals.

The work is useful in highlighting the complexities of household allocation of resources, especially labor and the role of women in societies undergoing change. Such aspects are rarely considered in river basin planning.

(available at Clark University and IDA)

OTHER RELATED DOCUMENTS

27. DUNSMORE, J.R. et al. 1976. The Agricultural Development of the Gambia: An Agricultural, Environmental and Socio-Economic Analysis. Land Resources Study, 22. Ministry of Overseas Development, Surrey. 450 pp. + maps.

Very useful detailed information on the aspects covered.

(available at Clark University)

28. UNDP. 1977. Development of the Gambia River Basin... Programme of Action. New York. 261 pp.

(available at SWA)

29. UNDP. 1982. Development of the Gambia River Basin; Preliminary Action Plan for Guinea. New York. 58 pp.

Presents summaries of sectoral reports as well as initial series of pre-investment projects seen as basic to land and water resources development in the Guinea. Also describes a process formulating a planning strategy based on computer modeling.

(available at IDA)

30. VERDELAIN, J. 1973. The Ecological Basis of Agriculture and Production Patterns in the Upper River Division of the Gambia. Basle, 47 pp.

31. WEIL, P.M. 1978. Social Analysis of Alternate Development Strategies for the Gambia River Basin: 1976-2000.

(available in IDA)

32. COYNE and BELLIER. 1980. Baardheere Flood Detention Reservoir. Final Report on Review. Paris. 105 pp.

With three other consulting firms, reviews proposals for the Baardheere Flood Detention Reservoir prepared by TECHNITAL/TECHNO-SYNESIS. (The Baardheer Dam is intended to provide flood control to protect irrigation areas downstream along the Juba River; to store water for release during the dry season and produce electricity for the Juba area and Mogadishu.)

The purpose of the review was to evaluate the geological information, design, layout, construction period and phasing of the dam as well as the estimates of quantities, unit prices and costs.

Costs for the dam were estimated (in Somalia shillings) as follows: dam construction 927 million; access roads 70 million; power station 60 million; dam and irrigation equipment 26 million; power station equipment such as transmission lines, 200 million.

(available at Clark University)

33. DOWHAN, JOSEPH J. 1984. "List of Reference Documents Pertaining To Juba Valley Projects." In Juba River Valley Development Project Environmental Assessment. Washington, D.C. 21 pp.

Consists of an alphabetical listing of about 180 studies ranging from major planning documents to more specialized technical and scientific reports to short notes and memoranda. The listing is based mainly on the holdings of documentation centers in USAID/ Somalia and the Ministry of the Juba Valley Development Project.

(available at Clark University)

34. GUNN, SUSAN E. 1982. Social Issues Related to the Proposed Baardheere Dam and Development Schemes: Pre-Feasibility Study. Mogadishu, 40 pp.

Evaluates the sociological coverage of the various studies that have been undertaken in connection with the plan for the Juba Valley Development, particularly those by TECHNITAL and IMPRESIT. It is particularly critical of the latter firm, whose studies, according to the author, are based on the assumption that "people are relatively unimportant because they are so scarce there." Furthermore, IMPRESIT's plan for large-scale development with heavy emphasis on mechanized systems is not in keeping with the country's plan for small-scale schemes.

Another important issue raised is that, although animal products are an important element in the Somali diet, the main irrigation schemes in Somalia have disregarded the livestock sector. Previous development schemes have attempted to supplant a multi-based economy (Consisting of agriculture, livestock and trade) with "discrete" project units which emphasize the development of single sectors and are totaly dependent on external aid.

The paper argues for an abandonment of large-scale development schemes in favor of multi-based agro-pastoral systems using local land and water management skills and institutions.

(available at Clark University and IDA)

35. IBRD. 1981 a. Consultative Group for Somalia. Chairman's Report. Washington, D.C. 147 pp.

Specially relevant are Annex J and Annex K. The former highlights the key issues of the World Bank's Report of the Juba Valley Review Mission. The key issues emphasize caution in initiating major investments such as the building of the Baardheere Dam because of "major macro-economic, implementation, and short-term water needs."

Two major recommendations are made: consideraion of alternative investment sequences and more studies on the land, soil and technical aspects of the Juba Valley Development Program, including the Baardheere Dam.

Annex K describes the composition and tasks of the steering committee set up to review the studies for the Juba Valley Development Plan.

(available at Clark University)

36. IBRD. 1981 b. Somalia Agricultural Sector Review. Washington, D.C. 3 volumes.

A comprehensive review of the potential and constraints to agriculture and livestock development is presented. Particularly relevant is Annex 2, entitled Water Resources Development which covers the following aspects: resources and potential; institutional framework and manpower; government policies and regulation; existing and proposed water development (surface and groundwater development, rainwater harvesting and flood control) and current constraints. With respect to the last, the report finds that the current organizational framework for water development is not "conducive to efficient implementaion of development projects ..." (p. 114).

(available at Clark University)

37. IMPRESIT. 1979. Up-dating and Revision of the Juba Valley Development Plan. Milan, 6 volumes.

Vol. I	Summary and Conclusions
Vol. II	Physical Aspects
Vol. III	Agronomy
Vol. IV	Engineering (3 parts)
Vol. V	Land Planning
Vo. VI	Economy

This plan is an up-date of the 1977 TECHNITAL Plan (see item 38 below) but involving a smaller net irrigable area and omitting the diversion dams at Saacow and Aalaaliyow. It also forms one of major sets of documents used to draw up a Master Plan for the Juba Valley Development Project.

(available in Ministry of Juba Valley Development, Somalia)

38. SOMALIA. BAARDHEERE DAM AUTHORITY. 1981. Baardheere Flood Detention Reservoir; Tender Dossier. 20 pp.

The document is reflective of the wide powers tha have to be given to foreign consultancy firms in the absence of local expertise to evaluate and supervise engineering works in large-scale irrigation projects.

The object of the contract (for which tenders were invited) was to work out the optimum dimension of the power station, finalize the technical details for the dam; prepare all Tender Documents; assist the Baardheere Dam Authority in awarding contracts and prepare cost estimates and time schedules. In addition, the contractor also had the mandate to "take over" the general supervision of the works and testing of materials and plant.

39. TECHNITAL. 1977. Juba River Valley Development Study. Rome. 6 volumes.

Vol. I	Summary Report
Vol II	Human and Social Development
Vol III	Geology, Hydrology and Hydraulic Engineering
Vol IV	Agriculture and Livestock
Vol V	Associated Development
Vol VI	Programme of Activities--Short-Term and Long-Term Measures

This work identifies eleven irrigation zones involving an area of 220,000 hectares. It also gives details of the proposed dams at Baardheere and Sacow. This plan has become one of the major documents used to formulate the Juba Valley Development Project.

(available in Ministry of Juba Valley Development, Somalia)

40. U.S. FISH AND WILDLIFE SERVICE. 1984. Juba River Valley Development Project Environmental Assessment: Preparatory Phase. Prepared by Joseph J. Dowhan. Washington, D.C. 37 pp. and Bibliography and Maps.

The report presents results of a two month consultancy, the main purpose of which was to initiate compilation of existing studies, reports, analyses and other data sources concerning environmental issues in the Juba Valley area. A related goal was to begin the process of developing a Phase II Country Environmental Profile with special emphasis on the Juba Valley Project.

After a very brief introduction to the physical characteristics of the Juba Valley, the report reviews existing and proposed major developments in the Juba Valley. Based on this review, 13 areas of potential environmental impact are identified. For each area some specific environmental changes and consequences are predicted drawing from experiences from similar development projects in other rivers. A number of studies are proposed with emphasis on incorporating the data from these studies into management plans, e.g., an Agricultural Chemicl Management Plan; a Reservoir Fishery Plan; a Reservoir Management Plan, etc.

The next section reviews existing environmental reports, studies, etc. as well as on-going national projects relating to the Juba Valley. This section together with the bibliography of "Reference Documents Pertaining to the Juba Valley Projects" makes this document a valuable source of information for any work on the Juba Valley Development Project.

(available at Clark University)

41. USAID. 1983. Project Paper For Juba Development Analytical Studies. Project Document (649-0134) 27 pp. + Annexes.

The paper describes USAID's contribution to collecting base line data for the preparation of the Master Plan to optimize the resource uses of the Juba River Valley. The paper points out that so far the emphasis has been only on engineering aspects. The purpose of the Master Plan is to include consideration of land and human resources.

The proposed project will have three components: a survey of land use and a soils classification ($2 million); environmental/-socioeconomic assessment of the effects of the proposed scheme ($0.65 million); technical support to the Ministry of Juba Valley Development (including long-term advisors, consultants, long and short-term training, and logistics) ($1.6 million). The contribution by Somalia is expected to be 50 percent of the USAID grant in addition to providing counterpart scientists, professionals and technicians.

Besides describing the components of the project, their implementation and procedures for their evaluation, the paper also gives useful information on the background to river basin development in the Juba Valley, a brief description of completed and ongoing studies, and an analysis of the financial implications of the proposed development. With respect to the latter, the paper points out that the proposed development will require a total of U.S. $2 billion up to the year 2010 and cost Somalia an annual interest payment of $50 million--after the grace period--in a current situation where the national debt is $1 billion and exports earn $167 million a year.

The project itself reflects USAID'S current policy to provide information and management skills to a national organization in order to enable it to participate in the planning and implementation of a river basin development strategy right from the start.

OTHER MAJOR PLANNING DOCUMENTS (not available for full annotations). Information taken from DOWHAN, item J2.

42. ENTZ, B., and others. 1982. Report of the Mission for the Pre-construction Investigations of the Baardheere Dam and Reservoir in the Juba Valley. Nairobi, UNEP. 3 volumes.

Vol. I General Report on Environment
Vol. II Socioeconomic Development and the Environment
Vol. III Aspects of Environmental Health and Epidemiology

(available at Ministry of Juba Valley Development and USAID/Somalia)

43. FAO/LOCKEWOOD SURVEY CORPORATION, LTD. 1967-68. Agricultural and Water Surveys: Somalia. Final Report. Rome. Document no. SF/SOM. 6 volumes.

Vol. I General Development Projects
Vol. II Water Resources
Vol. III Land Forms and Soils
Vol. IV Livestock and Crop Production
Vol. V Engineering Aspects of Development
Vol. VI Social and Economic Aspects of Development

44. HAUPT, W. 1983. Agriculture in the Juba Valley. Mogadishu, 53 pp.

Presents current data and information on agriculture in the Juba Valley downstream of Baardheere, including the amounts and types of farm land systems, based on an analysis of the major Juba Valley studies.

(available at the Ministry of Juba Valley Development)

45. MINISTRY OF JUBA VALLEY DEVELOPMENT. 1983. Review of Juba Valley Development Programme. Mogadishu, 19 pp.

Response to World Bank report, 1983--rejecting the Bank's suggestions for more feasibility studies.

(available at Ministry of Juba Valley Development and USAID/Somalia)

46. M. MACDONALD and PARTNERS. 1977. Mogambo Irrigation Project: Supplementary Feasibility Study. Cambridge, England.

Covers hydrology, soils, agriculture and livestock, infrastructure and institutions for an irrigation project involving 6,400 hectares of rice, maize and cotton.

(available at UNDP/Somalia)

47. WORLD BANK. 1983. Somalia: Review of the Juba Valley Development Program. Final Draft. Washington, DC. 76 pp. + Annexes.

(available at USAID/Somalia)

48. BROKENSHA, DAVID. 1978. "Development from Below and Integrated River Basin Development" in Towards a Rational U.S. Policy on River Development in the Sahel. Edited by Charles L. Joyce. Washington, DC. pp. 6/1-8.

Brief but clear discussion of four points about local participation: what does it mean? Why bother about it? How is it perceived? How can it be related to development?

The paper also describes an indigenous successful land and water use scheme in the inland delta of the Niger River in Mali, where "up to 100,000 hectares of land are farmed using floodwater techniques; up to 100,000 tons of fish are caught on an annual basis by some 80,000 fishermen, and some three million stock are pastured."

(available at Clark University)

49. CLUB DU SAHEL. 1976. Hydro-agricultural Programming, 1975-2000. Republic of Niger. 47 pp. + Appendices.

The first part of the report argues that given the demographic pressure, shortage of farmland and risk of drought, the development of hydro-agricultural projects using both surface and underground water is of "capital importance."

Three principal areas are identified for such development: the river valley, the Ader Doutchi Maggia and the Valley of Koumadougou. Existing problems in the irrigated sector are identified and include: lack of adequate data on water resources, poor management of schemes, wide scattering of small perimeters, and the high cost of operations (U.S. $ 10,000/hectare).

The next section details a number of short-term and long-term plans for the three areas. The former cover projects that could be carried out before the construction of flood control dams, e.g., the Kandadji. They are designed to ensure an increase of 2,000 hectares per year. If this can be achieved, the country would be able to attain self-sufficiency in rice and sugar cane by 1985 but leave deficits in wheat and sorghum for which an additional 20,000 hectares would be necessary. The report argues that this additional irrigated land cannot be achieved without large-scale development proposed for the Kandadji and/or the Lake Chad Basin.

In addition to technical details for increasing output, the report also gives details of scientific and management personnel required for the proposed plans. Other needs that are identified as requiring attention are discussed in general terms. They include the formulation of an irrigation policy, research and

further studies, decentralization of the administrative structure giving each of the three areas its own structure, monitoring and evaluation of projects and the need to identify related projects such as feeder roads and factories. The report also sees the need for price incentives and farmers' participation in decisions, though again these are described only.

Total costs for the proposed projects excluding investment in dams and _____ roads is estimated to be about 94 million over the 20-year period. The breakdown is by area of development rather than by sector, so it is difficult to see how much of these costs are scheduled for training, management, monitory and evaluation or remedical measures.

(available at Clark University)

50. NIGER. HAUT COMMISSARIAT A L'AUTORITE DU BARRAGE DE KANDADJI. 1981. Kandadji Dam. Report of the Committee of Experts for the Study of the Possible Limits for Irrigation in the Niger Valley without the Dam. Prepared for the European Development Fund. 55 pp. + Appendices.

The report concludes that the creation of water storage for irrigation purposes upstream of the irrigable areas is not indispensable before 1995 and perhaps not even before the year 2000. Some cheaper alternatives are described to make up water deficits for agriculture up to the two time periods.

The dam is more justifiable from the energy producing point of view, but even there, the study recommends that the advantages of the Kandadji must be viewed with alternate means of producing hydro-electric energy.

(available at USAID Library, Rosalyn Plaza)

51. REYNA, S.P. 1983. Social and Economic Analyses for Niger River Basin Planning. (Project no. 625-0944). 52 pp. + Appendices.

The paper deals with two aspects: the capacity of the Niger Basin Authority (NBA) to plan, create and manage a river basin development process; concepts and methodologies for conducting socioeconomic studies in connection with formulating the Integrated Niger Basin Plan (NBP).

With respect to the former, the paper points out that NBA's planning ability is impaired by three major deficiencies: the lack of a planning unit, the undifferentiated role of the secretariat and lack of planning personnel within the directions or subsections. On the whole, the report claims, "a few development professions are doing technical details of development and none

are doing planning. Recommendations include the setting up of a planning initially with expatriate staff but at the same time training counterparts to take over; on the job training of technicians and technical assistance to collect and analyze data for planning.

On socioeconomic issues, the paper emphasizes that the studies must work from the premise that the people and their socioeconomic systems are the most important resource in the Niger Basin. The studies must thus be a mechanism to understand existing land and water use systems for incorporation into the planning process and straegy. Two types of studies are recommended: short-term and 24 month long studies. The report specially emphasizes the need for using the data to devise a "development from below" strategy, actively involving the people in the planning and implementation of the INBP. A number of subjects to be studied are identified including the special role of women, land and labor allocation practices, land tenure isues, and alternative souces of income as trade-offs to agricultural intensifications.

(available at Clark University and IDA)

52. UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP). 1970. Integrated Development of the Niger River Basin Interdisciplinary Mission. Abidjan. 49 pp. + Appendices.

The report argues that neither the Basin proper nor the River represent a real political or economic entity. Therefore "complete overall economic integration of the member states....does not appear feasible or even desirable at least at short or medium terms" (p. 16).

The report, therefore, recommends a "progressive integration." Specifically, this strategy would entail operations/projects that would group two or more sectors and have a direct impact on two or more states as an initial phase. The operations/projects would then encompass other states/sectors, as further integration was considered necessary and desirable by the member states.

Specific discussions and recommendations focus on the role and needs of the Niger River Commission (NRC). The report sees the role of the NRC as that of a liaison organization to: harmonize the plans of the national organizations of the member states; contract services or capital for multi-national projects; and provide information to the member states. With respect to the last, the report recommends the setting-up of a documentation center to collect existing materials and diffuse information. The needs for local and expatriate personnel for the NRC are also identified.

Other specific recommendations concern socioeconomic sectors: water resources; participation of population; training; health; transport; energy; agriculture and meteorology. However, as the existing situations of these sectors are not described in detail, the recommendations take on the aspects of a mere formula -- without data to work out the specifications.

The report also has some critical evaluations of international aid. It suggests that some agencies may have gone overboard with their pre-occupation with studies (p. 13). It is also critical of the neglect of the training aspect (p. 13, 17).

(available at Sahel Documentation Center)

53. USAID. 1982. Niger River Basin Planning (625-0944) and Support to National Organizations (698.0413.12) 50 pp. + Appendices.

Describes a project costing U.S.$ 11.7 million to develop (with other donors) an institutional capacity within the Niger Basin Authority (NBA) to carry out "coherent river basin development planning and identify rational development." To do this, the project will: assist is the creation of a four-person planning unit within the NBA, complete a river sytems analysis, collect socioeconomic and environmental impact assessment data, apply the knowledge in the preparation of an integrated Niger Basin Plan.

The project expects the final output to be NBA's ability to have baseline data, planning tools and personnel in order to provide information to member states on the impacts of various proposed projects.

(available at Clark University)

54. USAID/NIGER. 1981. Sahel Regional Niger River Development Planning (625-0915). A Project Paper Amendment. 27 pp.

USAID's overall strategy in the Niger Basin has been towards increasing the capacity of the local river basin authority to plan the development of the basin. This project, estimated to cost $1.04 million, is part of that strategy. Specifically, it involves a river systems analysis, using a modeling technique to be carried out by the U.S. Corps of Engineers. Such an analysis is considered essential to enable the local authority, the Niger Basin Authority, to assess the implications of planned projects.

55. USAID. NIGER. 1984. Niger Irrigation Sub-Sector Assessment. Niamey. 47 pp. + Appendices.

The report claims that of over 9,000 hectares of irrigation schemes established in Niger since independence, only 5,500 hectares were actually in production in 1983.

Existing irrigated area is falling out of production at the rate of 12 percent per year. Moreover, land under production was producing well below the potential. A multi-disciplinary team was therefore fielded to identify the reasons for this substantial underachievement.

The team concluded that the problems of the irrigation sub-sector were part of the constraints facing the country's agricultural sector. However, these were also specific problems such as poor water supply, maintenance and management of the irrigation works, and weaknesses in the services of ONAHA, the organization most responsible for the sector.

It recommended that USAID concentrate on improving the performance of the existing schemes by addressing specific problems such as labor bottlenecks, poor selection of cropping patterns, poor management of water, and lack of perimeter level research.

It further recommended strengthening ONAHA while at the same time persuading the organization to divest some of its activities to the private sector, particularly agricultural extension. For the latter, a pilot project was suggested, as a first step.

RELATED DOCUMENTS

56. APPALO, PLASCIDE AMOUSSOU. 1981. Planning Role in the Development of the Niger River Basin. M.Sc.(Hydrology) Univ. of Arizona. 168 pp.

(available at SWA)

57. DEVELOPMENT ALTERNATIVES. 1980. A Mid-Term Evaluation of three Niger Food Production Projects: Development of Irrigation of Rice Production in the Firgoun Basin. Washington, D.C.

58. GROUPEMENT, G.V. 1974. Kandadjji Dam, Niger River Basin, Africa. Des Moines. 52 pp.

(available at the Sahel Documentation Center)

59. INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT. 1975. Development of the Niger River Basin. Washington, D.C.

60. NIGER BASIN AUTHORITY. EXECUTIVE SECRETARIAT. 1980. Two-Year Development Plan (1981-1982). Niamey.

(available at the Sahel Documentation Center)

61. RIVER NIGER COMMISSION. 1976. Compedium of Existing and Prospective Principal Water Resources, Works and Projects in the River Niger Basin. Niamey: River Niger Commission/Commission du Fleuve, Niger.

(available at the Sahel Documentation Center)

62. ADAMS, ADRIAN. 1981. "The Senegal River Valley." Rural Development in Tropical Africa. Edited by J. Heyer, P. Roberts and A. Williams. New York, St. Martin's Press: 326-353.

Describes two types of agricultural change based on irrigation in the Senegal River Valley: Change initiated from with local communities (author's developpement paysan) and that imposed from above (developpement de fonctionnaires). Official attempts to supplant the former type of development with the latter were being resisted by the peasants because they saw "no necessary fit between their own interests (which was growing vegetables for the local market using low inputs) and those of officialdom" (which was to grow rice using high inputs and involving considerable outlay of capital).

(available at Clark University

63. BAJSAROWICZ, J. AND WELTO, J. 1979. "Surface Water - Groundwater Condition in the Senegal River Basin near Matam, Senegal" in: Hydrology of Areas of Low Precipitation. Proceedings of the Canberra Symposium of the International Association of Hydrological Sciences, pp. 235-248.

In 1976 USAID employed BECHTEL Inc., San Francisco, to evaluate alternative irrigation methods (among other terms of reference), including the use of surface and subsurface water resources. Exploration showed two extensive "argillaceous formations with almost unlimited and highly transmissive aquifers." Based on these assessments BECHTEL devised an entirely new irrigation scheme using a combination of wells and surface water sources. The authors of this paper summarize the key aspects of the scheme and conclude that "...a cautious and flexible-phased development offers a viable alternative in this area." They also assert that the alternative precludes the need for vast capital investment or major disruptions to existing social structures. It also minimizes negative environmental impacts which appear to be invariably caused by large-scale irrigation schemes.

64. AMERICAN PUBLIC HEALTH ASSOCIATION. 1977. Final Report-Environmental Assessment and Health Component Design - Bakel Irrigated Perimeter Project, Senegal. Washington, DC. 58 pp. + Appendices.

The review, based on secondary sources, official documents and field data sees no "foreseeable adverse impacts" of the small-scale irrigation projects in the Bakel area. However, it does recommend the free distribution of anti-material prophylaxes in

order to improve the health of the farmers and thereby their productivity.

The report is also useful for its detailed description of the project, which it calls a "fairy tale" of success, due largely to the fact that the project was a direct result of initiatives by farmers. Another aspect emphasized is the positive contribution of migrant labor. In most other reports, river basin planning is aimed at reducing migration from the planned areas. This report presents a contrasting approach.

(available at Clark University.)

65. GANNET FLEMING CORDDRY and CARPENTER/ORGATEC. 1980? Assessment of Environmental Effects of Proposed Developments in the Senegal River Basin. Plan of Action. Final Report. Harrisburg/ Dakar. 158 pp.

This report is based on a three year study set up to evaluate the interrelated effects on the environment of the proposed development projects, namely, the construction of the Manantali and Diama dams and associated agricultural and industrial installations.

The three-year study findings are described in one synthesis and 14 sectorial reports. The present report summarizes the findings--highlighting both beneficial and adverse effects on the 14 sectors--and makes recommendations for a plan of action. The recommendations are of three types:

--- to enhance beneficial impacts;
--- to mitigate adverse effects;
--- to create or strengthen public institutions to carry out environmental actions.

The overall conclusion of the report is that the benefits far outweigh the adverse consequences. Nevertheless, it warns that if the Senegal River Basin is improperly managed, the proposed development will provide "further evidence of man's overuse of his environment and its relationship to encroaching desertification" (p. 63).

The conclusion is therefore contingent on good management of the projects--an aspect that is assumed throughout the assessment since it is not specifically discussed as a variable in any of the 14 sectorial reports. Is the conclusion, thus, weakened?

Nevertheless, the multi-volume study and the present report reflect thoroughness and sensitivity to a wide range of complex issues and provide data and recommendations that make it possible to heed to the warning and make the conclusion possible.

(available at Clark University)

66. IBRD. 1979. Project Performance Audit-Senegal: Terres neuves Resettlement Project. (Credit 254-SE) by W.L. Weiner. Washington, DC. 64 pp.

The project which began in 1971 and ended in 1978 cost U.S. $1.35 million. It involved the resettlement of 300 peasant families into villages, each with a block of 1250 hectares of land. Other objectives were to provide basic services and facilities to the settlements as well as to an additional 250 already established farmers in the area, and introduction of intensive farming techniques.

The World Bank considers the project to be a success. The "Audit report agrees: economic return was 59 percent instead of the estimated 13 percent. Farmers' incomes within and without the settlement schemes increased considerably. More people than planned for came to the schemes indicating the attractiveness of basic services.

However, the report is cautious about the way incomes were calculated. Furthermore, the Bank's insufficient socioeconomic knowledge, particularly with respect to land tenure and land distribution, was already causing problems.

It was also not clear to what extent farmers' incomes could be attributed to the project since many of them did not follow the farm plan of the project, but responded rather to market forces.

(available at Clark University)

67. MILLER, R.P. 1984. Peasant Economy and Irrigation: Innovation in the Senegal River Basin. Evanston, Ill.

Discusses the relationship between externally induced innovations involving technological change with state intervention, and forms of struggle for continued community control within irrigation schemes in the Senegal River Basin.

The author claims that there are two major aspects of this relationship. In the first place, the responses to state intervention illustrate that the peasants are active participants in the development process. Secondly, the tension between the state bureaucracy (SAED) and the local associations is not over maintenance of traditional technologies but rather over control of the new technologies that will eventually replace the old ones (p. 254).

The study, therefore, concludes that "to the degree that the peasants and the state could agree more closely on the objectives of irrigated agriculture, and the peasants are given increased responsibility in helping fulfill those objectives, it is likely

that irrigation agriculture would become a more viable option for a production technology for the Senegal River Basin" (p. 259).

68. JOYCE, CHARLES L. 1978. "Towards a Rational U.S. Policy on River Basin Development in the Sahel." Proceedings of a Colloquium held in Washington, DC. March/April 1978. Washington, DC. Various pagings.

The work comprises of a comprehensive set of papers on key issues and the major river basin development activities in West Africa. The colloquium was held in order to "define the degree to which U.S. should participate in the major infrastructure activities associated with river basin and attendant programs of irrigation development."

Some of the outstanding issues discussed were: the adequacy and comprehensiveness of river basin planning, the alternative use of scarce capital resources, the high per hectare and per family costs of irrigation, the appropriateness of available technology, and the management and planning capacity of local institutions.

The comments on the papers and the questions raised during the discussions are as illustrative of the complexities of river basin planning and development as the papers themselves.

(available at SWA and Clark University)

69. OMVS. 1976. OMVS Programme: Presentation, Methods and Means of Implementation. Dakar. 140 pp.

The OMVS sees the development of the Senegal River Basin as important for restructuring national economies and establishing links of cooperation between states, thus, going far beyond the generally accepted concept of integrated basin development. With respect to the latter, the OMVS sees the need to identify common interests on the basis of which joint activities and complementary actions can be taken without producing bottlenecks. Achieving these objectives needs planning of activities as well as of institutions.

The report is divided into three sections. Chapter One describes the "OMVS program," the main components of which are the construction of the Manantali and Diama Dams, development of rainfed and irrigated agriculture, development of other resources, (livestock, fishery, minerals, industries) and improvement of navigation and transport along the Senegal River.

Chapter Two outlines the methods and means of setting up the planning and implementation framework, including the restructuring of OMVS. The last chapter provides a time chart for the activities.

(available at Clark University)

70. OMVS/CLUB DU SAHEL. 1980. Indicative Programme for Hydro-Agricultural Development of the Senegal River Basin, 1981-1990. Dakar. 113 pp.

The program is based on the fact that two major flood control works are due to be completed during this period, namely, the Diama and Manantali dams. The goal is to address the current constraints to the development of irrigated agriculture through planned action that takes into consideration existing resources, projects, activities and institutions.

The first part of the report describes the potential of the basin, the current food production systems, the existing hydro-agricultural operations, and constraints to development of the irrigated agricultural sector.

The second part details hydro-agricultural installations and supporting activities such as training, reorganization of institutions and feasibility studies. The proposed program is expected to affect about 40,000 families, result in increased agricultural production and new employment opportunities, as well as stimulate other sectors such as agro-industries and trade. Activities are not restricted to agriculture but also concern livestock, forestry and fishing.

The budget for "hydro-agricultural" projects is quite revealing. Of the 105,343 billion CFA ($478.8 million) 84.4 percent was budgeted for civil engineering works; 8.5 percent for studies; 3.3 percent for training and supervisory structures; 2.8 percent for machinery for agricultural production.

71. QUOC-LAN, N. n.d. "The Development of the Senegal River Basin: An Example in International Cooperation." 13 pp.

"The purpose of this paper is to provide some highlights on the approach adopted by the three nations (Senegal, Mali, Mauritnia) in the solution of the problems of joint ownership of hydraulic works on the Senegal River, the allocation of their benefits and costs and their financing." - Author's abstract.

72. SPARLING, E.W. 1981. A Survey and Analysis of Ex-Post Cost-Benefit Studies of Sahelian Irrigation Projects. Colorado University. 24 pp.

Concludes that investment in large-scale irrigation of rice falls far short of paying for itself; small-scale irrigation projects have higher rates of return. The author attributes the difference to the types of production controlling the two types of schemes -- hierarchical in the former; greater farmer participation in the latter. Moreover, the small schemes also allow the farmers greater decision-making scope for alternative use of labor. They thus have greater "downstream multipliers from income spent locally" than the large schemes which resemble extractive industries with few local multiplier effects.

Recommendations include avoidance of large-scale perimeters, reorganization of existing large scale perimeters to give farmers more production control, redirection of government agencies from managing production and subsidizing inputs towards a client-orientated R & D. Other recommendations focus on how to eliminate specific constraints limiting farmer productivity. The paper also emphasizes the need to consider the impact of large-scale irrigation schemes involving dams, on existing flood recession and traditional irrigation schemes.

The analysis is based on two studies: Social Cost-Benefit Analysis of the Nianga Project, Senegal by E. Weiler and Costs of Rice Production in Irrigated Perimeters of the Senegal River Valley, by H. Diallo.

(available at SWA and Clark University)

73. STEPHENSON, JAMES E. 1983. Technical Review of Project Paper. Prepared for USAID. 53 pp. + Appendices.

This report is an appraisal of the OMVS Integrated Development Project (IDP) as designed and presented by the USAID field personnel.

The report describes the key elements of the IDP, identifies critical technical considerations and implementation aspects that affect the viability of the project, and makes recommendations for actions.

The report concludes that the tasks that the IDP has set itself to do are "most difficult." The construction aspects such as upgrading and building new irrigation perimeters are achievable; the greatest difficulty will be upgrading the capability of the national organizations (SAED, SONADER and OVSTOM) and making them more responsible to farmers' needs.

The management aspect of the IDP is the crux of the matter and on it lies the success or failure of the project.

A notable omission is any commentary on the IDP's proposals to privatize the supply of inputs and marketing of produce.

(available at SWA and Clark University)

74. SYLVIAN, FRESSON. 1978. Village Participation in Pump Irrigation Areas in the Matam zone in Senegal. Paris OECD document no. CD/R (78) 12. (Experiments in Rural Development. Special Document no. 4).

Discusses farmers' interest and effective participation in pump irrigation areas in small-scale irrigation projects. In such projects all improvements are done by hand and work and expenses are managed through collectives organized within the existing social structures.

The author attributes the success of the schemes to two facts: the persistence of drought related chronic food shortages needing external support and the existence of a highly structured hierarchical society where mutual social and economic assistance was still prevalent and important.

This study is useful in pointing out the value of incorporating local institutions into the management of river basin development programs.

(available at SWA)

75. U.S. DEPT. OF INTERIOR. BUREAU OF RECLAMATION. 1975. Senegal River Basin: Water Resources Development Analysis. Washington, DC. 127 pp.

Presents a detailed assessment of three major studies on the Senegal Basin area: "the Senegal Consult Report", the "SOGREAH Mathematical Model Report," and the "Beyard Study." The review identifies 17 functional areas that were deficient on technical data to support the proposals contained in the three sets of documents.

(available at SWA)

76. U.S. DEPT. OF INTERIOR. BUREAU OF RECLAMATION (BUREC). 1976. Senegal River Basin: Preliminary Data Examination and Suggested Study Program. Washington, DC. 195 pp.

In 1975 BUREC reviewed three major proposals for the development of the Senegal River Basin (see item 75). In 1976 BUREC

sought additional literature and field data to assess seven of the seventeen areas found to be deficient in technical data.

The present report is a composite of the two studies. Among the deficiencies in the proposals BUREC discovered are the following:

... irrigation development in the delta could increase rather than decrease salinity in the area inspite of the planned anti-salinity Diama Dam;

... the benefits of the Manantali Dam are unclear because of its potential for adverse effects on existing recession type agriculture;

... most of the planned irrigation developments require pumping water both for water supply and drainage. Yet gravity schemes near the Bakel area are feasible and would be more appropriate;

... none of the major projects under consideration can be implemented soon enough to relieve present food shortages.

(available at SWA)

77. USAID. 1978. Project Review Paper: SAED Training. Washington, D.C. 27 pp. + Appendices.

Describes proposals for a project, the main elements of which were as follows:

--- creating a training structure within SAED to upgrade the skills of about 400 of its employees in the use, maintenance and repair of equipment;

--- devising "on the job" training methods for such employees;

--- construction/repair of five training centers/workshops;

--- establishing an equipment and supplies management system.

The goals of the project are far-reaching in principle but an evaluation in 1982 by Aurora Associates found that "progress toward the achievement of project objectives has been unsatisfactory" (SAED Training Project Evaluation Report, August 1, 1982.).

The two reports illustrate the problem faced by USAID in developing management skills in the Senegal River Basin.

(available at Clark University)

78. USAID. OMVS. 1982. Integrated Development Project. (No. 625-0621.) Dakar, Senegal. 7 volumes.

The Integrated Development Project (IDP) is comprehensive and complex strategy for the development of the Senegal River Basin in Mauritania, Senegal and Mali. It consists of an agricultural component as well as a program to address policy and institutional constraints.

The proposals formulated by USAID's River Basin Development Office (RBDO) in Dakar, Senegal, envisage a seven-year project consisting of four related but separately managed programs to prepare feasibility studies and maintain new irrigation perimeters for about 15,000 hectares as well as to improve productivity, management and services in the existing ones. The OMVS ($9.3 million) will be strengthened to act as donor financing coordinating mechanism, while the three national programs will be assisted to "increase productivity, expand irrigated agriculture, rehabilitate existing schemes, maintain health surveillance and construct feeder roads" ($21.0; $21.7 and $11.0 for Senegal, Mauritania and Mali, respectively).

The overall management will also be two-pronged. USAID's RBDO will be responsible for the management, responsibility and direct overseeing of regional programs, budget and coordination; while USAID's in individual countries will be responsible for national programs.

The IDP is aimed at increased farmer participation; provision of extensive organizational advice prior to construction; promotion of strong links between researchers, extension agents, and farmers; and developing alternate private systems for input supply and produce marketing.

Specific programs include creating about 160 village associations for effective construction, maintenance and management of irrigated perimeters; training 1500 villagers as perimeter technicians; assisting 10,000 farmers to master irrigation technology and improve yields through applied farming system research effort.

The focus will be on private farmers. Institutional and policy reforms will also aim at "streamlining state interventions in the agricultural sector and fostering the growth of private enterprise."

The whole project is targeted to produce 200,000 tons of cereals by 1990; that is, 10 percent of the projected consumption reqirements of the three countries.

(For an evaluation of the proposals see item 72)

(Volumes available at Clark University
I Development Context
II Project Paper
III 1.0 Economic and Financial Analysis
2.0 Social Analysis
3.2 IDP Irrigation Component
4.0 Institutional Analysis)

79. USAID/SENEGAL. 1983. OMVS Groundwater Monitoring Project (625-0958). Dakar, 107 pp. + Annexes.

Describes a U.S. $4.6 million project to establish an effective monitoring and early warning system to identify current and potential problems related to groundwater development and management. The project also includes provisions for training nationals from OMVS member states to carry out the monitoring.

This is one of the few studies in which river basin development organizations working in Africa show an awareness of the potential effect of large-scale irrigation development on groundwater resources.

(available at DIU and Clark University)

80. USAID/SENEGAL RBDO. 1982. U.S. Development Objectives in the Senegal River Basin. Dakar, 77 pp. + Appendices.

The objective of the paper is stated as "to set forth the rationale for U.S. participation in the development of the SRB and to propose the manner in which it can be done" (p. 2).

The rationale is two-fold: the first relates to food aid, the second to the potential for private investment. The report argues that U.S. will be progresively less able to supply food aid which conversely will increase in demand (p. 11). With regard to the second, the report sees great potential for joint American/African ventures in mining, energy, forestry, agro-industry and manufacturing.

The proposed strategy is three-fold: assist in projects to increase food production in the SRB to keep pace with population, promote policy reforms that remove constraints to agricultural production, improve the capability of private and public institutions to "manage the transition from traditional to irrigated agriculture." The three aspects are discussed against the report's identification of the current constraints to irrigated agriculture in the SRB.

(available at SWA and Clark University)

81. WATT, S.B. 1981. "Peripheral Problems in the Senegal Valley" in: River Basin Planning: Theory and Practice. Edited by S.K. Saha and C.J. Barrow. New York, John Wiley, pp. 167-189.

Examines the current difficulties of promoting irrigated agriculture in the Senegal Valley against the historical processes that have affected the region. The study identifies the out-migration of youth from the Senegal Valley as the most severe end effect of underdevelopment and the single most important cause for the present low status of agriculture in the valley. The absence of youth affects aspects such as changes in land distribution and ownership, or attempts to make the Village Associations more democratic or egalitarian.

The paper also includes a good overview of the experience of small-scale perimeters (item) asserts, that smll does not guarantee success. (p. 179).

Significant documents (not available for full annotation) include:

82. BEYRARD, NORBERT. 1974. Integrated Development Program of the Senegal River Basin. 11 volumes.

83. FAO/UNDP. 1977. Hydro-Agriculural Study of the Senegal River Basin. New York? 319 pp.

84. OMVS/UNDP. 1980. Social Economic Study of the Senegal River Basin. 7 volumes.

85. SENEGAL CONSULT/SWITZERLAND. 1970. Feasibility Survey of the Regulation of the Senegal River. 9 volumes.

86. WANE,M.A. 1983. International Cooperation and Technology Transfer Within the Framework of the Organizaion for the Development of the Potentialities of the Senegal River Valley (OMVS). Berlin, German Foundation of International Development.