UNITED NATIONS

ECONOMIC
AND
SOCIAL COUNCIL

Distr.
GENERAL

E/CEPAL/G.1203
19 July 1982

ENGLISH
ORIGINAL: SPANISH

C E P A L

Economic Commission for Latin America

ENVIRONMENTAL MANAGEMENT AND LARGE WATER RESOURCE DEVELOPMENT PROJECTS */

*/ Revised version of the document entitled "Aspectos ambientales de la gestión de grandes obras de infraestructura hidráulica" (E/CEPAL/PROY.6/R.2) prepared by Messrs. Axel Dourojeanni and Terence Lee of the CEPAL Natural Resources Division.

82-5-1036

CONTENTS

/I. BACKGROUND

I. BACKGROUND AND UNDERLYING CONCEPTS

1. Introduction

Large multi-use water resource projects are among man's most impressive efforts to master the elements of his environment for development purposes. The water engineering works executed under these projects have great impact both because of their physical magnitude and economic cost and because of the chain reactions they set off in the environment and the resulting changes in the living conditions of the people dwelling there.

The supervision and execution of multi-use water resource projects comes under the heading of "management for development".1/ When this type of management directly affects the environment, as it does in the case of water resource projects, it is called "environmental management". Environmental management is an integral and continuous process which is part of management for development and has as its main objective the administrative and technical supervision, execution and monitoring of all the changes which man brings about in the environment in order to satisfy his survival and development needs, while maintaining a certain balance between his own needs and those of the environment to which he belongs. In this connexion, it must be pointed out that the expression "environmental management" does not refer only to the execution of "environmental protection measures" but, as noted, involves the supervision and co-ordination of certain activities aimed at the rational utilization of the environment.

1/ The word "management" as used in this study corresponds to an entrepreneurial concept which involves the direction and supervision of the performance of both administrative and technical tasks for the attainment of certain goals. In Latin America in general, the word "management" is translated as "manejo", "ordenamiento", "administración" or "gestión", with no distinction drawn between them. It is, however, felt that the nearest Spanish equivalent to the word "management" is "gestión" and that the words "manejo", "ordenamiento" and "administración" refer to operations involved in management rather than to management itself. In this connexion, it might be pointed out that in the field of natural resources and the environment in general, the performance of technical activities within the management process is commonly referred to as "manejo" or "ordenamiento". Thus, for example, the management of river basins is frequently referred to as "manejo de cuencas" or "ordenamiento de cuencas"; water management, as "manejo de agua"; animal management, as "manejo de fauna"; grasslands management, as "manejo de pastos" and forest management, as "manejo de bosques" or "ordenamiento de bosques". It follows that a combination of such technical activities which makes possible the rational use of natural resources is referred to as "manejo de recursos naturales" and even as "manejo ambiental". The administrative activities within the management process in the field of natural resources mainly involve functions of planning, financing, monitoring, supervision and other activities which regulate and make possible the performance of the technical activities in the field. Management therefore involves the direction and supervision of the performance of both groups of activities -technical and administrative. On the other hand, management can be performed at various levels and for various purposes, the most important form of management being performed by man for his own survival and development, and known as "management for development".

/The supervision

The supervision of the execution of a project making use of natural resources, such as water resources, is a specific part of environmental management, involving the identification of concrete objectives to be reached within a given physical environment and time span. A project always involves the execution of pre-determined phases, so the time factor is important in its definition and delineation within a larger ongoing process such as that of environmental management in general.

Difficulties arise in connexion with environmental management when it is subdivided into the execution of many projects whose objectives and timing do not inter-relate. When this happens, the concept of environmental management is confined to isolated measures with regard to the environment without foreseeing or controlling the series of effects, both positive and negative, which may result from altering the original environment. This means losing the opportunity to attain a higher level of development at lower economic, social and ecological cost.

In Latin America, these problems have usually materialized as a result of too much concentration on the phase in which the works are constructed, to the detriment of the subsequent phases in which the systems constructed are operated and the resources belonging to the physical area of the project are managed and conserved.

It has been noted that this problem has two main sources -first, a failure to recognize that actions executed in a given environment must be integrated and complementary, and second, the fact that the responsibilities of those who execute the projects are excessively limited.

One reason for these problems is obviously conceptual errors resulting from the large and varied terminology which has been adopted with regard to the environment (this study attempts to find at least a partial solution to this). One such conceptual error, for example, is to say that a water resource project "has environmental considerations" when, in building a water use project, no more is done than to assess or list the probable environmental "impacts", "problems" or "effects" which may result from major water engineering works. This represents an attempt to isolate water projects from environmental considerations or (which amounts to the same thing) to separate the construction of water projects from other environmental management activities. This separation is artificial and inappropriate since a water project is itself clearly an environmental management activity in that environmental considerations are always incorporated in the whole process of managing a project and not just in part of it. This reality may also be denied when those responsible for a project are unwilling or unable to assume responsibility for controlling in any way the effects of its initial activities (water engineering works in this case), confining themselves to making a passive list of impacts for "other bodies" to take into consideration, without specifying what "other bodies" they are referring to, what they should do, at what cost, when, and with what resources.

The first observation to be made is that the success or failure of many projects is closely linked to the possibilities which exist of gaining a better view of the effects the planned action will have on the environment and the level of responsibility which those responsible for the execution and financing of projects are willing and able to assume in order to exert direct or indirect control over those effects.

This study therefore seeks, at a preliminary level, to make recommendations which may help such persons to improve their management activities from both the technical and the administrative point of view by identifying practical

/principles and

principles and criteria for improving the kind of environmental management involved in the execution of large water resource projects.

With this aim in view, and on the basis of prior case studies and the drafting of a conceptual framework, an attempt is made to analyse the relative effectiveness, at both the technical and the administrative level, of the activities carried out by those responsible for some large water projects in terms of the well-being achieved by the people living within the project area, the degree of control exercised over the negative effects of the main technical action taken under the projects, the level of efficiency reached in taking preventive measures to control such effects, and other factors which are discussed further on in this study.

The case studies taken into consideration were the Tinajones water resources development project in Peru, the project for the development of the valley of the river San Francisco in Brazil, and the Salto Grande multi-use water resource project in Argentina and Uruguay.

This paper was originally presented to the regional seminar on environmental management and large water projects organized by CEPAL and UNEP in collaboration with the Salto Grande Mixed Technical Commission and held at Concordia, Argentina, from 1 to 3 October 1981 and the conclusions and recommendations reached in this paper benefited from the discussions held at the seminar.2/

2. Large water projects in the development of Latin America

The regulation and control of river flow systems in order to harness water resources has spread widely during recent years in Latin America, and this trend is expected to continue. The sustained growth of the main economies of the region has increased the demand for drinking water, hydroelectric energy, irrigation and river transport and has heightened the need to protect areas subject to flooding and satisfy other needs of the population with regard to water supplies. It is necessary to construct hydraulic engineering works and operate existing systems appropriately if the natural supply of water is to be made to meet the demand.

The extent to which river systems are affected by the construction of dams, dikes, locks and other means of regulating flow has risen in recent years, and the natural flow conditions of all the major river systems except the Amazon are being substantially modified. The most notable instances of the extension of controls over river flow systems are found on the river Paraná in the river Plate Basin; the river San Francisco in Northeastern Brazil; the river Caroní in the basin of the river Orinoco in Venezuela; and the rivers running down to the Pacific from Ecuador to Chile, but in fact increased regulation of river flow régimes is common throughout Latin America.

Control structures and reservoirs have constantly grown in both number and size, although irregularly (see table 1). Over the same period, the number of large dams in Latin America has also grown as a proportion of the world total.

2/ Axel Dourojeanni and Terence Lee, Aspectos ambientales de la gestión de grandes obras de infraestructura hidráulica, (E/CEPAL/PROY.6/R.2, Santiago, Chile, 1981).

/Table 1

Table 1

LATIN AMERICA: CAPACITY OF RESERVOIRS AND NUMBER OF LARGE DAMS

Period of construction	Reservoirs			Dams		
	Millions of m3	Cumulative	% of total existing in 1977	Number	Cumulative	% of total number in 1977
Before 1942	15 170	15 170	4.6	191	191	20.2
1943-1952	23 124	38 294	7.0	103	294	10.9
1953-1962	83 585	121 879	25.3	213	507	22.5
1963-1972	126 779	248 654	38.4	277	784	29.3
1972-1977	81 280	329 938	24.6	162	946	17.1

Source: International Commission for Large Dams (ICOLD); World Register of Large Dams.

/Thus, during

Thus, during the period for which statistics are available, the percentage of large dams and reservoirs constructed in Latin America has doubled (see table 2). In spite of this progress, the total water storage capacity made available through the construction of large dams is less than 5% of the annual volume of surface water, if we exclude the Amazon River Basin, whose flow alone accounts for half the annual volume of surface water in the region.

Although the changes brought about by these projects would appear to have had a relatively modest effect on the hydrological conditions of Latin America, this is nevertheless sufficient for them to be considered as a challenge to the capacity to execute water resource projects in the region.

It cannot be denied that vast experience is available in connexion with this kind of project, but this experience is for the most part limited to the design, construction and operation of large water projects. When it comes to the management and conservation of natural resources and, in general, to the environmental management required to meet the needs of the people settled within the zone of influence of such works, it is a different matter. In other words, it may be said that there is a need to bring the goals regarding the construction of such projects into closer harmony with the environmental goals in order to obtain results which meet the needs of society.

In the case of many unusually large works, the project execution has been so dominated by their technical and hydraulic aspects and their constructional features that other important activities needed to benefit the population which the works were intended to serve have been postponed or completely omitted. This has been noted in a number of studies which draw attention, for example, to the substantial inequality in terms of time and magnitude between investments in the execution of large dams for regulating water resources for irrigation, and investments for the physical development of land and human settlements in the areas which stand to benefit from the regulated flow. Moreover, there is usually a radical difference between the working conditions and facilities made available to those responsible for the construction work and the very limited conditions accorded to those responsible for operating the water system once it is built. It is therefore necessary to bear in mind that hydraulic works, and especially their construction, are only one option and one temporary phase of environmental management, and that in order to serve the present and future society correctly, the remaining options must not be ignored nor must the other phases in the environmental management process be omitted.

3. Methodological approach

In order to suggest alternatives for improving the systems of management or direction of large water projects, it is necessary to begin by defining some underlying concepts for use as guidelines in analysing the relationship between water, development and the environment.

/Table 2

Table 2

LATIN AMERICA: NUMBER OF LARGE DAMS, BY COUNTRIES, AS OF 31 DECEMBER 1977

Country	Number of dams	Height of dams in metres			Number constructed between 1975 and 1977
		15-30	30-60	60	
Argentina	77	25	36	16	4
Brazil	415	317	82	16	17
Chile	59	43	9	7	4
Colombia	28	10	13	5	1
Costa Rica	3	2	-	1	-
Ecuador	4	2	1	1	1
Mexico	429	300	99	30	54
Paraguay (Dec. 1974)	1	-	1	-	n.d.
Peru (Dec. 1974)	54	48	3	3	n.d.
Dominican Republic	2	-	2	-	1
Uruguay	5	1	2	2	1
Venezuela (Dec. 1974)	52	31	16	5	1
Subtotal	1 129				84
Antigua	1	1	-	-	
Cuba	49	35	14	-	
El Salvador	4	2	-	2	
Haiti	1	-	1	-	
Honduras	2	2	-	-	
Jamaica	2	1	1	-	
Nicaragua	4	1	2	1	
Panama	5	2	1	2	
Suriname	1	-	-	1	
Trinidad and Tobago	4	4	-	-	
Total Latin America	1 202	827	283	92	84
Total percentage	100	68.8	23.5	7.7	
World total	29 588	23 636	4 676	1 276	743
Total percentage	100	79.9	15.8	4.3	
Percentage share of Latin America in world total	5.0	3.5	6.0	7.2	11.3

Source: ICOLD, World Register of Dams, second updating, 31 December 1977, Paris, 1979.

/It has

It has been observed that in general only two broad approaches are taken in analysing the relationship between water, development and the environment. In the first of these approaches, the environment is regarded as depending on development, while in the second, development is considered to depend on the environment.3/

Under the first approach, a decision must be taken in advance as to what are considered to be appropriate environmental characteristics, so as to be able to determine how to modify the style of development without affecting them. Conversely under the second approach it is necessary first to identify desirable levels of development so that, on that basis, it may be decided how the environment can be "managed" in such a way as to reach them.

Both of these approaches to the analysis can give rise to passive and active responses. Passive responses are those in which only existing relationships or situations are explained. Active responses are those which go further and involve proposing machinery for overcoming the problems identified in order to achieve the proposed environmental, development or other goals.

In order to facilitate an understanding of what is meant by active and passive responses, the approaches to analysis may be expressed in the form of questions. With regard to the first approach, i.e., where the environment is considered to be dependent on development, two questions may be posed:

(a) How does the style of development affect the environment?

(b) How can the style of development be changed in order to establish, conserve or preserve desirable environmental levels or characteristics?

Two questions may likewise be asked with regard to the second approach (i.e, where development is considered to depend on the environment):

(i) How does the "management" of the environment affect development?

(ii) How must the environment be "managed" if certain desirable levels of development are to be achieved or maintained?

The first questions with regard to each approach lead inevitably to passive responses and the second ones to active responses, as these terms were defined above.

Replies formulated under the first approach, in which desirable environmental characteristics must be decided on in advance, usually take the form of criticism of the effects had by development on the environment, and on their basis changes may be suggested in the style of development. Thus, the reply to the first question -How does the style of development affect the environment?- determines the "impacts" or effects had by a particular development activity on the environment. It constitutes a passive way of evaluating an environmental situation existing under a certain style of development. To make the evaluation, it is necessary to compare a desired environmental situation, which must be clearly defined in advance, with the existing situation. The second question under the same approach -How can the style of development be altered so as not to affect the environment?- leads to replies of broader scope and of an active nature which also involve

---

3/ A. Dourojeanni and C. Collantes, "Orientación general para la formulación de estrategias para el mejoramiento de la gestión de recursos naturales con fines de desarrollo". Class notes for the UNEP/TDC Course in Planning and Economic Policy - Technical Secretariat of the Office of the President, Santo Domingo, Dominican Republic, 1981.

/political considerations.

political considerations. These replies are, in general, intended to motivate or suggest changes in development policies or styles of development, especially by drawing attention to the negative effects had by a given development policy or measure on the environment. Usually their effectiveness is proportional to the reception with which this criticism and these suggestions meet at the appropriate levels of government.

Replies formulated under the second approach, which require that the desired levels of development be fixed in order to use them as reference points in determining how the environment should be "managed", usually have a more positivist flavour than those described above. Thus, the first question (How does the "management" of the environment permit the attainment of development?) seeks to explain how the various aspects of current knowledge of environmental management make it possible to reach appropriate levels of development. The question is framed in such a way as to elicit replies on management alternatives (especially technical or management alternatives which make it possible to control the chain reactions produced by a particular action in the environment), and not merely to give rise to a list of "problems" or "environmental impacts".

The second question -How must the environment be "managed" in order to achieve development?- reflects this same position, but in an active way. It is designed to seek the best technical alternatives for the management of natural resources and to show how they can be put into practice. By definition, it is aimed very markedly at what were initially defined as techniques of environmental management for development.

In short, after comparing this way of looking at the subject with the approach taken in a wide variety of studies analysing the relationship between the environment, environmental management and development (especially with regard to water resources), it may be noted that:

(a) A large number of analyses and studies have been carried out without indicating which of the two approaches or groups of questions they seek to answer. This makes the analyses inconclusive, since in the findings no distinction is drawn between recommendations for policy changes and recommendations for changes in the techniques of environmental management.

(b) Another group of studies is designed only to answer the passive questions, thus confining themselves to reporting situations without suggesting solutions. Failure to tackle the active phase, when what is sought is to promote a change, implies the assumption that changes in the style of development or in environmental management will be brought about simply by identifying and calling attention to "environmental problems" or "impacts": a method which has not proved to be very effective in practice.

For these reasons, and taking as a basis the "idées-force" presented as two approaches to the analysis of the relationship between the environment, management and development, this study -whose goal is to put forward recommendations for the management of large multi-use water resource projects- associates itself firmly with the approach whereby the socioeconomic development of a country is considered to be dependent on man's capacity for environmental management, and seeks to answer the question "How must the environment be "managed" in order to achieve development?"

/The CEPAL

The CEPAL water resources programme, in co-ordination with and supported by UNEP, has oriented its activities largely towards promoting a better understanding of the way in which the environment interrelates with water resource development and the management of water projects.4/5/

These studies revealed that the main difficulties in the management of large water development projects originated at the management level. These problems were related to such factors as the organizational structure of the management, its installed capacity, its level of autonomy and the social importance attached by it to environmental management.

Specifically, these studies suggested that:

(a) It is essential to use a systems approach in the management of large water resource development projects because many subsystems, sectors and subsectors are closely interrelated, thus making it inappropriate to tackle the problem solely by components or sectors of such a system.

(b) From the above it follows that without a global view of the system and its components, there is not a sufficient basis for identifying the ways in which they may interact.

(c) Some components of the system are not totally interrelated, and it is therefore possible to identify and isolate a considerable number of subsystems with a view to their technical analysis.

(d) In spite of the fact that the most important interrelationships are relatively limited and identifiable, the chain reactions and cycles identified in connexion with each interrelationship constitute complex subsystems.

(e) The global view of the environmental system can be synthesized in the form of actions and chains of effects. Each action represents an intervention by man in the system. When an act, such as a dam, is initiated, man is under the obligation to keep track of its effect on the environment. In order to correct or control this effect, he must perform other acts which set off another series of effects. These must then be controlled in turn, and so on until a certain degree of global control over the environment in general is attained and the undesirable effects are attenuated as much as possible.

(f) The performance of the actions mentioned above calls for the existence of an appropriate form of organization, which must guide and execute a wide range of activities, both technical and administrative. Systematic analysis of the environment makes it possible to find appropriate structures for this organization and to identify areas of technical and administrative incompatibility in terms of institutions and areas of geographical authority, so that they can be dealt with by co-ordination machinery.

(g) The forging of the sound and cohesive intersectoral and interdisciplinary relations needed to bring about this co-ordination, which might also be called institutionalization of intersectoral and disciplinary co-operation, is a difficult task, but unless it is done, the results generated in a decision-making process for environmental management will be greatly weakened.

Figure 1 shows the action taken and the series of effects observed in a major water resource development project.

4/ CEPAL/UNEP, Agua, desarrollo y medio ambiente en América Latina, op.cit.

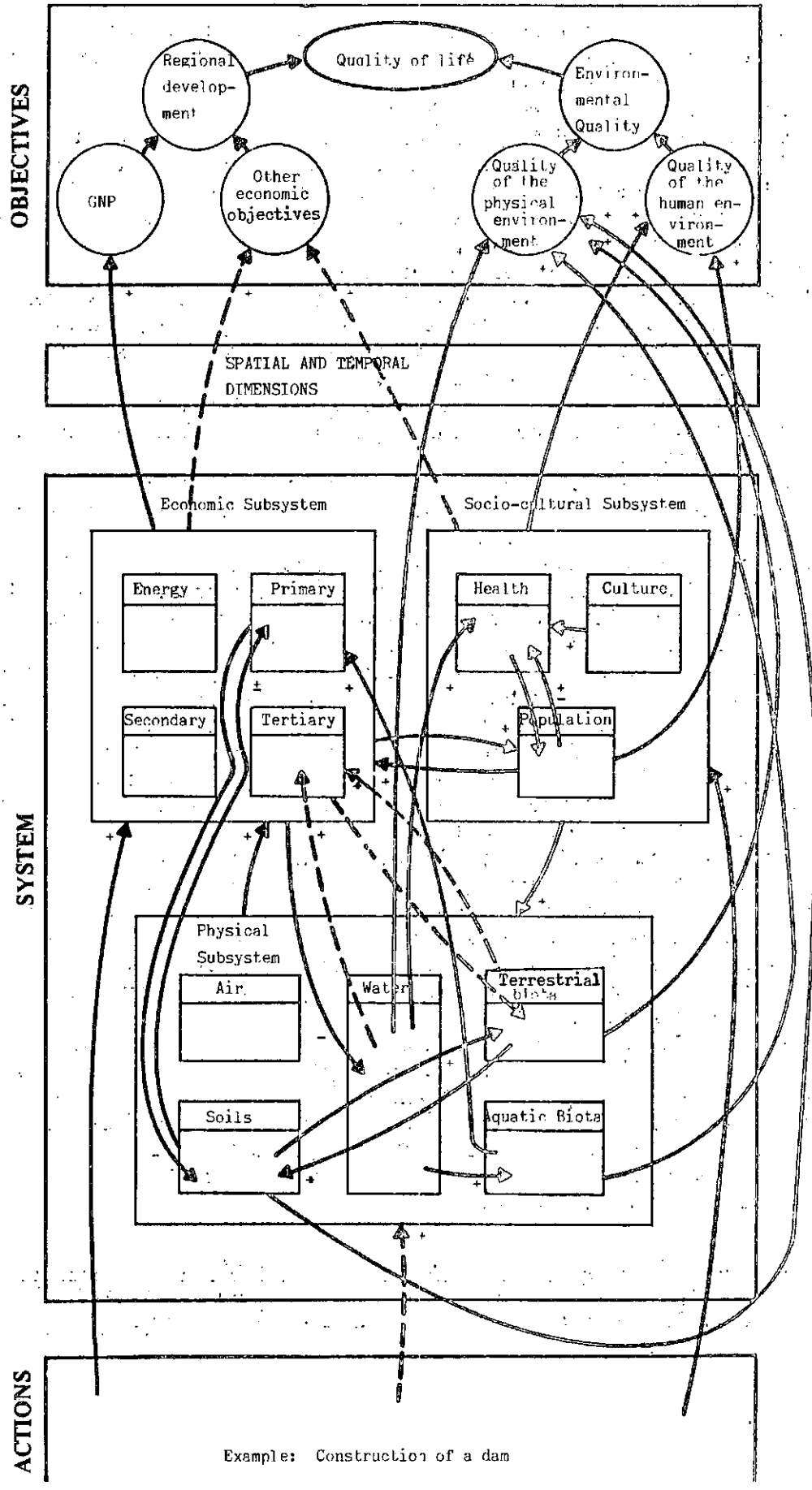
5/ G. Gallopin, T.R. Lee and M. Nelson, "The environmental dimension in water management: The case of the dam at Salto Grande", Journal of Water Supply and Management, 1980.

/Figure 1

Figure 1

ACTION AND CHAIN REACTIONS OF AN ENVIRONMENTAL SYSTEM DIVIDED IN SUBSYSTEMS

(G. Gallopin, T. Lee, M. Nelson)



4. Methodological system

This paper grew out of three case studies of large water development projects: The Tinajones Water Project,6/ implemented with the participation of the Peruvian Development Foundation; the Sobradinho dam (Brazil),7/ constructed by the San Francisco Valley Corporation, and the Salto Grande Bi-national Project (Argentina-Uruguay),8/ carried out by the Salto Grande Joint Technical Commission.

These studies were made on the basis of a methodological system in which the most important aspects to be considered in evaluating the environmental management of a project are interrelated with each other (see figure 2). The system can be summarized as follows:

(a) Definition of objectives and goals to be reached through the project. This involved determination of: the way in which the project tied in with national, regional and local goals; the economic sectors involved in the definition of the objectives and goals; the public and private objectives, especially the demands of users and/or the needs of the inhabitants of the area of influence of the project and the way in which they are expected to be met by the project.

(b) Definition of the environmental system affected. This included the identification of its main subsystems -(a) physical, (b) economic and (c) socio-cultural- and of the main components of these subsystems: air, soil, water and the terrestial and aquatic biota in the physical subsystem; population, health, culture and organization in the socio-cultural subsystem; and the main economic and financial indicators in the economic subsystem. It also included identification of the project's geographical limits of influence, both politico-administrative and natural or physical.

(c) Identification of action under the project and the chain reactions it sets off in the environment. Definition of the main action taken under the project, such as civil engineering works (hydraulic works, roads, etc.), pest control, fish breeding, wildlife management and in general all the technical action executed under the project in the environment and the chain reactions which this action produces. It is particularly important to identify actions and chain reactions in the physical subsystem (water, soil and flora and fauna), the socio-cultural subsystem and the economic subsystem.

6/ Jorge Yañez B., Gestión ambiental en grandes obras hídricas: Estudio del proyecto Tinajones (Perú), Fundación para el Desarrollo Nacional (E/CEPAL/PROY.6/R.1), August 1981.

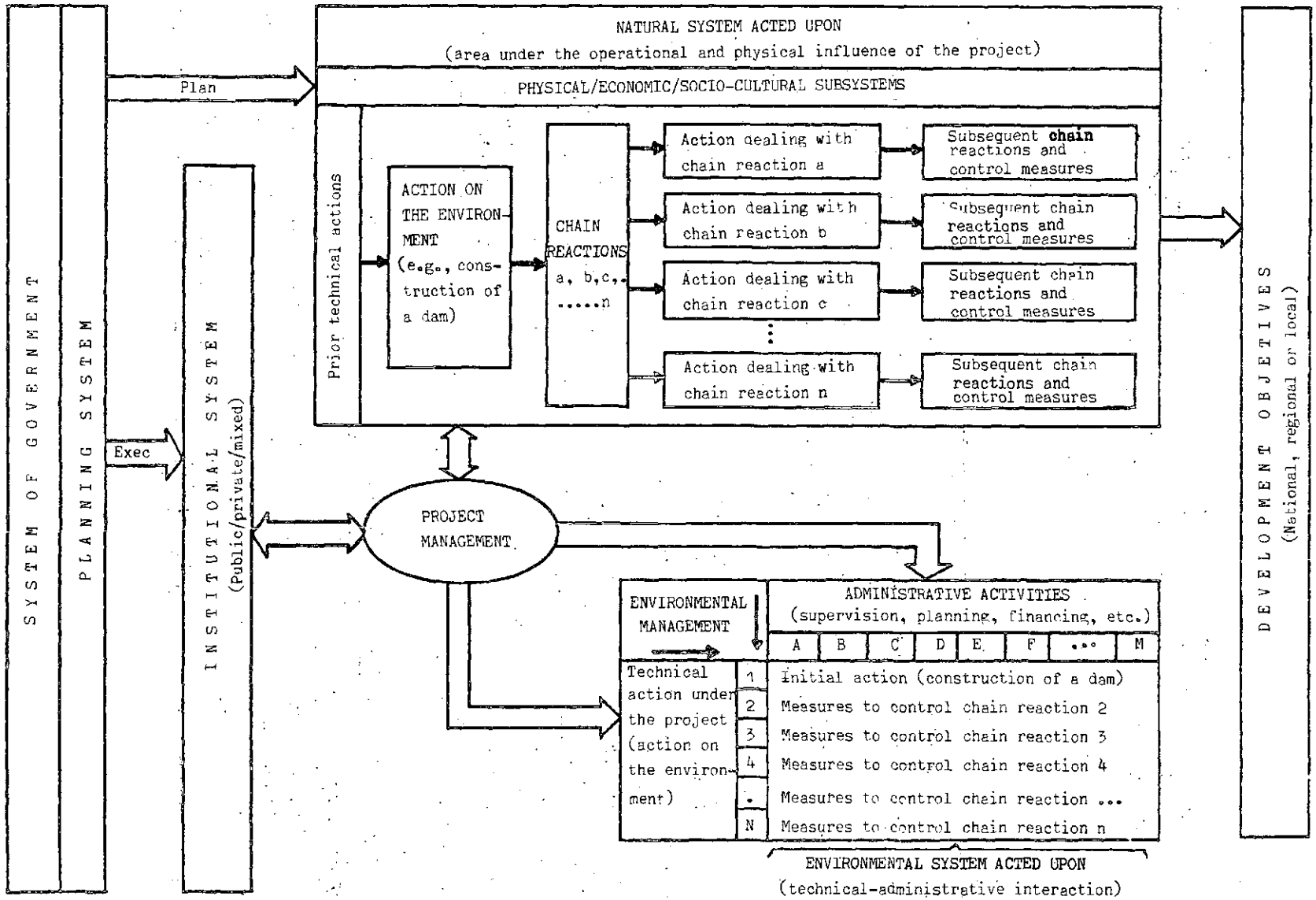
7/ CODEVASF, Gestao ambiental em grandes obras hídricas: Projeto Sobradinho integrante do plano global do desenvolvimento do Vale do Rio São Francisco (Brazil) (E/CEPAL/PROY.6/R.4), September 1981.

8/ Salto Grande Joint Technical Commission, Gestión ambiental en grandes obras hídricas: Estudio del aprovechamiento múltiple de Salto Grande (Argentina-Uruguay) (E/CEPAL/PROY.6/R.3), April 1981.

/Figure 2

Figure 2

SIMPLIFIED SYSTEM FOR CHARTING THE RELATIONSHIP BETWEEN THE MANAGEMENT OF AN ENVIRONMENTAL MANAGEMENT PROJECT AND THE NATURAL SYSTEM ACTED UPON AND THE INSTITUTIONAL SYSTEMS



Note: The project management is responsible for executing or co-ordinating all environmental management technical action effected in its area of operational and physical influence. Its organization is based on the number of environmental management technical measures which it must execute or co-ordinate in the project area. It is up to it to see that this environmental action is carried out in such a way that the Government's development objectives or other goals can be achieved. If more than one project management is acting on the same natural system, they must co-ordinate their work among themselves.

(d) Identification of the institutional system directly or indirectly linked with the project. Identification of public or private institutions carrying out actions in the project area; public or private institutions which could or should implement action in the project area; institutions which represent users and others. Attention was also drawn to the way in which these institutions are related to the project management and the co-ordinating machinery available for carrying out their action within the project's area of influence or the environment acted upon by it.

(e) Description of the structure of the project management. Description of its organizational structure and evaluation of its scope with regard to (i) the action it executes and chain reactions it must control; (ii) its role or responsibility with regard to the co-ordination of the implementation of technical action by other institutions within the project's area of influence, and (iii) the physical area and sectors of development under its responsibility. This covers organizational structures, personnel, sources of financing and other items. The variations in the organizational structure of the management during the phases of development of the project -mainly studies, works and operation- were also described.

(f) Assessment of the operation of management. An appraisal was made of the relative degree of efficiency of the management, using indicators on the spatial coverage of the activities, the volume of technical action executed, the number of inhabitants benefited . the quality of the action carried out, the priorities assigned and, in general, the fulfilment of the goals and objectives set and the degree of control over the chain reactions produced by the action taken under the project in the environment acted upon.

(g) Description of other relevant aspects. An attempt was made to specify how it is possible to improve the management component of a major water resource development project so that it can achieve its environmental management goals. Individual cases of action and systems of organization through which success had been achieved were described. Attention was drawn to approaches or systems for facilitating the participation of both the inhabitants of the project area and its users in management decisions. Reference was made to other aspects of management such as planning, financing, training, research, information and other operations used by the management of the large projects under study.

A seminar was held at Concordia, Argentina, to discuss the case studies, which was attended not only by those responsible for the studies but also by representatives of the management of other large projects and experts in the matter.9/

9/ The seminar was organized by the Development and Environment Unit of the CEPAL Natural Resources Division as part of the CEPAL/UNEP project on horizontal co-operation in Latin America regarding styles of development and the environment.

II. ANALYSIS OF THE CASE STUDIES

1. General considerations

Large water projects are usually justified on the basis of the benefits they provide in terms of the increased productivity of society, more equitable distribution of wealth, a higher level of consumption by the inhabitants, greater crop production, the generation of jobs, the conservation of natural resources, better health conditions, transport and marketing facilities, improved settlement of the national territory, self-sufficiency in products, industrial development, and other areas which may be summed up as being "requisites for improving the living conditions of the inhabitants".

The achievement of these objectives calls for a national or regional development plan which provides for the execution of the series of activities necessary for this purpose, including those related to water resources development, presented coherently.

In practice, this has not always happened and many water resource development projects arose without being part of a socioeconomic development plan. In some cases this was corrected in later phases by structuring regional plans in such a way as to accommodate the project under way. In other cases the development plans were not formulated until the engineering works had been terminated, and finally there are examples of projects which were never incorporated into a regional development plan.

For example, the three projects chosen as case studies had the following specific objectives when they were begun:

(a) The San Francisco Valley development project was created as part of an integral plan prepared by a special commission for the economic development of this valley. One of the focal points of the plan was "water control", which in concrete terms meant the regulation of the River San Francisco as a necessary measure for navigation, irrigation and the generation of electric power for purposes of the comprehensive development of the resources of the Valley. In this case, therefore, water resource development was from the beginning included among the goals of a plan for the integral development of a major river basin. It is easy to understand why water resources were given priority, since the plan was primarily aimed at the settlement of an extensive territory whose backbone, in terms of transport, the irrigation of arid land and the generation of power, was the river.

(b) The binational Salto Grande project was initially 10/ focussed almost exclusively on the development of the River Uruguay for the generation of hydroelectric energy, although consideration was also given to the water needs of the population, navigation, the conservation of the fishery resources and irrigation. Later on, when the main works had already been constructed, "the importance of the accelerated, harmonious and balanced economic development of the project's zone of influence" was reaffirmed, signalling a more integrated approach to environmental considerations. Specifically, the project as now conceived has multiple objectives aimed at achieving an environment favourable to regional development. These objectives include the generation of electric power; the improvement and extension of navigation;the construction of an international bridge;industrial, agriculture and livestock development;a plan to increase the fishery resources of the River Uruguay;

10/ Article 5 of the 1938 agreement between Argentina and Uruguay.

/the creation

the creation of tourist,sports and recreation areas; the improvement and/or control of the quality of the water provided to the population, and wildlife protection.

(c) The Tinajones Special Project sprang from the need for action to irrigate and drain a valley on the Pacific coast in Peru, and although it also makes provision for the generation of hydroelectric power, it was initially conceived as no more than an irrigation project. Its specific goals are to regulate irrigation in existing cultivated areas, make possible the irrigation of new areas, improve existing systems for distributing water for irrigation and recover salinized areas or areas with defective drainage through water channelling works, dams, and works for exploitation, transportation and draining of water. The generation of hydroelectric power was also included in the initial project design, but the execution of this part of the project was assigned to an independent agency.

An analysis of the objectives pursued shows that only one of the projects -that relating to the River San Francisco- came into being as part of a regional development plan, its initial goal being to contribute to the integral development of a river basin.11/ As for the Salto Grande project, it began with more limited objectives, but more comprehensive concepts involving the economic development of the project's "zone of influence" were later incorporated, which also enlarged its scope in terms of environmental management. From the hydrological point of view, its area of influence only includes one stretch of the River Uruguay, which is part of the River Plate Basin.

The Tinajones project was the most restricted in terms of objectives, which were initially confined to the crop-growing sector of agriculture. There were also plans for the generation of electric power at the beginning, but these were not executed, and work on this part of the project began only recently.

Except for the Salto Grande project, none of the cases analysed specifically associates the objectives of "environmental management for purposes of development" with the objectives of water resource development for purposes of overall development. In other words, what is known as the "water resource development project" and what are termed the project's "environmental effects" or "environmental considerations" are considered to be two different things.

In the past, under this approach, once those responsible for the projects had planned what they considered to be the project activities proper (almost always the water engineering works), they listed or described the effects of those activities "on the environment",12/ without necessarily tying them in with the project activities or considering it their responsibility to monitor the effects. If another entity concerned itself with these effects whether in co-ordination with the project leadership or not, the project was then considered to have "environmental considerations" or to involve "environmental management".

It is, however, very interesting to note that as solutions were found to many "environmental impacts", these were no longer considered to be "impacts" nor were

---

11/ In these case of Tinajones there is no indication as to whether or not the project contained in a regional development plan or whether there are co-ordination arrangements in this connexion; however, a regional development body with functions specifically relating to this matter is known to exist.

12/ Instituto Nacional de los Recursos Renovables y del Ambiente (INDERENA), "Compilación Resumida de Métodos para la Evaluación del Impacto Ambiental", Bogotá, Colombia, November 1981.

/they any

they any longer felt to be "outside" the project, but became part of its regular activities.

The best known example of this is that of the salinization of land caused by irrigation after the construction of a system for this purpose. Usually the activities carried out to remedy this negative effect were not a regulation included under the water resources development project, since the problem was considered to be outside the purview of the project management. This was basically due to ignorance concerning the real magnitude of the problem and lack of know-how for solving it. Now that the importance of salinization has been recognized and people know how to solve it, however, what was once a negative effect on the environment and incidental to the project, has become a positive activity within the project under the title of "land drainage and reclamation".

This can be put in another way by saying that as people have learned how to deal with "environmental impacts" positively, i.e., as the social, economic and physical importance of solving them in order to attain the real aims of the project has been revealed, these "impacts" are no longer considered to be external to water resources development projects, and their solution has become part of the action objectives of the project.

This kind of experience adds force to the affirmation that a water resources development project is a practical expression of environmental management. The fact that no one knows how to handle a given alteration in the environment which certain works may have caused does not mean that it is external to the project or a "negative by-product" of it, and that only then can its treatment be called "environmental management".

In this respect, there is need to stress the decisive role that water resources development projects have played in many parts of Latin America in the development of a given region. Many such projects have constituted a prerequisite for the socioeconomic development of certain areas, especially in arid and semi-arid zones.13/

The lack of integral regional plans prepared prior to the execution of a water resources development project has caused many problems in that later on demands for water have increased or changed in terms of quality, quantity and times and places of consumption, without such requirements having been determined in advance.

In defence of the water resources development projects which were created outside any regional development plan, it must be remembered that many were conceived at a time when this planning orientation was not common. Moreover, projects of this type responded to very concrete perceptions or demands for flood control, irrigation regulation, navigation or other forms of water control or utilization: demands whose only purpose was to solve immediate problems, not future ones. It is a current and periodical task, then, to update plans for water development so that they may be applied consistently with regional development plans.

2. Analysis of the geo-socioeconomic scope of the projects

The area of physical influence of river development projects, by its very nature, may include all of one or more basins from which the water resource is obtained, as well as the entirety of the regions where this water will be utilized

---

13/ University of the Pacific, "Estudio sobre las perspectivas y alcances del Proyecto Majes-Siguás", Research Centre, Lima, Peru, February 1980.

/or discharged.

or discharged. In practice, for reasons of political, administrative or institutional boundaries, this area of influence may be confined to stretches of a river and its surroundings, valleys, areas between basins, lower or upper parts of the basin, and generally to geographic space which does not coincide with hydrological limits. These areas become the operative areas of influence of the project and not their physical area of influence. The ideal, however, is that both areas should coincide.

The three case studies make some comparisons possible:

(a) The project for development of the San Francisco River Valley covers the development of the entire basin which forms this valley, covering more than 640 000 km2 (see figure 3). The project is divided into various operative or programme areas which are aimed at developing stretches of the river and potentially irrigable zones which, considered independently, constitute large-scale water utilization projects.

(b) The Salto Grande project includes the development of a segment of the Uruguay river and the operative area of influence of the project (see figure 4). The project is part of the development of the basin of this river, which has a surface area of 380 000 km2.

(c) The physical area of influence of the Tinajones project (see figure 5) includes the entire basin of the Chancay-Lambayeque river on the Peruvian Pacific watershed (a relatively very small area in comparison to the previous projects (6 125 km2)), and the upper parts of neighbouring basins on the Atlantic watershed, from which water is currently being obtained and from which it is hoped to obtain more in the future through interconnexion systems. The operative area of the project is centred on the regulation of irrigation and drainage in a Peruvian coastal valley, as well as the expansion of the areas irrigated in order to incorporate regions bordering on the valley.

The case of the San Francisco River Valley demonstrates that the physical area of influence of a large water development project may include various operative areas of influence. Thus, each of these operative areas may constitute areas of projects which are independent from the administrative point of view, but not from the hydrographic point of view. This implies the need to provide the necessary co-ordination machinery between these projects -administratively independent but hydrographically dependent- whether they belong to the same economic sector of development or to different sectors.

To achieve integrated environmental development, it is vital to make an adequate selection of the limits of the physical and operative areas of influence of a project as well as the necessary machinery for the co-ordination of activities among the bodies which are taking action within the physical areas of influence. The lack of sufficient consideration for this aspect may cause serious technical, social and economic problems. The most frequent technical problems are, for example, water pollution from the damaging effects of one project on another, the silting-up of reservoirs because of erosion in the upper part of basins from which the water is obtained, or the impossibility of providing for simultaneous demand for water for various uses. Other effects have a direct impact on the population when, for example, the only beneficiaries from investments and facilities are the inhabitants of the lower basins or valleys, and the inhabitants of the upper part of the same basin are ignored, or when credits and technical assistance are offered only to the sectors under irrigation, excluding from these benefits and assistance the inhabitants of non-irrigated areas or other areas affected by problems of salinity and poor drainage located outside the area of the "project".

/Figure 3

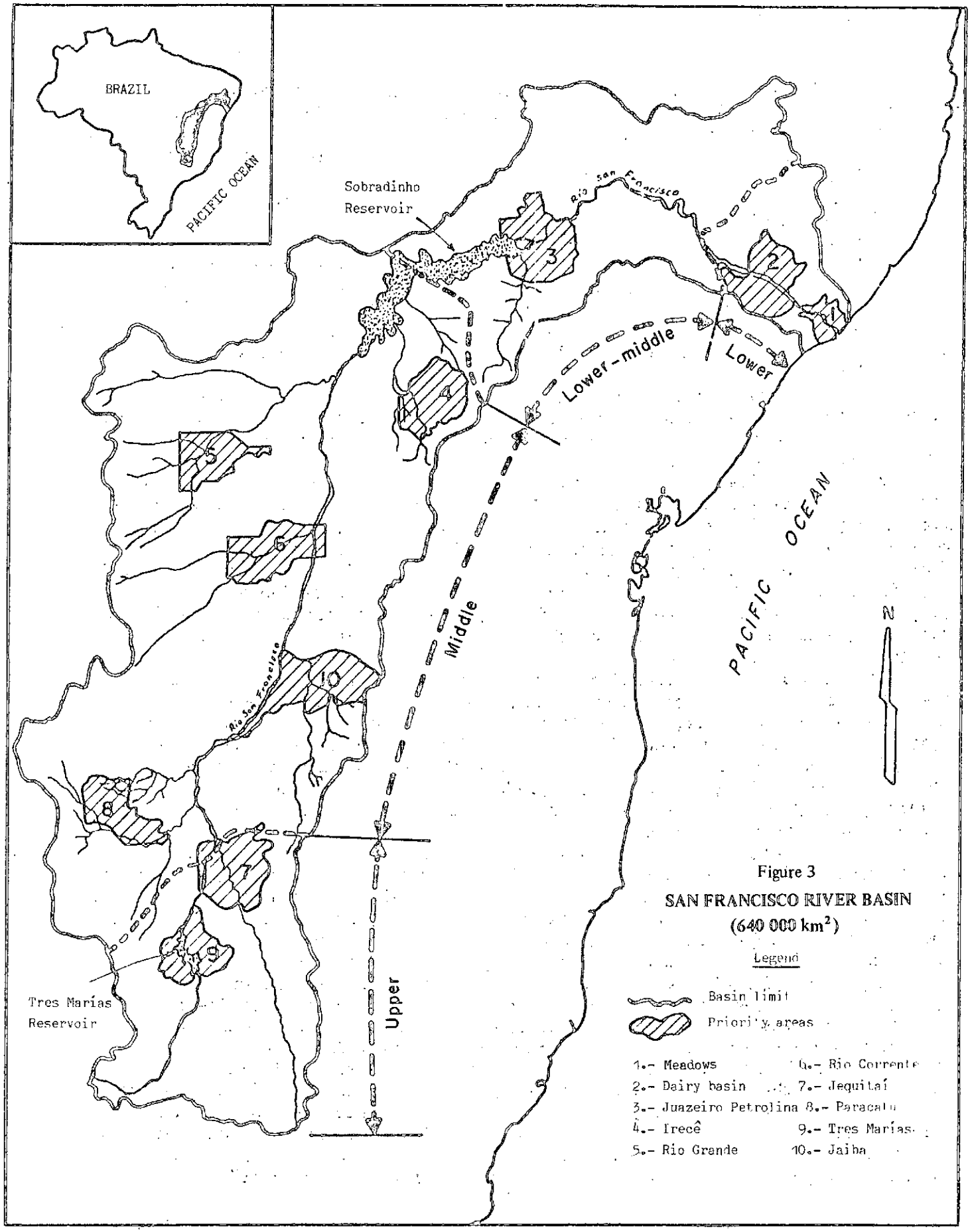


Figure 3
SAN FRANCISCO RIVER BASIN
(640 000 km²)

/Figure 4

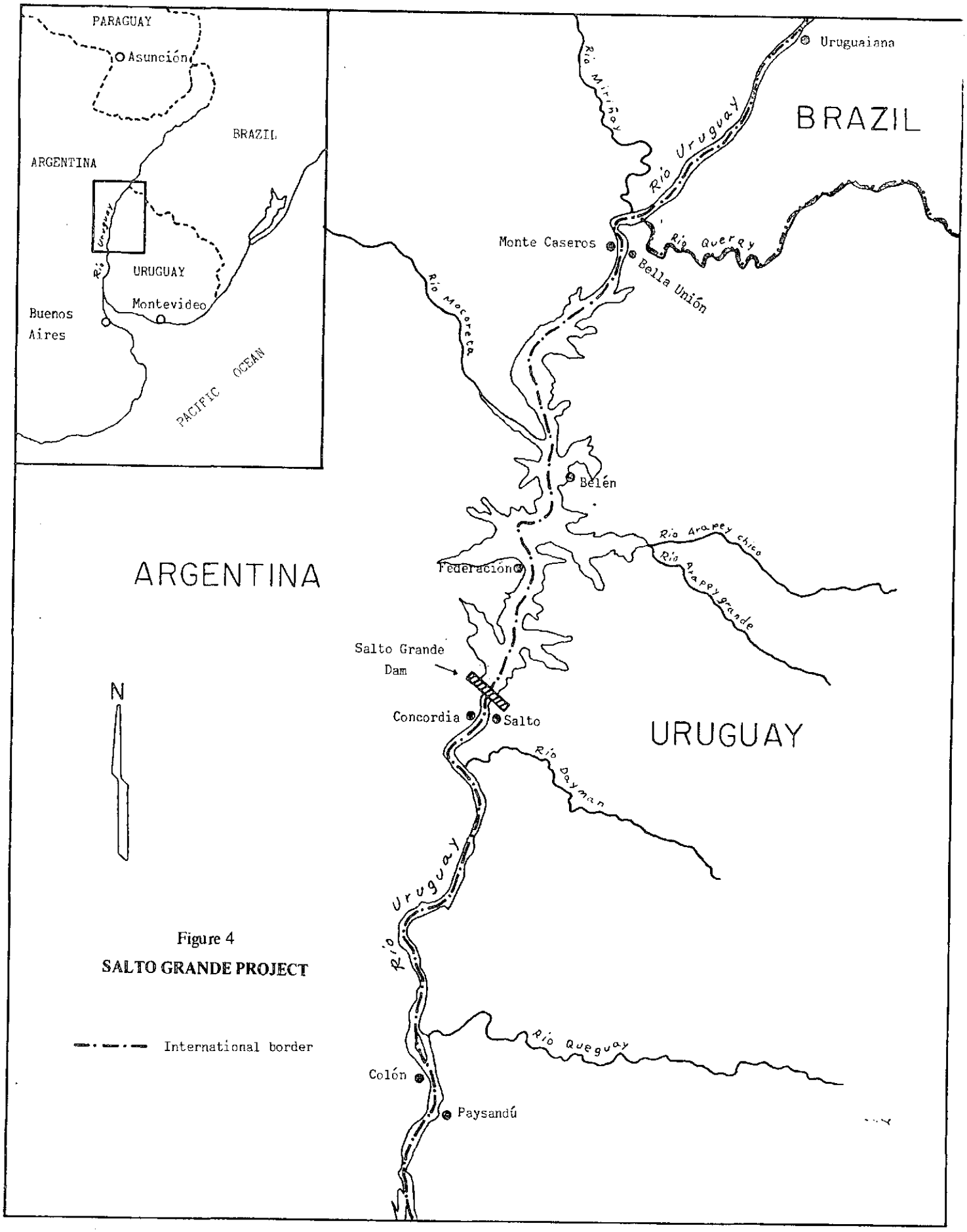


Figure 4
SALTO GRANDE PROJECT

/Figure 5

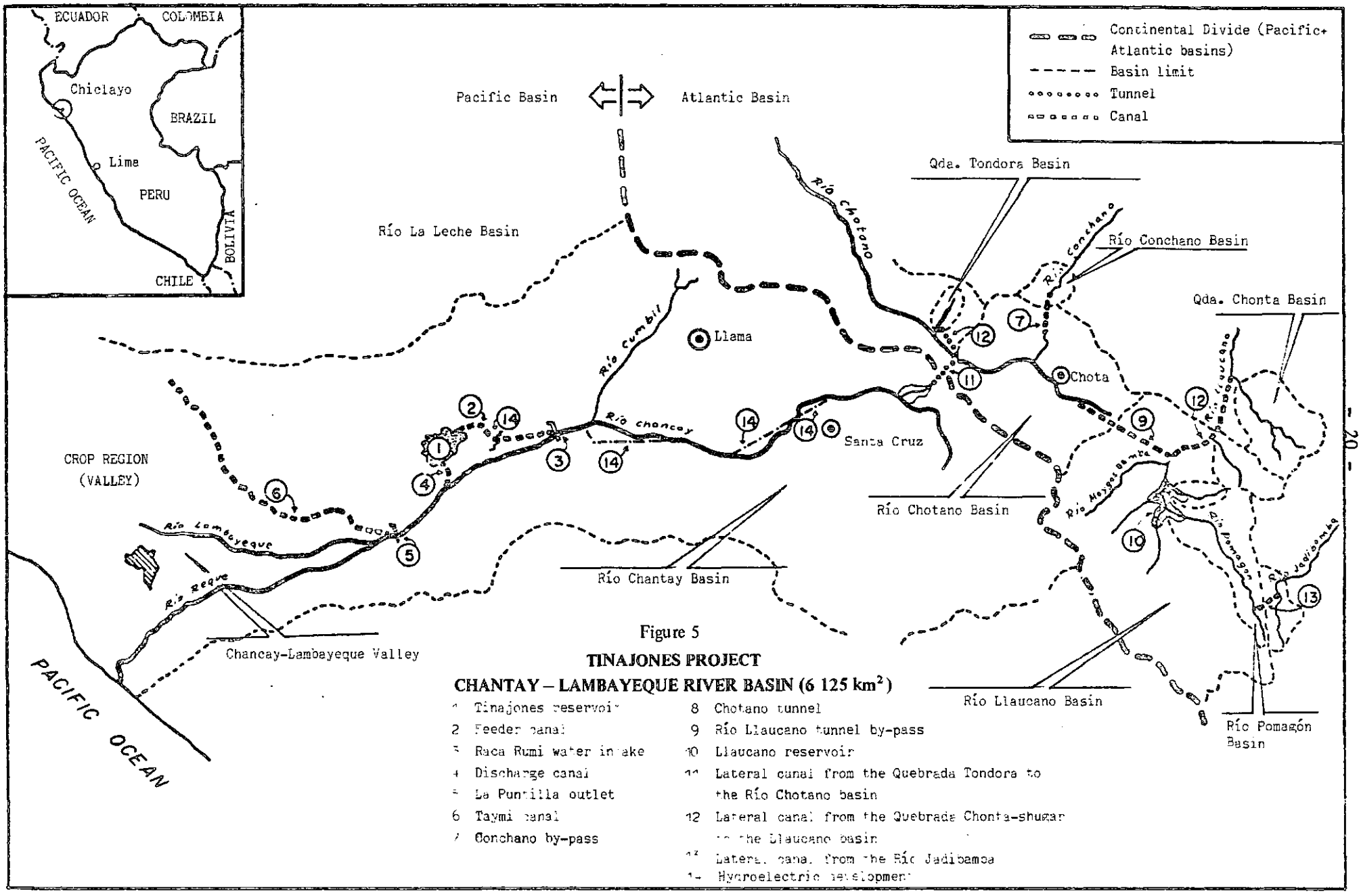


Figure 5

TINAJONES PROJECT

CHANTAY – LAMBAYEQUE RIVER BASIN (6 125 km²)

1 Tinajones reservoir
2 Feeder canal
3 Raca Rumi water intake
4 Discharge canal
5 La Puntilla outlet
6 Taymi canal
7 Conchano by-pass
8 Chotano tunnel
9 Río Llaucano tunnel by-pass
10 Llaucano reservoir
11 Lateral canal from the Quebrada Tondora to the Río Chotano basin
12 Lateral canal from the Quebrada Chonta-shugar to the Llaucano basin
13 Lateral canal from the Río Jadibamba
14 Hydroelectric development

Economic problems arise when sufficient budget funds are not allocated for the implementation of the project activities in the entire area of its physical influence. A common case, for example, is the lack of funds to reforest a basin in which a dam is to be built, or the lack of funds to operate properly the hydraulic systems once they have been constructed, because of inefficiency, for example, in the systems of collecting and reinvesting water tariffs.

3. Analysis of technical aspects

The implementation of the main activities required for the integral execution of a water resources development project usually requires the completion of various activities which may be summarized in three principal stages: preliminary, intermediate and operative (see figure 6).

If the projects are aimed at benefiting various sectors at the same time, which is usually the case in water resource development projects, those carrying out these activities must take into account the needs of each sector from the beginning.

In practice, however (often for reasons of administrative and financial control), the responsibility for carrying out a project with multisectoral goals usually falls to only one sector, for example, energy or agriculture. This may cause, in the short or long term, serious technical problems, especially because of the difficulty, for example, of inserting a posteriori within the design of a project the requirements of a sector which was not initially taken into account.

This problem is seen to be more acute in the operative stage of the projects, especially if there is competition between simultaneous demands for water for different uses which have not been previously detected, or when there are natural problems such as droughts, floods and other natural phenomena which cause damage to all the sectors together. In these conditions, if there is no clear previous allocation and limitation of authority and responsibility in the operation of the systems, no sector wants to -or can- take responsibility for the control of these problems: they limit themselves at most to pointing out the problems but do not take practical action to solve them, considering them outside their competence. It has also been observed that when there are problems, for example, of erosion in the upper parts of a basin, no particular sector which uses the water obtained from this basin wants to assume responsibility for the control of the phenomenon. For this reason it is indispensable that each sectoral project not only assume the responsibility for carrying out all the stages of the project but is also aware that it should control the positive or negative effects resulting from its actions in other sectors. This control consequently requires that a system of co-ordination be defined or created which would be in charge of predicting and following-up the effects of each action on the environment to be developed, and especially it requires that the control of the negative effects which each sector may cause on the environment should not be ignored. It thus creates greater options for the well-being of the present and future population living in the area of physical and operative influence of the projects.

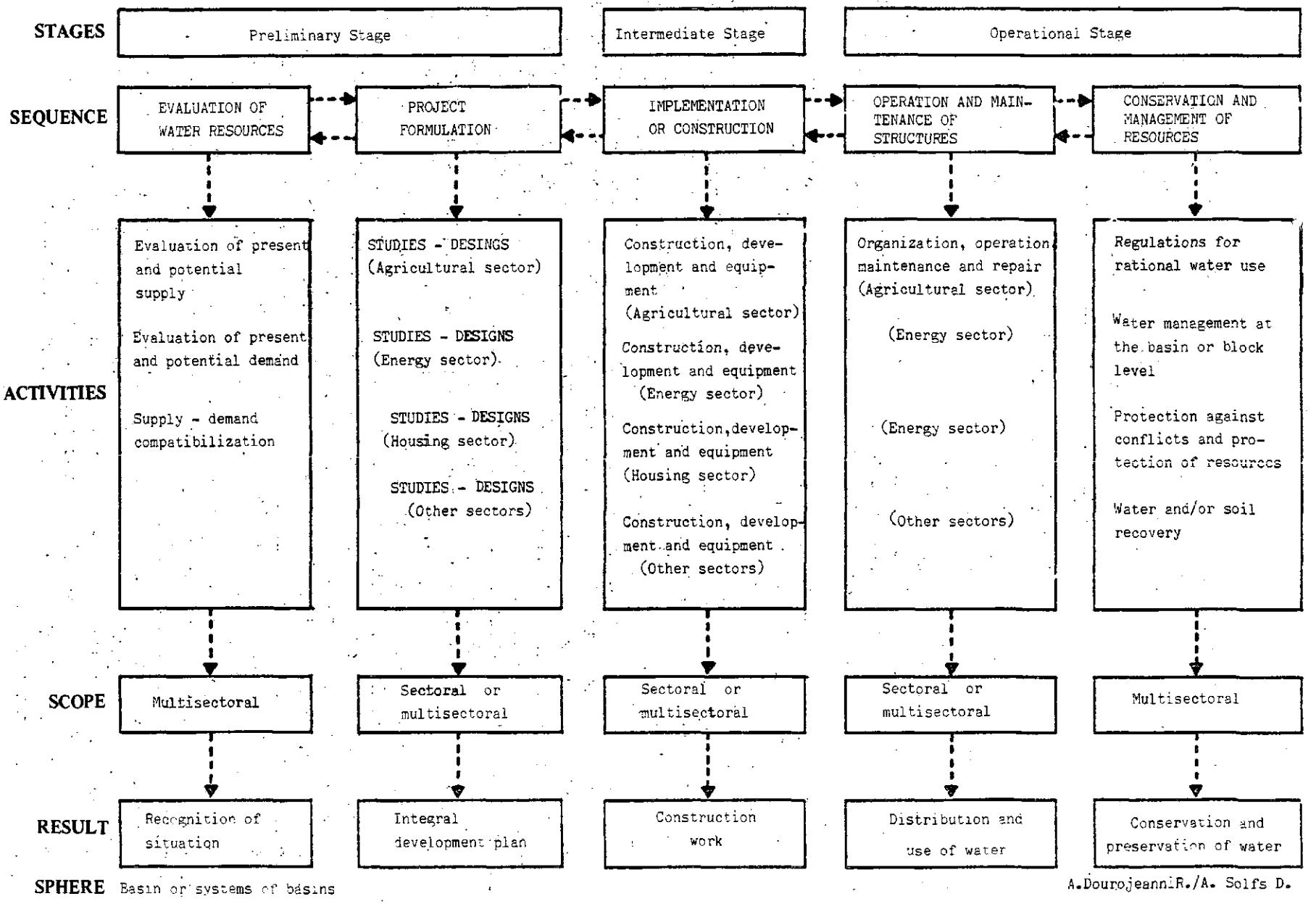
The need for good co-ordination is particularly important when the administration of a project lacks sufficient autonomy or multisectoral coverage to be able to implement the necessary activities with its own resources.

In the light of these points, the three case studies are now analysed briefly to explain the technical activities which were considered and the way in which their implementation was planned.

/Figure 6

Figure 6

IDENTIFICATION AND SEQUENCES OF THE PRINCIPAL ACTIVITIES REQUIRED FOR DEVELOPMENT, USE AND CONSERVATION OF WATER RESOURCES



A.Dourojeanni R./A. Solfs D.

/(a) The

(a) The San Francisco River Valley study has been structured in the context of an integral basin development plan, based on the implementation of various large water development projects. The principal technical stages of its execution were the following:

(i) an initial stage of basic studies and global planning for the development of the basin and especially the regulation of the river;

(ii) a stage of identification of priority areas or programme areas. These programme areas constitute the operative areas of the most important natural resources development projects (especially water resources);

(iii) a stage of implementation of the principal water projects for river control, hydroenergy utilization and irrigation and drainage, as well as other projects (mainly highway and urban projects), and

(iv) a stage, currently in progress, designed to formulate a new master plan for the integral development of the basin.

(b) The Salto Grande project has an integral development concept of a river control project and its operative area of influence. It may be considered a very complete model for the present study. The evolution of this project developed along the following stages:

(i) a stage aimed at the planning and construction of the principal engineering works and certain supplementary actions connected with them, and

(ii) a stage aimed at the operation and maintenance of the systems constructed and the environmental and regional development of the area of influence of the project (an activity which is very unusual in such projects).

(c) The Tinajones case study seeks to analyse the evolution of an essentially irrigation-type project, in both is construction and operative phases. The most significant technical stages in its evolution were:

(i) evaluation of resources, basic studies and the formulation of the project. In this stage most of the technical considerations were aimed at the lower part of the basin or coastal valley, in respect of irrigation, drainage and land recovery. The upper part of the main basin and the adjoining basins from which water is taken were only considered as catchment areas for this resource. In this stage considerations were also included regarding the creation of a hydroelectric plant in the middle part of the Chancay-Lambayeque river basin;

(ii) the construction of the principal works: transfer tunnel, catchment works and storage dam, and main canals and drains. This stage is still being carried out and will be concluded once the water transfer works have been extended to the adjoining basins on the Atlantic slopes and the construction of canals and drains in the coastal valley has been completed;

(iii) the operation, maintenance and repair of the water systems after they have been constructed. This periodic stage is considered crucial for the success of the project and is currently the source of the greatest difficulties in achieving the goals fixed for it, and

(iv) the organization, management, protection and recovery of natural resources at the level of the irrigated coastal valley and of the upper catchment basins. This stage is currently being carried out at the valley level, especially in irrigation, drainage and land recovery, but no significant actions are being carried out at the level of the upper basins, where there are active processes of erosion and population migration.

Comparing the three projects, we may make the following observations:

/(a) Generally

(a) Generally speaking, the three projects have as their frame of reference the development of water resources at the basin level. It cannot be specified, however, whether this development is considered as a whole or is limited to treating only certain priority sectors.

(b) They do not explicitly describe the type of links between the water resources development projects and the regional development plans, if they exist. It is assumed, however, that the projects studied form part of or are considered as part of these development plans.

(c) Except for the Salto Grande binational project, there is no programme (see table 3) in any of the case studies which specifies the technical activities planned in order to achieve integral environmental management nor the bodies to be in charge of their co-ordination and/or implementation.

(d) The technical activities which form part of the projects generally have good coverage, which includes -besides the construction of the principal works- a description of the activities prior to them, such as deforestation of the flood area, and subsequent to them, such as drainage and recovery of land, fishery management, control of aquatic diseases, etc.

(e) Despite the above considerations, it is not always indicated whether consideration has been given to activities for the management of catchment basins, erosion control, transport of sediments and other aspects related to the management of fauna and flora or the selection of nature reserve areas.

4. Analysis of administrative aspects

It is evident that the successful management of a large-scale water development project, as indicated by the previous CEPAL/UNEP studies and the case analyses, depends on two basic factors:

(a) Adequate integral planning of the activities necessary to achieve the project objectives, coherently conceived within a general framework of regional development, so as to make it possible to improve the standards of living of the inhabitants to be benefited by these actions.

(b) An appropriate system of administrative organization to co-ordinate, carry out and follow up the previously planned actions and all those which become necessary during the evolution of the project.

In practice, these two conditions are rarely satisfied completely, due to many factors. Thus, it is possible to have very well structured plans but very little operative capacity to carry them out or, vice-versa, there may be a satisfactory capacity for implementation but inadequate integral plans of action.

In the cases studied there is an interesting contrast between the levels of autonomy and stages in the management of the Tinajones and Salto Grande projects. In the case of Tinajones, as in other similar projects in Peru, the phases of formulation of the project and execution of the large engineering works usually depend on a special management unit, while the phases of the operation and maintenance of the systems after their construction depend on the irrigation district administration within whose area the works were constructed. The special management unit enjoys relative autonomy, according to the size of the project, although both it and the area administration come under the agriculture sector from both the technical and administrative points of view. The Irrigation District Administration depends administratively on a local agricultural region but technically on a national-level normative general management. The levels of autonomy of these administrations are very relative, and fluctuate easily with political changes in the national and regional bodies.

/Table 3

Table 3

ACTIONS DESIGNED TO COMPLY WITH THE OBJECTIVES OF THE SALTO GRANDE PROJECT

	Water
Sanitary and domestic purposes	- Water quality standards - Water treatment plants - Control of snails and other harmful agents - Control of eutrophication and pollution
Navigation	- Deforestation - Reinforcement of banks and bottoms - Diversification and increase of agricultural production - Tourism and sports
Energy production	- Deforestation - Afforestation of banks - Water quality standards
Irrigation	- Determination of crops suitable for irrigation - Determination of suitable areas for use of irrigation - Promotion of irrigation
Conservation of fish resources	- Deforestation - Water quality standards - Intensive and extensive fish farming - Development of fishery exploitation - Fish ladder
Regional development	- Toursim - Electroindustries - Agroindustries - Territorial management - Soil conservation - Intensive and extensive fish farming - Promotion of investment

/In the

In the study of this case it became clear that the greatest stumbling block to the progress of the project is the difficulty of making the transition between the construction and operational phases, especially because of the shortage of resources usually available for the second phase, as well as the frequent changes in the powers of the two administrations. Because of this, those in charge of the two phases have formulated corrective measures to overcome these difficulties and especially to provide the administration of the operational phase, by means of water charges, with sufficient resources for the adequate accomplisment of its functions. The plan is to invest part of the water use revenue in the management and conservation of water and soil at the level of the entire basin which supplies water to the project; if this goal is achieved it will be an important basis for implementing long-term environmental management initiatives in the area of influence of the project, and a model of self-financing for Latin America.

In contrast with the above, in the case of Salto Grande the Joint Technical Commission (JTC), as the binational entity responsible for the project, has always had full authority to carry out the activities related to it. Within the institutional organization of the JTC, a Health, Ecology and Regional Development Administration was established to take charge of all of the so-called "environmental aspects" of the project, from control of the workers' health to control of the effects of the project on the surrounding region.

The so-called "environmental consideration" in the Salto Grande project, during the pre-feasibility, feasibility, formulation and execution stages of the works and their subsequent utilization, was implemented with increasing thoroughness and a growing flow of resources.

Thus, during the stage of execution of the work, the quality of the water was protected, effluents were controlled, and care was taken to maintain the arboreal vegetation and the autochthonous vertebrate fauna. At the appropriate time, steps were taken to control harmful agents in the environment, especially carriers of disease, and basic sanitation infrastructures were set up, including the regulated elimination of industrial waste.

Beside these contractual requirements for maintaining optimal environmental conditions, the JTC handled other activities, such as the deforestation or elimination of vegetation and vegetable residues from the area corresponding to the bed of the artificial lake, as a rational means of avoiding its eutrophication and facilitating sport sailing and fishing. It rescued and relocated many specimen of fauna endangered by the disturbance of their biotopes, and relocated human skeletons.

Specific legislation was passed to cover the new ecosystemic conditions, providing for the subsequent afforestation of the banks of the lake in order to consolidate them and promote the renewal of vegetation; the construction of the piers and moorings necessary for access to the lake, and measures covering human settlement, the distribution of the space and the use of its components.

Understandably, in the current stage of the Salto Grande project, now that the building of the lake has been completed, hydroelectric power production has begun and possibilities have been created for technified exploitation of the soil, the participation of the population is very important and is bound to have wide repercussions.

The "environmental considerations" at the present time are directed towards protecting the achievements and objectives already reached and strengthening the existing system for the control of the changes and evolution of the ecosystems, that is to say, supporting and consolidating the human populations located in the

/region in

region in both their social and economic aspects and guaranteeing optimal use of the facilities created by the actions carried out initially in the project, while retaining the option of improving them.

The evaluation of the measures, and the plans being made or carried out for this purpose, have also received attention. Thus, the programme of systematic control of the environment, and the system of supervision established to detect any adverse situation and to test the effectiveness of the standards applied to it, should be a permanent and long-term concern.

In conclusion, and without claiming to be exhaustive, we may mention some of the situations which cause difficulties:

(i) formulation of plans which are too sectoralized and which are not coherently related to the plans of other sectors or to the regional and national development plans;

(ii) allocation of too limited functions to the executive bodies of the project. These restrictions may refer to their administrative or financial autonomy, their power to co-ordinate with other bodies, or the authority or machinery available to pressure other sectors into carrying out the tasks which are their responsibility;

(iii) too frequent changes in organization and in the officials responsible for the different stages or actions of the project, which are not conducive to continuity;

(iv) lack of clarity in the delimitation of functions and responsibilities among the different bodies charged with the development of the project area, resulting in conflicts between the multisectoral and sectoral and/or national and regional bodies;

(v) excessive differentiation of working conditions, wages, autonomy, financial support, etc., among the different bodies responsible for the implementation of the different stages of the project, resulting in conflicts among the personnel and problems of equipment, bureaucratization, etc.;

(vi) abandonment or lack of follow-up of the long-term control and supervision activities which must be carried out to achieve the goals of the project, for example, drainage activities, land recovery, erosion control, reforestation, pollution control and others. Sometimes these controls and follow-ups exist, but are underutilized.

To overcome these problems, resort is had to emergency solutions, some of which have only a partial effect if they are not adequately conceived at the beginning. The following are some of these solutions:

(i) formulation of "regional development" or "integral basin development" plans, after having drawn up a specific water development project;

(ii) creation of "special co-ordination commissions", with different degrees of permanence, autonomy and power of action or authority, to try to guide or plan the activities of different bodies in the area of influence;

(iii) creation of emergency working groups, usually to resolve unforeseen conjunctural conflicts whose solution is urgent, such as pollution problems, droughts, floods or the repair of major works;

(iv) changes in administration and organization, resulting in the concentration or dispersion of functions and dependencies, or the allocation of greater or fewer resources and responsibilities to them. (These changes, which constantly occur, encourage their proponents to think that they will provide a solution to the problems, but since the positive side of the existing solutions is usually not adequately evaluated, their corrective effect is lost.);

/(v) contracting

(v) contracting of firms or technicians at a high cost. This has yielded results only when the functions and activities involve a speciality not available in the country. In other cases it would have been enough to pay a better wage or listen to the technicians of the project itself before bringing in others from outside;

(vi) applications for technical assistance to specialized national or international bodies and exchange of knowledge through horizontal co-operation machinery among countries. This method has turned out in various cases to be more feasible and economical than the previous alternative for solving concrete problems.

All these observations lead to the conclusion that in the organizational aspects, four main variables affect the administrative efficiency of large projects, conceived as an expression of environmental management for the purpose of development:

(a) The relative degree and level of administrative and financial autonomy of the management of the projects and their power to co-ordinate with other bodies related to the project.

(b) The physical and operational area of influence which is placed under the responsibility of the management.

(c) The number of technical actions to be implemented or co-ordinated by those in charge of the project.

(d) The relative degree of continuity of the responsibility of the management for implementing the different technical stages of a project (studies, works and subsequent operation) and its relative stability.

Putting together these four main variables, a preliminary comparative analysis may be made of the managements of large-scale projects.

Thus, a project which has total administrative and financial autonomy, which has multisectoral technical responsibility for the entire operational and physical area of influence in which it is located and which also handles all the technical phases would be a project with the highest level of responsibility in terms of environmental management.

In contrast, a project with almost no administrative autonomy, only covering a small territorial area or part of a basin, and implementing only one specific sectoral action would be a project with the lowest level of responsibility in terms of environmental managment.

In practice, intermediate situations are usually found, depending on the physical size of the project, the amount of the investments, the political importance of the actions and of the region benefited, the operational arrangements of the public bodies, the sources of financing, the method of implementation, the degree of regionalization of the country, the types of legislation in force, and other factors. The analysis and classification of important water resources development projects as a function of these variables could provide very valuable information on their organization and the ways in which the aspect of environmental management could be approached in Latin America. Moreover, it would make it possible to open a network of interinstitutional co-operation among those in charge of handling these actions.

It is currently believed that it is more important to learn more about project managment than about the actual formulation and evaluation of the projects, since there are already many publications on the latter subject. On the contrary, very little information is available on how to carry out the executive and operational stages of integral water resources development projects, especially those involving more environmental considerations.

/5. Conclusions

5. Conclusions and recommendations

Using as a reference both the analysis of the case studies and the opinions offered at the seminar,14/ during which the subject of environmental management and large water resource development projects was fully discussed, the following conclusions and recommendations are reached:

(a) Large water resource development projects, and especially the works associated with these projects, are one of the concrete options man has for managing the environment with a view to development. It is worth stressing the desirability of orienting the analysis of environmental management towards answering the question of how to manage the environment for development purposes, in order to obtain answers which will help those in charge of this management.

(b) The fact of properly incorporating so-called "environmental considerations" within the executive decision-making process of a project does not mean placing limits, restrictions or a greater burden of costs on economic development, but on the contrary means reaching the goals of development more efficiently.

(c) A close correlation should always be maintained between national or regional development plans and water development projects during both the formulation and the implementation stages. There have frequently been cases, however, and these still occur, in which water resource development projects and plans have neither formed part of nor been linked in a timely manner to development plans.

(d) The so-called "environmental dimension" is also usually misunderstood or unsiutably analysed both in the formulation and implementation of regional plans and in water resource development projects. Thus, it is common to observe that certain so-called "environmental management" actions are dealt with separately from others which are called "project implementation" actions. This is particularly so in the construction of water engineering works, even though the latter clearly form part of environmental management, and it is thus incorrect to consider them separataly from other actions.

(e) With regard to the delimitation of the area of influence of the management of a project, it is important that this should include at least the total catchment area of a basin, or system of basins, including also those areas towards which the water is drained, whether surface or underground. This is particularly important for siutable management of the operation and maintenance phases of the water infrastructure systems, as well as water resources management and conservation in general. It is also important to note that if this geo-hydrographic area is subdivided into samller operational areas for political or administrative reasons, the necessary co-operation and co-ordination machinery must be established among the different managements of the projects being carried out in the areas mentioned.

(f) It is of fundamental importance to identify the chain effects (in the ecological and productive sense) which result from the implementation of a large water resource development project. This task is necessary for the successful environmental management of a region.

(g) The identification of the chain effects and their element is a permanent task which, because of its complexity, must be carried out (especially at the

---

14/ CEPAL, Report of the regional seminar on environmental management and large water resource projects, Concordia, Argentina (E/CEPAL/L.262), Santiago, Chile, February 1982.

/beginning of

beginning of the project) by a competent team. Given the dynamism of this task it is necessary to keep constant vigilance over the environment and have the real power to take at the appropriate time all the measures considered necessary for "managing" the environment or, in other words, technically controlling the chain effects. Such vigilance requires in turn the prior specification of a siutable set of indicators which make it possible to quantify the changes occurring in the environment as a result of the actions carried out. In brief, the identification and separation of the chain effects into operational sectors, from the technical and administrative points of view, as well as the follow-up work on the effect of human actions on the environment, are the two basic instruments for the administration of any environmental management project -such as water resource development projects- since on these bases the technical activities which must be carried out by the project management and the other bodies with responsibilities within its geographic area of influence are clearly identified.

(h) With regard to institutional problems, it may be noted that these are related to the organizational structure of the project management itself and the management structures of the other institutions which must or can participate in the technical environmental management activities within the project's area of influence. Moreover, the project management must be able to identify the major groups of actions to be implemented within the area of the project. Once these actions have been determined, the management must distinguish which ones it can carry out directly and which must be implemented by other bodies. For this purpose, the management must guide and facilitate this participation by other bodies -if necessary through specific financing- so that they can carry out technical or environmental management actions within the area of influence of the project. This requires the creation of a system of effective and useful co-operation between this management which is directly in charge of the project and those bodies. Experience has shown that this co-operation is highly beneficial for project purposes from both the technical and economic points of view.

(i) Environmental management thus comes to constitute the direction of the implementation of the technical and administrative activities of the project. The results of this management must be siutably evaluated in order to facilitate its improvement. This evaluation of the environmental management which temporarily materializes with the implementation of the project is done by using indicators of spatial, technical and social coverage as well as by assessing how and when the technical actions have been implemented, what control has been exercised over them and what chain effects they produce. Since it has been observed that these indicators are scarce and often do not apply, it is recommended that a study be made of which of them are the most appropriate, with the aim of utilizing them to optimize the relationship between the implementation of the management activities and the implementation of the technical actions of the project.

(j) The technical and administrative management of a project is a dynamic activity by definition. In the administration of large environmental management projects, such as water resource development projects, this characteristic is even more noticeable. This means that it is necessary to create project managements simultaneously capable of conducting short-term and long-term planned actions during the different stages of execution. Moreover, the structure of the management of a project varies according to whether it is in the study or preliminary stage, the construction or intermediate stage, or the operational stage. It has been observed that the greatest needs for improvement in the administrative processes are found in the operational stage, where the water systems which have been

/constructed have

constructed have to be operated and maintained and the natural resources managed and conserved, especially the water itself and the basin where this resource is caught. The management structure must be substantially changed in order to adapt itself to this last stage. The period of transition between the intermediate or construction stage and the operational stage thus requires adequate planning, financing, preparation of staff, equipment and other aspects which are often not sufficiently considered.

(k) In summary, the organizational structure and powers of the management of the project depend on four factors: (a) the organizational structure and installed capacity of the other national, regional or local organizations which must intervene in the implementation of the project and its operation; (b) the number and variety of technical actions required to implement the project (these must include both the planned actions and the conjunctural measures needed as a result of the chain effects which occur); (c) the different technical stages of development of a project (preliminary or study, intermediate or construction, and operational), since these make it necessary to modify the management structure, and (d) the area or geographic space which the actions of the project are to cover.

(l) The economic and financial aspects are key factors in guaranteeing the success of the project. It was especially noted that the greatest financial problems occur in the operational stage, and that these create difficulties for proper environmental management. In this respect, it was indicated that the costs and benefits related to the totality of the environmental system should be taken into account, and they should not be limited only to the water system. This means that as far as possible the actions and respective chain effects affecting the environmental system should be determined in advance, in order to evaluate it economically. For this purpose it is necessary to consider the long-term effect of the water resource development project and the incorporation of the economic effects which are now called "indirect", as well as internalizing greater environmental management alternatives in the design and technical and economic evaluation of the projects.

(m) As a final conclusion, it is necessary to stress the importance of continuing the task initiated with this document in order to provide technical and administrative guidance for the managements of large-scale projects so that they will have a better understanding of what environmental management means. Concretely, it is hoped that the present document will serve as the basis for this task. Moreover, it may be concluded that there is an evident need to promote co-operation among persons who are working in these areas, and this can be achieved if adequate interinstitutional co-operation machinery is established.