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FORMULATION OF PLANS FOR WATER RESOURCE MANAGEMENT IN
LATIN AMERICA AND THE CARIBBEAN

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Summary

This study, which is of a preliminary nature, examines the position with regard to the formulation of plans for water resource management in Latin American and the Caribbean countries, in order to explore the prospects of an interchange of experiences in the field of water management in the region.

The study is based on a comparative analysis of a number of plans for the management of water resources at different stages of formulation, both at the national and the regional level. The documents analysed come from Brazil, Colombia, the Dominican Republic, Ecuador, El Salvador, Honduras, Jamaica, Mexico, Peru and Venezuela. The aim has been to compare plans relating to the multisectoral use of water, although the report also reviews a number of sectoral plans, mainly in relation to population, energy and agriculture.

The analysis shows that the countries of the region which have undertaken the formulation of national plans for water management follow or have followed a similar methodology of work. This methodology includes the territorial regionalization of the water resource, the calculation of the supply and demand for water by regions, and the formulation of technical and administrative strategies to harmonize water requirements and availability. There is, however, an appreciable difference in the progress made in each country owing to the years of difference in the initiation of the plans, the different ecological-environmental conditions prevailing in each country, and the different modes of work and other factors, all of which indicates that there is considerable potential for an interchange of ideas on the subject.

By way of experiment, an effort has also been made to determine the relative usefulness of the formulation of plans, the way in which socioeconomic development plans are related to those of water development, and the form in which plans of national scope are linked with those applying to regions and to river basins. The study likewise includes an analysis of the way in which water resource plans incorporate the environmental dimension. Since there is no specific mandate on the subject, no attempt has been made to evaluate the form in which plans, once completed, have been or are intended to be put into practice.

From the main observations made in the text on plan formulation, it can be said that on the whole the formulation exercise has been useful in the countries which have undertaken it. The chief benefits obtained include: a better knowledge of the availability of water in these countries and in their respective regions, a better interinstitutional co-ordination with regard to water, a better knowledge and creation of alternatives for the harmonizing of water supply and demand, a better perception of the current and potential conflicts concerning water exploitation, a better prospect of incorporating environmental considerations which are usually neglected, and --almost immediately-- a larger number of options for improving the operation of the water systems already constructed.

The conclusions indicate that all this enables the countries to develop water policies in accordance with their socioeconomic development goals, although there is certainly no guarantee or compulsion that these policies will be realized or taken into account in the decision-making process.

ECLAC hopes that the present study will facilitate water resources management in the countries of the region through the promotion of horizontal co-operation, and will likewise serve as a source of information on the subject of the planning and management of water resources. To this end, in addition to the references incorporated in the text, a summary has been made of the content of each document used. This has been published by the Latin American Centre for Economic and Social Documentation (CLADES) of ECLAC, in the document series, PLANINDEX.

Introduction

The role of planning in questions of water utilization and management on the basis of Latin American experiences

The importance of planning as a basis for accelerating economic and social development has been a subject of debate since the end of the 1940s.^{1/} The purpose of the present study is to make a preliminary assessment of Latin American experiences in the planning of the utilization and management of water resources in order to: a) decide if it would be justifiable to make a serious attempt at horizontal co-operation, by assessing the existing relations between efforts and decisions in the planning field with regard to the allocation of resources to the water sector and the decisions made on the management (or utilization) of water and allied resources, parts of which depend the attainment of the development goals established in the plans; and b) define the scope of a co-operative effort between national institutions engaged in the planning, management and use of water resources.

The advocates of water resource planning maintain that it is the only way to achieve an integrated approach to the utilization and management of a resource which can satisfy several objectives and be used for multiple ends. Planning enables the long-term reciprocal influences of physical and socioeconomic systems to be taken into account, and thus provides the bases for a flexible management to cope with uncertainty and reduce traditional external effects (environmental repercussions) so as to obtain greater and more sustained economic services from the system of water and related resources. Planning permits the co-ordination of a multiplicity of institutions involved in the exploitation of natural systems (river basins) in which water is a central element, and this in its turn leads to the application of the integrated and flexible decision-making process outlined above.

The sceptics think that the planners of water use overlook the politico-institutional and socioeconomic realities which guide the actual decisions on public resource allocation and the way in which water is used. Hence the plans reflect a technocratic opinion expressed in ideal draft projects which have no relation to the real decision-making process and are therefore not functional. Although these opinions for and against may seem exaggerated they are contrasted in this way in order to elucidate the issues that must be considered.

Chapter I deals with the Mar del Plata Action Plan and questions relating to its application in Latin America. At the same time it presents a panorama of the resource potential and the actual and projected demand for water for urban supply, irrigation and hydroelectricity in the region. Chapter II deals with the theory of the national planning of water resources, that is, the projection of supply and demand and the formulation of a public policy (investments, periodic expenditure, regulations and taxes and price subsidies) to meet the demand and achieve the programmed production of water-related services. It is primarily concerned with the relations of the projections of demand at successive planning levels for the purpose of: i) the development of national, regional and river basins of a multisectoral nature; ii) sectoral development within the three types of area mentioned; iii) the

development of subsectors and river basins (irrigation, urban supply, hydro-electricity, tourism, fishing, etc.) within the water "sector". Chapters III and IV analyse and compare the experience of the Latin American countries in the national planning of water use and the planning of subsectors and river basins. The conclusions of chapter V are based on the theory and practice of water resource planning in Latin America and the Caribbean, indicating how this planning may be made more effective and by what means horizontal co-operation may contribute to this end.

I. WATER RESOURCES IN LATIN AMERICA AND THE CARIBBEAN
AND THE MAR DEL PLATA ACTION PLAN

1. The potential supply and projected demand for
water resources

In Latin America and the Caribbean the governments have given considerable attention to the improved use of water, and their concern is reflected in the high investments made and projected for this purpose. Although no adequate figures are available on the global and relative percentage of the investments made and programmed by the countries with regard to water, and indirect appraisal can be made through an assessment of the investments made by user sectors. The sectors which have traditionally required the largest investments are agriculture, for the construction of large irrigation works; hydroenergy, for the construction of dams and power stations; and housing and health for the construction of systems of drinking water supply and sanitation.

a) Drinking water supply

The projections for investment to meet the demand for water and excreta disposal during the 1980s,^{2/} according to the goals set by the countries, fluctuate between US\$ 36 billion, an amount which would provide a minimum coverage, and US\$ 61 billion, a figure which would cater for the whole population (see table 1). It is estimated that in the period 1977-1990 the annual investment destined for the provision of drinking water and excreta disposal systems would amount to US\$ 2.77 and 4.72 billion respectively, in comparison with an annual average investment estimated at around US\$ 2 billion in the period 1970-1977 (see table 2).^{3/}

b) Irrigation

With regard to the agricultural sector, there are no global statistics available as in the previous case. Nevertheless, a few figures can give an idea of the magnitude of the investments made in this field, particularly in semi-arid countries like Mexico and Peru. In Mexico, according to Wionczek,^{4/} during the period from 1943 to 1955 the State assigned to agriculture an average of 10% of the federal budget, of which at least four-fifths went to large irrigation projects. In Peru ^{5/} during 1979 around 82% of the investments in agriculture were also devoted to irrigation and drainage.

According to FAO,^{6/} the area irrigated in Latin America in the period 1967-1977 rose from 94 370 km² to 128 550 km², that is, 36% in ten years (see table 3). According to Merea,^{7/} there is still a large potential for increasing the areas of irrigation in Latin America (see table 4). It is to be hoped that Brazil will bring the largest area under irrigation in a shorter period, being able to begin with an increase of 3 million hectares, since it possesses extensive areas suitable for this purpose. In the Northeast of the country, in the State of Piauí alone, there are around 6 000 hectares irrigated out of a potential area estimated at up to 500 000 hectares.

Table 1

FUTURE DEMAND FOR WATER SUPPLY AND EXCRETA DISPOSAL BASED ON COUNTRY GOALS FOR 1990

Countries	Drinking water supply						Excreta disposal					
	Urban			Rural			Urban			Rural		
	Population served in 1977	Population to be served in 1990 a/	Increment in population served	Population served in 1977	Population to be served in 1990 a/	Increment in population served	Population served in 1977	Population to be served in 1990 a/	Increment in population served	Population served in 1977	Population to be served in 1990 a/	Increment in population served
Argentina	14 849.8	20 876.3	6 026.5	675.5	1 672.5	997.0	7 000.6	18 266.7	11 266.1	3 184.5	4 181.2	996.7
Bolivia	596.2	3 345.2	2 749.0	63.3	1 587.3	1 524.1	616.1	2 341.7	1 725.6	126.5	1 388.9	1 262.4
Brazil	46 359.7	91 204.5	44 844.9	4 361.7	13 851.6	9 489.9	45 657.2	82 413.7	36 756.5	17 446.8	23 374.5	5 927.7
Colombia	13 044.8	23 073.7	10 028.9	2 522.1	6 495.1	3 973.0	12 392.5	20 510.0	8 117.4	7 653.4	8 660.1	1 006.7
Costa Rica	856.4	1 460.7	604.3	696.3	1 183.3	487.0	376.6	1 460.7	1 082.1	963.2	1 314.8	351.5
Cuba	5 508.8	7 655.5	2 146.7	354.0	1 339.4	985.4	2 784.7	6 889.9	4 105.3	212.4	1 172.0	959.6
Chile	6 787.2	11 202.2	4 415.0	173.7	1 486.8	1 313.2	4 189.6	8 961.7	4 772.1	1 953.7	1 858.5	0.0
Dominican Republic	1 630.0	3 327.6	1 697.6	365.0	1 349.8	984.8	666.8	2 911.7	2 244.8	1 216.5	2 024.7	808.2
Ecuador	2 290.4	5 383.6	3 093.2	250.8	5 565.3	5 314.5	1 976.6	5 383.6	3 406.9	418.0	5 565.3	5 147.3
El Salvador	1 018.0	3 207.2	2 189.2	75.2	1 179.8	1 104.6	640.9	2 886.5	2 245.5	526.7	1 310.9	784.2
Guatemala	1 423.5	3 151.1	1 727.6	250.8	1 095.0	844.1	981.7	3 361.2	2 379.5	710.7	4 379.9	3 669.2
Haiti	214.5	1 093.7	879.1	0.0	388.6	388.6	0.0	698.1	698.1	207.2	1 813.6	1 606.5
Honduras	947.1	1 950.2	1 003.2	267.2	560.2	293.0	543.0	1 584.6	1 041.6	226.1	2 000.6	1 774.6
Jamaica	722.8	1 175.3	452.5	137.7	463.2	325.6	309.8	1 305.9	996.1	1 089.9	1 158.1	68.1
Mexico	28 416.7	57 059.7	28 642.9	7 257.2	15 756.0	8 498.8	16 644.1	49 927.2	33 283.1	7 937.5	26 260.0	18 322.5
Nicaragua	838.8	1 858.4	1 019.6	106.7	727.7	621.0	490.4	1 161.5	671.1	213.4	509.4	296.0
Panama	850.9	1 431.1	580.1	100.8	366.0	265.2	684.4	1 288.0	603.5	394.8	549.0	154.1
Paraguay	302.7	1 312.4	1 009.7	0.0	842.6	842.6	426.0	1 124.9	689.9	1 507.9	2 106.5	598.6
Peru	5 655.7	13 473.1	7 817.5	178.9	2 605.5	2 426.6	4 318.9	11 789.0	7 470.1	119.3	2 279.8	2 160.5
Uruguay	1 800.1	2 785.7	985.6	112.5	380.2	267.7	1 296.1	2 785.7	1 489.6	356.3	380.2	23.9
Venezuela	6 767.0	13 618.2	6 851.1	968.8	2 390.3	1 421.5	6 767.0	11 915.9	5 148.9	2 750.2	3 187.1	436.9
Total	140 881.1	269 645.4	128 764.2	18 918.2	61 286.2	42 368.2	108 765.0	238 968.2	130 193.8	49 215.0	95 475.1	46 355.2

a/ Population estimates taken from CELADE, *Boletín Demográfico*, Año XII, No 23, January 1979; and *Boletín Demográfico*, Año XIII, No 25, January 1980.

Table 2

LATIN AMERICA: ESTIMATED ANNUAL INVESTMENT IN WATER SUPPLY AND
EXCRETA DISPOSAL, 1970-1977 AND 1977-1990

(Thousands of dollars at 1978 prices)

Country	Water supply		Excreta disposal		Annual average 1977-1990 as proportion of annual average 1970-1977	
	1970	1977	1977	1990	a/	b/
	<u>a/</u>	<u>b/</u>	<u>a/</u>	<u>b/</u>	<u>a/</u>	<u>b/</u>
Argentina	77 983	85 813	187 815	445 477	2.19	2.41
Bolivia	4 133	9 553	30 015	162 869	7.26	17.05
Brazil	760 101 1	105 612	77 038	1 100 569	1.00	1.02
Colombia	107 689	149 116	218 977	280 861	1.47	1.88
Costa Rica	7 753	9 471	11 446	23 754	1.48	2.51
Cuba	53 820	54 242	83 461	132 585	1.55	2.44
Chile	44 565	68 838	72 662	131 431	1.63	1.91
Dominican Republic	23 681	23 918	40 554	77 115	1.72	3.22
Ecuador	20 802	29 660	75 338	159 138	3.62	5.37
El Salvador	6 229	6 970	41 031	67 838	6.59	9.73
Guatemala	14 683	20 213	27 600	92 461	1.88	4.92
Haiti	530	1 365	15 846	102 100	27.60	74.80
Honduras	10 675	11 019	20 838	46 792	1.95	4.25
Jamaica	6 305	9 163	13 223	26 946	2.10	2.94
Mexico	181 633	205 460	505 854	967 208	2.78	4.71
Nicaragua	10 986	11 132	19 046	34 769	1.74	3.12
Panama	9 113	14 126	12 869	19 615	1.32	1.39
Paraguay	7 612	7 910	17 085	55 831	2.24	7.06
Peru	58 149	84 811	100 992	268 623	1.74	3.17
Uruguay	5 733	9 866	14 238	34 262	2.48	3.47
Venezuela	78 151	111 539	101 215	173 962	1.30	1.56
<u>Total</u>	<u>1 904 458</u>	<u>1 915 755</u>	<u>2 771 623</u>	<u>4 719 385</u>	<u>1.45</u>	<u>2.46</u>

Source: ECLAC, Agua potable y saneamiento ambiental, 1981-1990.

Estudios e Informes de la CEPAL N° 25, E/CEPAL/G.1238, June 1983.

a/ Estimate based on the "Unit cost of new connections" of PAHO.

b/ Estimate based on the "Unit cost of new connections" of IRDB.

Table 3
LATIN AMERICA AND THE CARIBBEAN: CULTIVATED AREAS AND
IRRIGATED LAND, BY COUNTRIES

Country	Cultivated area <u>a/</u> (thousands of ha)	Irrigated area <u>b/</u> (thousands of ha)	Irrigated area as percentage of cultivated area	Percentage increase in irrigated area 1974/1976-1982
<u>Central America and Mexico</u>	118 375	5 602	4.7	16.3
Costa Rica	2 802	26	0.9	-
El Salvador	1 335	110	8.2	243.8
Guatemala	3 118	72	2.3	18.0
Honduras	5 169	84	1.6	7.7
Nicaragua	6 259	82	1.3	24.2
Panama	1 743	28	1.6	21.7
Mexico	97 949	5 200	5.3	14.8
<u>Caribbean</u>	13 323	1 468	11.0	40.8
Antigua and Barbuda	11	n.a.	n.a.	-
Bahamas	11	n.a.	n.a.	-
Barbados	37	n.a.	n.a.	-
Belize	97	2	2.1	100.0
Cuba	5 715	1 000	17.5	68.6
Dominica	19	n.a.	n.a.	-
Dominican Republic	3 542	176	5.0	32.3
Granada	16	n.a.	n.a.	-
Guyana	1 715	125	7.3	3.3
Haiti	1 401	70	5.0	-
Jamaica	471	33	7.0	6.5
St. Vincent and the Grenadines	19	1	5.3	-
Saint Lucia	20	1	5.0	-
Suriname	80	39	48.8	30.0
Trinidad and Tobago	169	21	12.4	10.5
<u>South America</u>	590 809	7 524	1.3	17.0
Argentina	178 800	1 620	0.9	12.3
Bolivia	30 375	150	0.5	28.2
Brazil	237 670	2 000	0.8	53.8
Colombia	35 680	318	0.9	14.4
Chile	17 448	1 259	7.2	1.4
Ecuador	6 525	530	8.1	4.1
Paraguay	17 540	62	0.4	17.0
Peru	30 635	1 180	3.9	4.1
Uruguay	15 081	88	0.6	54.4
Venezuela	21 055	317	1.5	6.0
<u>Total for Latin America and the Caribbean</u>	722 507	14 594	2.0	19.2

Source: FAO, Production Yearbook, 1982, 1983.

a/ Categories Arable Land and Permanent Crops and Permanent Meadows and Pastures, 1982, as estimated by FAO.

b/ As estimated by FAO, 1982.

n.a. = not available

Table 4

A. LATIN AMERICA: POTENTIAL IRRIGATION AREAS IN
SOME COUNTRIES a/

(Km²)

Country	Potential irrigation areas	Potential areas as percentage of irrigated areas
Bolivia	6 000	546
Chile	13 000	105
El Salvador	2 500	596
Guatemala	4 500	750
Haiti	1 100	157
Honduras	2 500	563
Mexico	80 000	160
Panama	2 724	900
Peru	17 330	155
Venezuela	7 270	309

B. LATIN AMERICA: IRRIGATION AREAS TO BE INCORPORATED IN SOME
COUNTRIES IN THE SHORT AND MEDIUM TERM

(Km²)

Country	Area of on-going programmes <u>a/</u>	Increase as percent- age of irrigated lands
Brazil	3 670	61
Colombia	900	33
Costa Rica	1 000	151
Chile	920	7
El Salvador	1 528	584
Honduras	767	173
Panama	728	241
Peru	2 247	20

Source: IICA, Merea (1977).

a/ Medium term was considered to be a period of up to 30 years and at different levels of study, financing and execution. The information relates to 1976 and/or 1977.

As regards the financing needed for this expansion, the World Bank 8/ points out that the cost of irrigating a hectare of land fluctuates between US\$ 2 000 and 10 000, which explains why the large irrigation projects absorb a considerable part of the budget of the agricultural sector. Table 5 gives some projections on areas under irrigation.

c) Hydroenergy

With respect to hydroenergy resources, the projections made for Latin America are equally significant. The Latin American Energy Organization (OLADE) calculated that this region has a hydroelectrical potential of close on 620 000 MW according to 1979 sources 9/ (see table 6). Since in that year the region used only 7% (44 223 MW) of the potential hydroenergy resources, it is predicted, as in the case of irrigation, that large sums will continue to be invested in this sector, of which the average annual historic growth has been 10.2%. The estimated average cost of installing one kW is US\$ 1 000, from which it is possible to deduce in some degree, and according to the plans for hydroenergy development in each country, the amounts of investment required in each case (see table 7 on historic growth and projections in Latin America).

Apart from these broad areas of investment in the water field, many countries assign large sums to the control of water courses, lakes and lagoons, whether for purposes of navigation, channelling or flood control. The sums invested in these projects vary considerably from country to country and are generally associated with programmes for multiple water use.

d) Conservation measures

Another highly important aspect is investment for the preservation, protection and/or conservation of the quantity and quality of water. This field includes activities for the protection and management of water catchment basins, the control of soil erosion by water, the improvement of water use in the cultivation of arid land, the elimination of excess water through drainage, the control of the exploitation of groundwater and its management in conjunction with surface water, the control and reclamation of polluted water bodies and courses, the improvement of the habitat of aquatic fauna and flora, the promotion of recreation and the application of other measures to improve the employment of the resource on the part of the users. All these practices are fundamental for the development and survival of mankind and should therefore be taken into account in any plan for the management of water resources.

2. The Mar del Plata Action Plan and the planning process

The studies on population growth and the demand for resources point to a rapid rise in every country in the demand for fresh water. In one report 10/ it is stated that the consumption of water for the period 1975-2000 will rise by between 200 and 300% in the world as a whole. The population growth alone will double the demand in practically the whole of Latin America and the Caribbean. Since the uses are competitive, they will enter into ever fiercer conflict not only as regards quantity but also in relation to quality, time and places of consumption.

Table 5

A. REQUIRED PROJECTION OF IRRIGATED AREA FOR 1990 IN
IMPROVEMENT AND INCORPORATION OF NEW AREAS

(Km²)

Regions	1975 <u>Irrigated area</u>	1990		Irrigated area to be incorporated <u>a/</u>
		<u>Improvements of irrigation</u>		
		Small improvements	Large improvements	
North and Central America	52 550	8 000	8 000	10 000
Caribbean	9 080	1 620	1 620	2 400
South America	52 640	13 870	13 870	18 610
<u>Total</u>	<u>114 270</u>	<u>23 490</u>	<u>23 490</u>	<u>31 010</u>

B. REQUIRED PROJECTION OF DRAINED SURFACE WITH OR
WITHOUT IRRIGATION, 1990

Regions	1975 <u>With or without irrigation</u>	1990	
		<u>Areas to receive drainage</u>	
		With irrigation	Without irrigation
North and Central America	81 600	2 110	41 540
Caribbean	12 000	770	3 110
South America	372 250	17 300	127 620
<u>Total</u>	<u>465 850</u>	<u>20 180</u>	<u>172 270</u>

Source: Merea (1977), on the basis of the FAO document entitled, Agua para la agricultura (1977).

a/ Includes drainage systems.

Table 6

LATIN AMERICA: INSTALLED CAPACITY OF HYDROELECTRIC
ENERGY GENERATION

Country	Installed capacity		Percentage of total installed capacity of electricity generation	
	1976	1980	1976	1980
	(thousands of KW)	(thousands of KW)		
Argentina	1 745	3 269	17.7	27.7
Bolivia	241	243	60.4	56.5
Brazil	17 675	27 267	83.9	85.9
Chile	1 461	2 306	54.9	61.2
Colombia	2 305	3 175	85.2	65.3
Ecuador	145	297	22.9	26.4
Mexico	4 251	5 321	34.6	30.8
Paraguay	265	300	79.3	81.1
Peru	1 406	1 861	55.9	58.3
Uruguay	236	371	33.9	44.4
Venezuela	2 245	2 920	43.4	32.0
Costa Rica	239	445	58.9	69.9
El Salvador	109	244	31.5	49.3
Guatemala	119	125	31.3	21.9
Honduras	69	110	43.4	54.2
Nicaragua	103	103	33.4	27.1
Panama (including the Canal Zone)	216	316	30.5	41.3
Cuba	44	46	2.6	1.9
Dominica	3	4	50.0	57.1
Dominican Republic	150	150	17.6	16.4
Haiti	47	50	52.8	41.3
Jamaica	17	20	2.4	2.8
St. Vincent and the Grenadines	2	2	25.0	22.2
Suriname	180	200	49.9	47.6
<u>Total for Latin America</u>	<u>33 273</u>	<u>49 145</u>	<u>48.1</u>	<u>52.5</u>

Source: United Nations, Yearbook of Energy Statistics, 1980, New York, 1981.

Table 7

HISTORICAL PROJECTION OF THE GROWTH OF INSTALLED ENERGY TO THE YEAR 2000

Sub-region	Total energy						Projection of share of hydroenergy						
	Historical growth rate	Installed energy 1979 (MW)	Installed energy projected 2000 (MW)	Hydroenergy potential 1979 (MW)	Installed hydroenergy capacity 1979 (MW)	Historical growth rate of hydro-electric energy	70%		80%		90%		
							Energy (MW)	Growth rate	Energy (MW)	Growth rate	Energy (MW)	Growth rate	
Mexico	I	7.1	14 200	63 588	25 250	5 200	6.3	25 250 _{a/}	7.8	25 250 _{a/}	25 250 _{a/}		
Caribbean	II	6.3	4 790	17 280	16 000	486	16.8	12 096	16.54	13 824	17.3	15 552	17.94
Central America	III	9.0	2 382	14 551	28 300	1 267	10.1	10 186	10.4	11 641	11.1	13 096	11.76
Andean Pact	IV	9.0	17 082	104 351	254 000	8 023	10.1	73 046	11.1	83 481	11.8	93 916	12.4
Argentina, Chile, Paraguay, Uruguay	V	5.4	15 510	46 802	81 000	5 110	10.2	32 761	9.3	37 442	9.94	42 122	10.6
Brazil	VI	10.1	28 386	214 110	213 000	24 137	11.3	149 877	9.1	171 288	9.78	192 699	10.4
Total			82 350	460 683	617 550	44 223	10.2	303 216	9.6	342 926	10.24	382 635	10.82
								.66 _{b/}		74.6 _{b/}		83.3 _{b/}	

Source: OLADE, SIECA, CIEP, Technical reports from the countries, United Nations statistics.

a/ It is considered that the installed potential up to 1979 will be technically and economically saturated in the year 2000.

b/ Represents the percentage resulting from the share of hydroenergy in the region, owing to which region I might not achieve the percentage estimated in the hypothesis of the saturation of the resource.

This rapid increase in demand, the growing complexity of the task of meeting it, both from the technical and economic standpoint, the social and environmental effects that may be brought about by an inadequate harmonization between supply and demand, together with the long periods of maturation of the projects --among other important aspects-- inevitably compel the governments to plan far ahead the way in which to utilize and conserve water in order to achieve their development goals.^{11/}

It is universally understood that water is an essential resource for life and development. Nonetheless, few people realize that, although this is a renewable resource, it is also subject to deterioration and hazard if it is not conserved by appropriate and timely measures. In practice the degree of awareness of this problem is inversely proportionate to the availability of water. Although this view may seem logical in the short run, it is not advisable or prudent to project it into the long term. We must not wait to be overtaken by acute scarcities, serious contaminations, disastrous floods or conflictive situations in order to take measures for their solution. It is desirable that the governments should concern themselves about this situation and take all possible precautions for the future.

These aspects were fully understood and debated at the United Nations Water Conference, held in the city of Mar del Plata, Argentina, in March 1977. The agreements reached at that conference were set forth in what was designated the Mar del Plata Action Plan. In this plan the countries and international agencies were recommended, among other points of priority, to give due attention to everything concerning the planning and management of water resources. To quote from the text: "Increased attention should be paid to the integrated planning of water management. Integrated policies and legislative and administrative guidelines are needed so as to ensure a good adaptation of resources to needs and reduce, if necessary, the risk of serious supply shortages and ecological damage, and to ensure public acceptance of planned water schemes and guarantee their financing. Particular consideration should be given not only to the cost-effectiveness of planned water schemes, but also to ensuring optimal social benefits of water resources use, as well as to the protection of human health and the environment as a whole. Attention should be paid to the shift from single-purpose to multi-purpose water resources development as the degree of development of water resources and water use in river basins increases, with a view, inter alia, to optimizing the investments for planned water-use schemes. In particular, the construction of new works should be preceded by a detailed study of the agricultural, industrial, municipal and hydropower needs of the area concerned. Water-management plans may be prepared using systems analysis techniques and developed on the basis of already adopted indicators and criteria. This analysis would take into account the economic and social evolution of the basin and be as comprehensive as possible; it would include such elements as time horizon and territorial extent, and take into account interactions between the national economy and regional development, and linkages between different decision-making levels. National policies must provide for the modernization of existing systems to meet the requirements of the present day".^{12/}

In addition to these generic aspects, a series of specific proposals were made to the countries on the subject of planning, with the following recommendation: "Each country should formulate and keep under review a general statement of policy in relation to the use, management and conservation of water, as a framework for

planning and implementing specific programmes and measures for efficient operation of schemes. National development plans and policies should specify the main objectives of water-use policy, which should in turn be translated into guidelines and strategies, subdivided, as far as possible, into programmes for the integrated management of the resource".^{13/} Likewise it was emphasized that the international agencies and other support organizations should, according to their own procedure and on request, assist the countries in the working out of the aforesaid Plan.

As a complement to the foregoing the countries were also recommended to make the necessary institutional arrangements to carry out this planning. This was stated in the following terms: "Institutional arrangements adopted by each country should ensure that the development and management of water resources take place in the context of national planning and that there is real co-ordination among all bodies responsible for the investigation, development and management of water resources. The problem of creating an adequate institutional infrastructure should be kept constantly under review and consideration should be given to the establishing of efficient water authorities to provide for proper co-ordination".^{14/}

Specific recommendations were also made on legislation, designed to facilitate and consolidate the planning processes, in the following terms: "Each country should examine and keep under review existing legislative and administrative structures concerning water management and, in the light of shared experience, should enact, where appropriate, comprehensive legislation for a co-ordinated approach to water planning. It may be desirable that provisions concerning water resource management, conservation and protection against pollution be combined in a unitary legal instrument, if the constitutional framework of the country permits. Legislation should define the rules of public ownership of water and of large water engineering works, as well as the provisions covering land ownership problems and any litigation that may result therefrom. It should be flexible enough to accommodate future changes in priorities and perspectives".^{15/}

3. Progress in the application of the Action Plan and the planning of water resources

One of the main tasks entrusted to the Economic Commission for Latin America and the Caribbean (ECLAC) in the field of water resources has consisted in the assessment of the progress made in the countries of the region in the application of the Mar del Plata Action Plan since its adoption in 1977.

This task has been hampered by the lack of a detailed study to serve as a base of reference on the existing situation in the water field in these countries at the time of the adoption of the Action Plan. Nor has it been possible to know with certainty whether the changes or advances made by the governments in respect of water are due to an application of the Plan or are tasks which they would have carried out in any case with or without the existence of the Plan.

In order to overcome this problem to some extent a survey was undertaken in 1980 ^{16/} to examine the progress made in the countries in the application of the Plan. This survey was conducted at global level and was answered by 57 countries, 14 of which were in Latin America and the Caribbean. With respect to the advances

made in the review of policies at global level since the application of the Plan, 17 out of the 56 countries replied that they had carried out this task, which amounts to 30% of the total. In Latin America the proportion was similar.

This survey cannot, however, be taken as a sufficiently detailed frame of reference for assessing the progress achieved by the countries for the better utilization of their water resources. For this reason ECLAC ^{17/} has considered it necessary to send missions to the countries of the region and to use as indicator and main reference base for this work the progress made in the planning of water use in terms of the development plans of each country. Preferentially attempts have been made to obtain information on plans of a national and multisectoral nature, but a review has also been made of national plans relating to sectors, regions and water basins. These plans to a greater or lesser extent reflect the recommendations made at the United Nations Water Conference and faithfully represent the interests of each government through having been carried out by the governments themselves.

Moreover, if the countries were not in possession of these plans or if they were in the process of preparation, they might possibly request the assistance needed to develop them. This assistance can be provided by international agencies or through horizontal co-operation mechanisms. In either case, it would signify some further progress towards putting into practice the recommendations of the Mar del Plata Action Plan.

4. Evolution and perspectives of water resource planning in Latin America and the Caribbean

Although it is premature to express opinions on the future of the planning of water resource management in Latin America and the Caribbean, it can be stated that there is a clear trend in all the countries towards the formulation of increasingly complete and long-term plans.

The common trend in the countries of the region was originally to plan water resources by user sector, especially with a view to irrigation, energy generation and the supply of drinking water. Frequently these plans did not form part of national or regional development plans, their sole purpose being to give priority to investments in water projects without taking into account other aspects regarded as fundamental today, such as "to incorporate the environmental dimension" in the designing and operation of the projects and in particular to promote the multiple utilization of water resources.

Neither were territorial spaces clearly defined in these plans. The use of water was planned in response to administrative rather than hydrographic limits and it was uncommon for hydrographic basins to be considered as the basis for an integral planning of the utilization of this resource.

As cause and effect of this situation there are still similar problems in the management of water systems in Latin America and the Caribbean. The main problems are as follows: a) the difficulty encountered in the operation and maintenance of constructed works and the management and conservation of the natural resources included in the project areas; b) the excessive sectoralization of activities in the field of water; c) the scant attention paid to social and environmental

considerations generated by the project in general; d) the difficulty of sustaining and giving priority to the large investments required for the utilization of water resources; e) the scant attention paid to the use of water in rain-fed zones in the agricultural sector.

In order to solve these problems the countries of the region have decided to seek different options for the management, co-ordination and integration of activities associated with water resources. At the outset it was usual to set up commissions formed by representatives of various sectors using water resources. When these commissions became permanent, and ceased to solve possible emergencies, they were gradually transformed into an instance of interinstitutional consolidation. The best-known case is that of Mexico, which in 1926 18/ formed the National Irrigation Commission, in conjunction with the enactment of a specific law on this priority aspect of water use. At the beginning of 1947, the National Irrigation Commission was raised to the category of Secretariat and there came into being what was then known as the Secretariat for Water Resources (Secretaría de Recursos Hidráulicos) (SRH), today designated the Secretariat (i.e., Ministry) of Agriculture and Water Resources (SARH). In 1950 there began to appear river basin projects for multiple purposes and subsequently in 1972 19/ the Commission for the National Water Plan was set up, forming part of the aforesaid ministry.

In the case of Mexico, the driving and cohesive factor which stimulated the creation of a national water plan was the need to plan the use of irrigation water, owing to the large investments required for this purpose. In other countries, and in line with their particular features, the priority uses have been linked with energy generation, the provision of a drinking water supply and navigation, together with the need to control the quality of water and such phenomena as floods or droughts.

The geographical area of action of these institutions was in accord with these sectoral purposes and frequently their activities were conducted only in certain parts of the territory of a country or in the area of a basin. More recently, however, these limits have been far exceeded in respect of water resource management. Thus, in addition to national plans and individual basin plans, there are binational and multinational plans comprising the integral management of the large basins, as for example the River Plate Basin, with the creation of the Intergovernmental Committee of the Countries of the River Plate Basin (CIC). These advances have been associated with an improvement in the co-ordination of interinstitutional activities and in water legislation.20/

These facts serve to show that on some fronts which foster the development of an adequate policy in the field of water utilization, such as planning, management, integration, interinstitutional co-ordination, legislation on water resources and financial negotiation, important progress has been made in Latin America and the Caribbean, and every effort to facilitate this progress will therefore benefit the countries of the region. The nature of these aspects is analysed in the present study.

II. REFERENCE FRAMEWORK FOR THE FORMULATION OF NATIONAL PLANS FOR THE MANAGEMENT OF WATER RESOURCES

1. Objectives and decision-making

In view of the many variables involved in the preparation of a plan for water resource management and considering the diversity of situations, an attempt must be made to classify and arrange these variables in order to tackle the subject, and particularly to propose solutions in a systematic manner (see table 8). We may take as a starting point a logical sequence of thought usually applied in analysing systems whose elements are the following:21/

a) To define and quantify the objective or objectives and give them a temporal dimension; to indicate the beneficiaries and the relation between principal and secondary objectives and the priority among multisectoral objectives.

b) To identify and analyse the geo-socioeconomic environments and territorial spaces within which it is desired to achieve the previously defined objectives.

c) To determine the problems and quantify the obstacles that must be surmounted in order to achieve the objectives within the geo-socioeconomic environment previously identified.

d) To generate solutions for overcoming the restrictions previously determined, to select and place them in order of priority, and to indicate the method of putting them into practice.

Moreover, when it is not possible to know or adequately to identify and define the objectives, the sphere of action, the restrictions or solutions, research must be carried out in order to obtain the necessary information. This logical sequence of work is carried out in practice in different ways, which reflects the relative conditions prevailing in each country in the field of water resources (see table 9).

González Villarreal has given a clear synthesis of the methodology of the planning of water resource utilization in table 10. This shows the interrelation and the flow of measures necessary for formulating a plan of this kind in a particular geo-socioeconomic environment.22/

The process of decision-making mentioned in the foregoing sequences must necessarily include the time variable. In the plans this variable is designated in different ways, including "horizon", which is a period at the end of which the objective is envisaged. This horizon is usually 25 years. The intermediate periods and intervals up to the limit of the "horizon" are known as "thresholds".

2. Water regionalization as a basis for harmonization of water supply and demand

A regionalization of water is the first step in the structuring of an adequate framework for using and managing water in a country (see figure 1). This framework serves a double purpose: it makes it possible to find units of study for the

Table 8

LATIN AMERICA: TENTATIVE CLASSIFICATION OF THE VARIABLES INVOLVED IN THE FORMULATION
OF PLANS FOR WATER RESOURCES

Spatial coverage		Sectoral scope	Planning horizons	Agents responsible for plan. Agencies	Agents in charge of the formulation of the plan	Variables in the application of the plan	Objectives of the plan
Politico-administrative limits	Hydrographic limits						
International	<u>By water catchment and/or discharge area</u>	<u>Multisectoral:</u>	Short term:	Central planning agency	State entities	<u>Instruments of plan control:</u>	<u>Economic</u>
Binational		Socio-economic	1 to 4 years	Sectoral planning agency	Public enterprises	- Tariffs	Production
National	Basin or system of basins	Environmental	Medium term:	Institute specialized in water resources	Private consultant companies	- Taxes	Consumption
Regional		(control of pollution, flooding, etc.)	5 to 9 years	Public enterprises (mainly energy, drinking water and sanitation sectors)	Special executive secretariats	- Subsidies	Expansion of cultivated area
Provincial or State	Valleys	<u>Sectoral</u>	Long term:	Municipalities	Individuals	- Quotas	Irrigation
District	Terraces	Health	10 to 25 years	Others	Groups of water-users	- Norms/decrees	Energy
Municipal	Hillsides	Agriculture	Very long term:	<u>Commissions, directorates and others</u>	International agencies	<u>Instruments for plan application:</u>	Aquaculture
Local		<u>By water bodies or source</u>	Energy	Over 25 years	Permanent commissions	- Regionalization	Livestock use
	- Surface water:	Transport		<u>Ad hoc commissions</u>	- Legislation	- Social	
	Rivers	Industrial			- Organization	Employment	
	Lakes	Mining			- Training	Supply of basic foods	
	Lagoons	Others			- Public enlightenment	Land reclamation	
	- Groundwater	<u>Subsectoral</u>			- Construction	Positive environmental effects	
	- Atmospheric water	Irrigation			- Evaluation	Regional integration	
	Fogs ("camanchaca")	Fish-breeding			- Others	New opportunities	
	Clouds, etc.	Recreation				Control of environmental conflicts	
	Others						
	<u>By zones of conflict</u>						
	Flood zones						
	Drought zones						
	Erosion zones, etc.						

Table 9

SEQUENCE FOR IDENTIFYING THE OBJECTIVES OF A PLAN FOR WATER
RESOURCE MANAGEMENT, THE MEDIUM IN WHICH TO ACHIEVE THESE
OBJECTIVES, THE PROBLEMS THAT MUST BE OVERCOME FOR THIS
PURPOSE AND THE ALTERNATIVE SOLUTIONS

A. OBJECTIVE

To have a constant supply of water adequate in quantity, quality, place and time to meet the needs of consumption, production and environment and to have protection against adverse effects associated with water resource management.

B. GEO-SOCIOECONOMIC MEDIUM

Hydrographic basin(s) or region(s) delimiting the sphere in which it is planned to harmonize water supply and demand to meet the objective(s) indicated above.

C. PROBLEMS

Physical and natural: To augment the water supply, increase efficiency in use or minimize natural conflicts and in general satisfy water requirements and water conservation conditions.

Socioeconomic: a) political and legal, to permit and execute plans in accordance with the interests of society; b) economic and financial, to allocate the economic and other resources needed to carry out the necessary technical measures; c) social and cultural, to implement with due knowledge and preparation the measures required to achieve the planned objectives, and d) institutional and administrative, to organize and implement the measures in an effective manner.

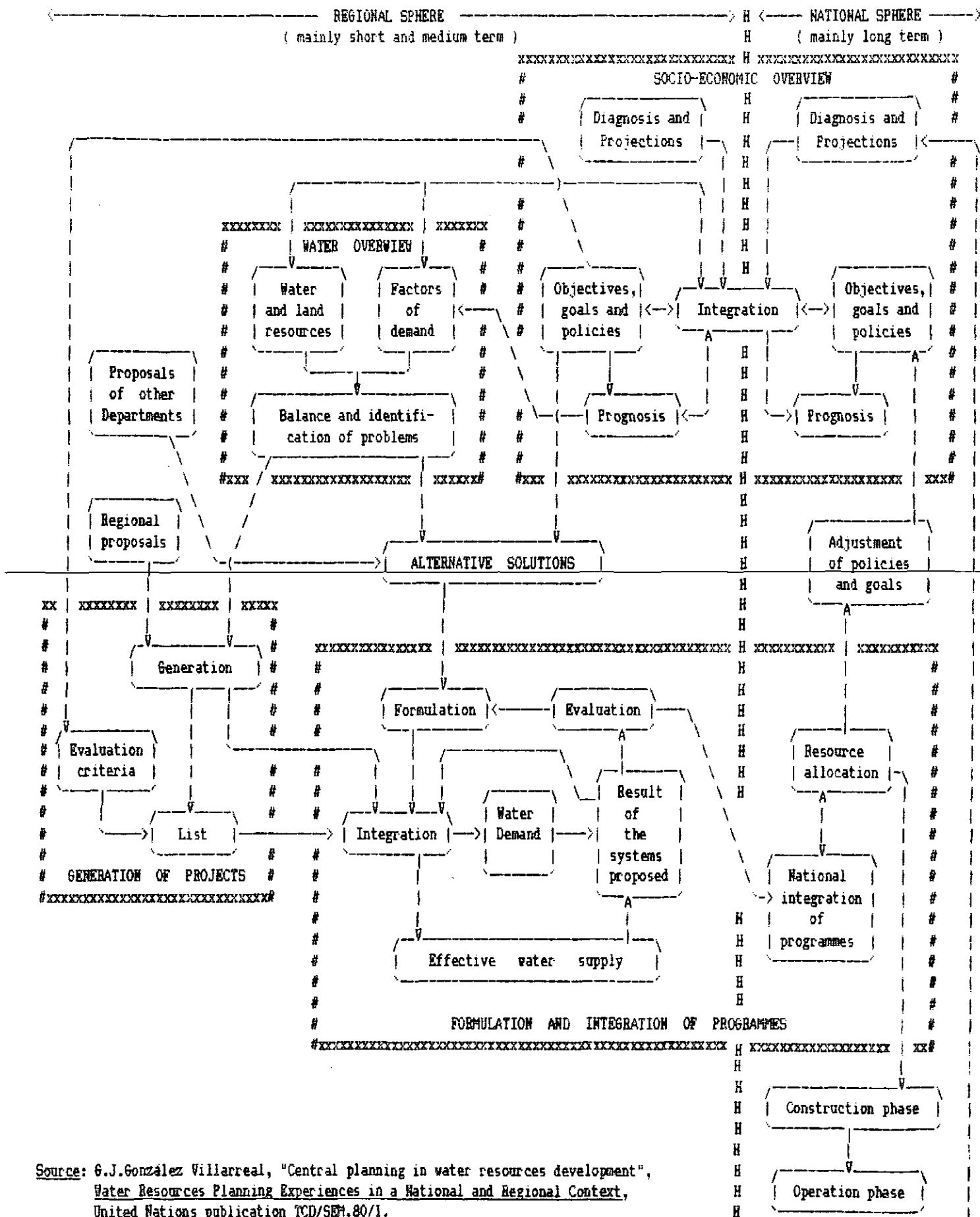
D. SOLUTIONS

Technical or engineering solutions: To overcome physical or natural problems. Includes activities such as studies of resources, formulation of projects, constructions of hydraulic works, operation and maintenance of hydraulic systems, and management and conservation of basins, water and other natural resources.

Political or administrative solutions: To permit the orderly execution of the technical or engineering solutions. Includes such measures as legislation, planning, financing, training, research, institutionalization, control, fiscal supervision, rationalization, personnel administration, information, etc.

Source: Axel Dourojeanni, La planificación para el desarrollo, aprovechamiento y manejo de los recursos hídricos, Course on the environmental dimension in development planning, CIFCA/ILPES/ECLAC/UNEP, Santiago, Chile, 20 October to 28 November 1980, document CDA-24.

METHODOLOGY OF THE PLANNING PROCESS



Source: G.J.González Villarreal, "Central planning in water resources development", Water Resources Planning Experiences in a National and Regional Context, United Nations publication TCD/SEH.80/1.

Figure 1

MAP OF MEXICO SHOWING THE WATER-PLANNED REGIONS



Source: Comisión del Plan Nacional Hidráulico, "Plan Nacional Hidráulico 1981", Mexico, D.F., March 1981.

harmonization of water supply and demand and also to fix the limits for the operation and management of water systems.^{23/} Within each zone, the initial step is the projection of water demand. Theoretically there should be a national economic development plan and, in addition, sectoral and regional plans as components of the former, which should make it possible to foresee the sectoral demand in each zone or basin. In the absence of such plans, considerable labour will be called for in preparing a description of the socioeconomic characteristics and trends in each zone. There are different methodologies for carrying out this task which have been fully analysed in the reference document,^{24/} and also in the methodological bases of the Plans of Venezuela, Mexico and Peru, among others.

In the analysis of the supply of surface and groundwater, it is considered that the most important physical features are the following: precipitation, generated and available run-off, soils, discharges into rivers, hydrology and volume and overloading of aquifers. The preparation of studies on water supply and demand and the balances confer numerous immediate benefits on the country carrying out this work. With this system zones are detected which have water incompatibilities of different kinds: in terms of quantity, quality, place and time and for several thresholds of planning, along with the reasons for the occurrence or possible occurrence of these incompatibilities. In principle, it helps to compile and rationalize quantitative information, usually dispersed, in a data bank, and to co-ordinate activities among agencies which are not accustomed to exchanging information despite their need for it. Equally, it facilitates the finding and prioritizing on a global level of a series of actual and potential conflictive situations in the short, medium or long term (see table 11 and figure 2).

The problems in harmonizing water supply and demand may be divided into two groups: natural or physical problems and politico-administrative problems. In the same way, the solutions may be divided into those of a technical or engineering type, when these are aimed at solving problems of a physical nature, and solutions of a directive type, when they are designed to overcome problems of a politico-administrative nature.

Finally, the water balance makes known the national, regional and local availability of water (see figure 3 and table 12); the zones of water shortage, the zones where there is no problem of supply, the zones where the supply is committed in other areas, and the zones with a supply which has quality problems for different thresholds and horizons of time. The balance represents a basic contribution to the development of the policies of utilization and management in the short, medium and long term.

Another aspect worthy of emphasis in the attempt to detect problems of harmonization of water supply and demand is that these problems are both technical or physical and administrative or political in origin. The study of the problems of harmonizing water supply and demand should consider both groups of problems and not be limited to the technical or physical aspects if the aim is to provide better elements of judgment for the formulation of utilization strategies. This is particularly important as a basis for designing the solution strategies. Outstanding in this group of problems are those created by society itself and its organization, such as inefficiency in the use of available water, the disproportionate growth of demand in zones with a water shortage, the lack of ineffectiveness of current

Table 11

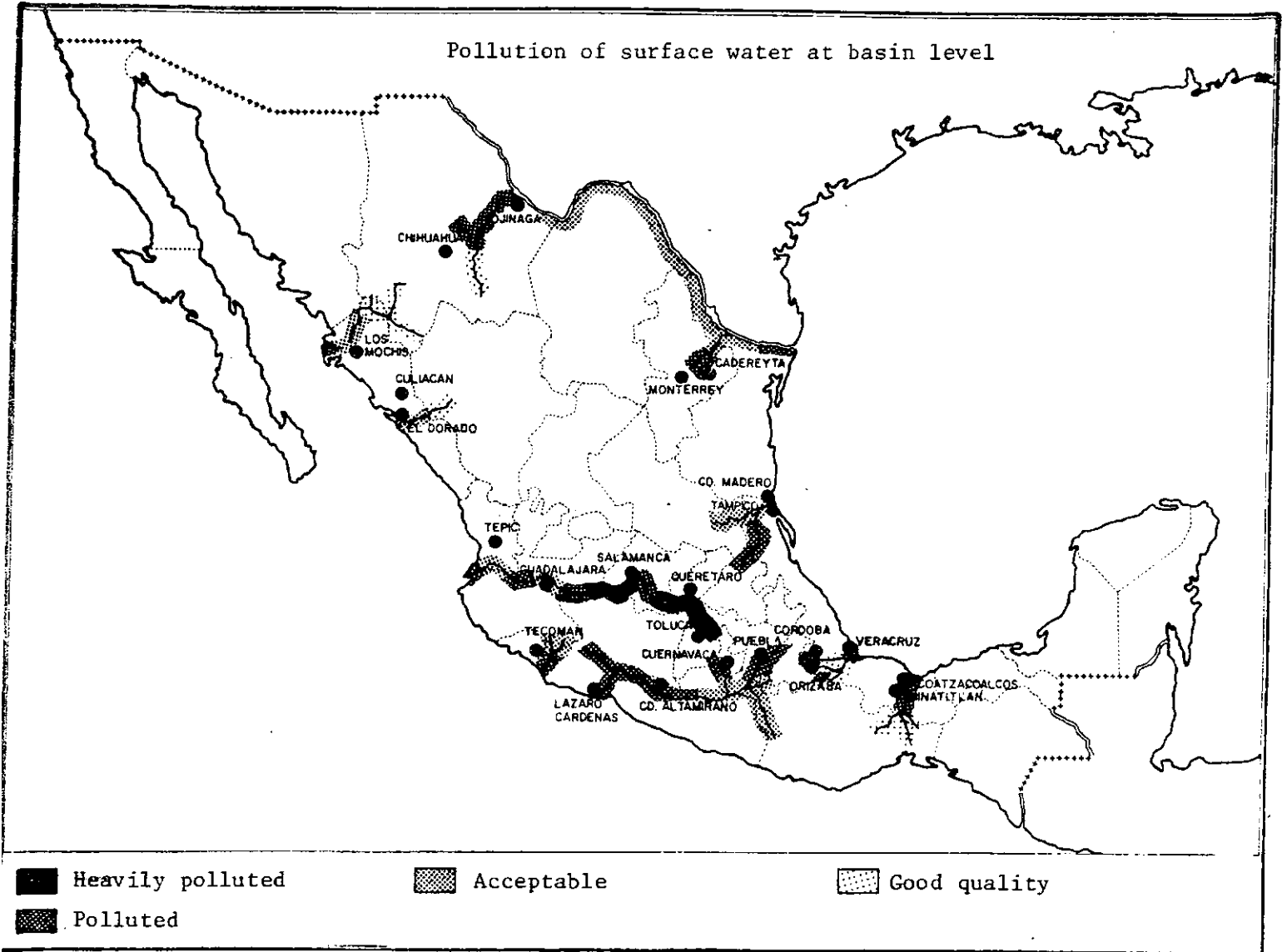
CONFLICTIVE SITUATIONS DETECTABLE IN A DIAGNOSIS OF WATER RESOURCE SUPPLY AND DEMAND

Situations	Considerations and/or ranges established for classification
1. Main zones of overexploitation of aquifers and resultant effects	<ol style="list-style-type: none"> 1. Lowering of levels 2. Saline intrusion or water migration 3. Land subsidence or fissures
2. Zones of prohibition of groundwater use	<ol style="list-style-type: none"> 1. According to agencies responsible for its control
3. Annual losses by overflow	<ol style="list-style-type: none"> 1. Very high (over 1 000 Mexican pesos per km²) 2. High (from 50 to 999 Mexican pesos per km²) 3. Medium (from 200 to 499 Mexican pesos per km²) 4. Low (under 200 Mexican pesos per km²)
4. Dams which need a review of their surplus water constructions	<ol style="list-style-type: none"> 1. Indication of capacities
5. Incidence of drought in the last 100 years	<ol style="list-style-type: none"> 1. High (over 12 droughts) 2. Medium (from 7 to 12 droughts) 3. Low (under 7 droughts)
6. Water pollution at basin level	<ol style="list-style-type: none"> 1. Heavily polluted 2. Polluted 3. Good quality
7. Pollution of surface and ground water at locality level	<ol style="list-style-type: none"> 1. Deficit of dissolved oxygen 2. Nutrients 3. Fats and oils 4. Coliform elements 5. Toxic elements 6. Intrusion
8. Sediment concentration in rivers and risks of water erosion	<ol style="list-style-type: none"> 1. Over 0.4% of the run-off 2. From 0.1% to 0.4% of the run-off 3. Under 0.1% of the run-off 4. High risk of erosion
9. Identification of conflicts of water supply to localities	<ol style="list-style-type: none"> 1. With actual and future conflict 2. With future conflict 3. With actual conflict but with alternative non-conflictive sources of supply 4. Without studies of ground water but with evidence that it exists 5. Without conflicts up to the year 2000 6. With present conflicts respecting water quality
10. Water balances by basins, zones and/or regions	<ol style="list-style-type: none"> 1. Rain 2. Natural availability (millions of m³) 3. Supply with infrastructure (millions of m³) 4. Demand 5. Extraction (millions of m³) 6. Balance I 7. Natural availability (millions of m³) 8. Balance II 9. Total consumption 10. Consumption and extraction within natural availability

Source: Plan Nacional Hidráulico de México, Mexico, D.F., 1981.

Figure 2

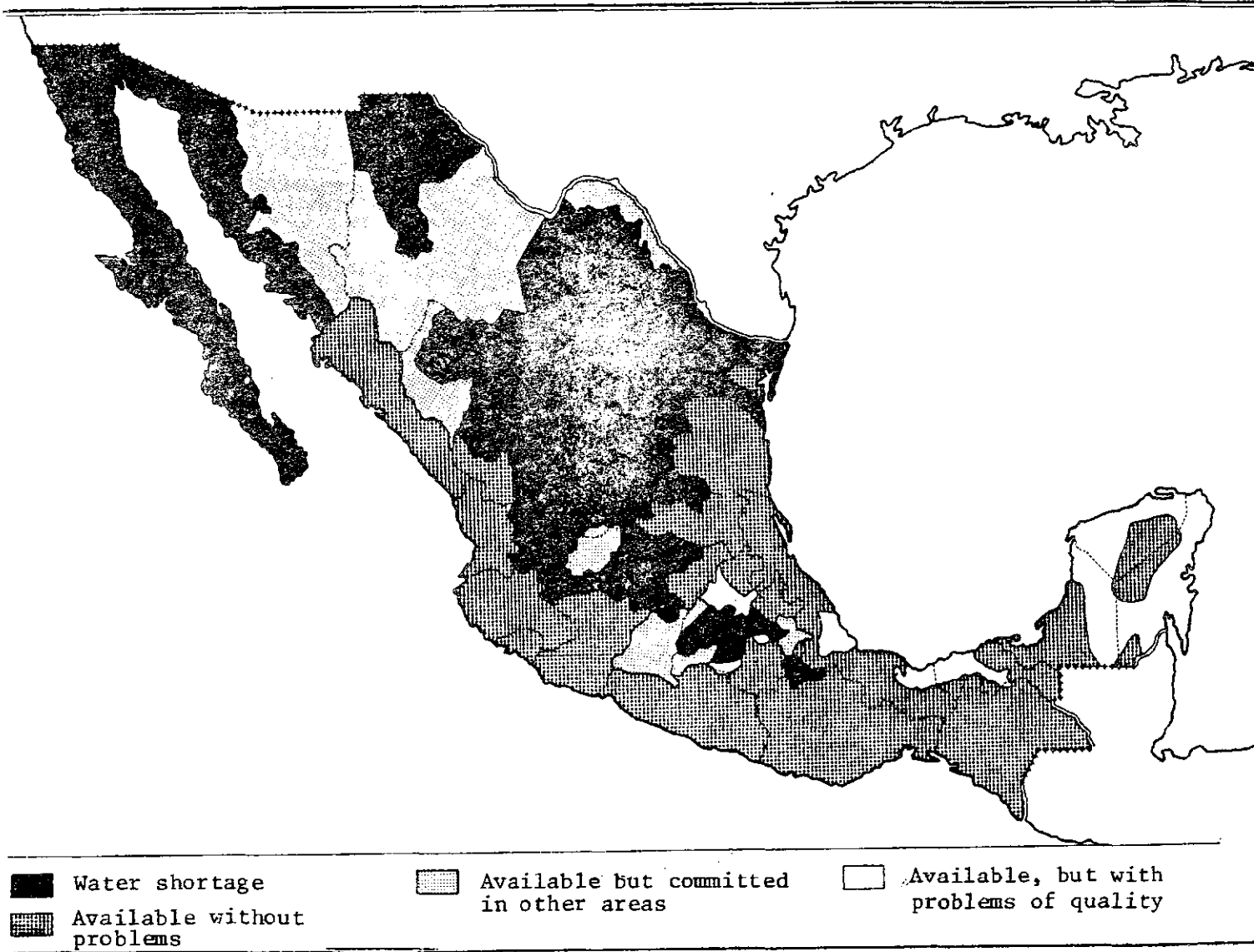
EXAMPLE OF OCCURRENCE OF CONFLICTIVE SITUATION FOR WATER USE



Source: Comisión del Plan Nacional Hidráulico, "Plan Nacional Hidráulico 1981", Mexico, D.F., March 1981.

Figure 3

MEXICO: REGIONAL AVAILABILITY OF WATER



Source: Comisión del Plan Nacional Hidráulico, "Plan Nacional Hidráulico 1981", Mexico, D.F., March 1981.

Table 12
WATER BALANCE OF MEXICO 1981

Zone	Rain		Natural availability			Year	Of. Com. Infrastructure			Demand	Extraction		
	Stratum	Volume	Virgin run-off	Aquifer recharge	Total		Surface	Underground	Total		Surface	Underground	Total
	mm					Millions of cubic metres							
North	425	242 406	11 669	4 528	16 197	1980	11 169	3 383	14 552	14 232	10 959	3 383	14 342
						1990	14 596	4 656	19 252	19 355	14 108	4 656	18 764
						2000	16 493	5 168	21 661	21 797	15 805	5 168	20 973
Pacific North and Centre	568	294 546	49 356	4 548	53 904	1980	25 120	5 244	30 364	30 413	23 266	5 244	28 510
						1990	45 790	5 718	51 528	50 813	43 757	4 758	48 515
						2000	70 360	6 117	76 477	75 481	68 332	5 073	73 405
Centre	946	265 531	55 475	7 750	63 225	1980	52 010	5 692	57 702	57 565	51 873	5 692	57 565
						1990	71 209	6 545	77 754	77 210	70 928	6 282	77 210
						2000	95 366	7 564	102 930	102 778	95 123	7 322	102 445
Gulf and Southeast	1 716	787 304	277 942	14 218	292 160	1980	72 673	1 308	73 981	53 557	52 249	1 308	53 557
						1990	129 639	2 302	131 941	99 743	97 441	2 302	99 743
						2000	304 063	3 677	307 740	281 134	277 590	3 877	281 467
Mexican Republic	864	1 589 787	394 442	31 044	425 486	1980	160 972	15 627	176 599	155 767	138 347	15 627	153 974
						1990	261 234	19 241	280 475	247 121	226 234	17 998	244 232
						2000	486 282	22 526	508 808	481 190	456 850	21 440	478 290

Zone	Balance I	Additional availability			Balance II	Total consumption	Extraction/Consumption		Natural availability Inhabitants (m3/inhab/year)
		Re-use	Import.(+) Export.(-)	Total			Natural availability		
	Millions of cubic metres								
North	110	440	-454	-14	96	9 996	0.89	0.62	1 609
	-591	949	-358	591	0	11 608	1.16	0.72	1 288
	-624	1 182	-358	824	0	13 032	1.29	0.80	1 044
Pacific North and Centre	-1 903	4	1 850	1 854	-49	17 677	0.53	0.33	6 595
	-2 298	88	2 210	2 298	0	23 937	0.90	0.44	5 030
	-2 076	221	1 855	2 076	0	30 107	1.36	0.56	3 905
Centre	0	0	0	0	0	14 690	0.91	0.23	1 885
	0	0	0	0	0	21 158	1.22	0.33	1 488
	-333	0	333	333	0	24 559	1.62	0.39	1 206
Gulf and Southeast	0	0	0	0	0	6 514	0.18	0.02	18 717
	0	0	0	0	0	17 175	0.34	0.06	15 359
	333	0	-333	-333	0	36 305	0.96	0.12	12 898
Mexican Republic	-1 793	444	1 396	1 840	47	48 977	0.36	0.12	6 313
	-2 889	1 037	1 852	2 889	0	73 878	0.57	0.17	5 018
	-2 800	1 403	1 497	2 900	0	104 003	1.12	0.24	4 076

Source: Plan Nacional Hidráulico de México, Mexico D.F., 1981.

legislation, the lack of interinstitutional co-ordination, the scant or non-existent public participation, the unequal budgetary allocations, the lack of specialized personnel, etc.

From the technical or engineering standpoint, the solutions for harmonizing water supply and demand are of two types: those which seek to obtain and deliver new sources of water that meet the requirements of quantity, quality, place and time, and those which aim at the more efficient utilization of the water already obtained or the limitation of its use.

In the first case action is taken on the supply, converting the potential water supply into reality. Usually this is achieved through the construction of water works for the retention, storage, regulation, control, channelling, management, treatment, distribution, recycling and/or disposal of the water. This group also includes the techniques for managing the natural sources of water retention: catchment basins, groundwater, areas of mist, management of snow, desalinization and artificial rain.

In the second case, the main objective is to reduce demand by means of: i) greater efficiency in the use of available water, by improving the performance and maintenance of the systems already constructed and developing techniques for a lower consumption per unit of use, along with the prevention of contamination, and ii) a control of the growth of demand in zones of water shortage. In both cases the participation of the user is essential, so that options for the training of users should also be included.

In order to carry out any of the possible alternatives for increasing supply or reducing demand, technical strategies must be combined with those of management. This latter group includes aspects relating to administrative organization, financing, training, the organization of users and, in fact, everything that will facilitate the execution of measures for the utilization, management, control, preservation and conservation of water.

Obviously the harmonization of water supply and demand must also take into account multisectoral uses of the resource, actual and potential, and not only the sectoral. Although this is obvious from a theoretical standpoint, it is usually ignored in practice, particularly owing to the sectoral origin of water projects. It is only taken into account when conflicts arise regarding its utilization and then "emergency" measures have to be taken.

To sum up, in putting forward solutions for harmonization, it is necessary:

a) To provide, in a proportionate and co-ordinated form, alternative solutions both for increasing water supply and for reducing demand.

b) To provide, in a proportionate and co-ordinated manner, solution strategies not only of a technical and engineering type but also those of management or direction.

c) To provide alternative solutions which will be co-ordinated with all the sectors using water, actual and potential, within the territorial area of the planning.

d) To generate options in accordance with the available resources so that they can be put into practice and be politically feasible, in order that they may be effectively taken into account as elements of decision for social and economic development and environmental management.

3. The relation between the national planning of water resources, the planning of basins and the formulation of projects

The planning of water resources is carried out at successive levels of detail. The data that appear in figures 1, 2 and 3 constitute the basis for strategical decisions on the place within the national water system in which policy intervention should be contemplated. The next level assumes practical decisions as to the manner of intervention in the equation of supply and demand, which entails a more detailed approach within the context of zones or river basins, leading to the identification and formulation of alternative projects. This is usually known as the incorporation of the environmental dimension, which is in effect a process of planning and policies and the formulation of projects adjusted to a broad definition of the system of physical resources which are to be administered along with the potential interactions between this system and the socio-economic institutional system within a relatively long temporal horizon.

The most prominent features of the processes of water resource planning within the framework of the integral management of resources are: i) the possibilities of generating alternative uses and preventing undesirable effects; ii) its inevitably unpredictable or uncertain character, particularly in the long term, and hence the need that it should be dynamic and interactive in order to be able to incorporate new data with the passage of time; iii) the need that it should be formulated by interdisciplinary teams in order to have the required depth and power of integration, and iv) the need that in the formulation and execution of the plans a given geographical area should be covered in a given lapse of time. All these characteristics are mutually complementary, so that the incorporation of the environmental dimension in the planning of water resources should be initiated from the moment when a development aim is put forward which requires the harmonization of water supply and demand.

As regards the first point, it must be stressed that the act of "incorporating the environmental dimension" is an exercise which makes it possible to generate a larger number of options for the utilization of the resources in taking possible chain effects into account, and also to avoid or prepare to control or attenuate undesirable consequential effects. This aspect is emphasized because it is usual to assume that the purpose of "incorporating the environmental dimension" is solely to "control the negative effects" and therefore it is usually associated exclusively with costs, without considering that it may potentially generate an equal or greater number of benefits.

In the second place, it should be borne in mind that planning by definition deals with activities for the future and hence is based on predictions with very differing degrees of certainty. Planning for water resource management is no exception to this unavoidable risk, particularly if the aim is not only to programme the execution of initial measures --such as to decide whether or not to build a dam-- but also to undertake this exercise with a prior knowledge of the possible chains or

networks of effects which will materialize in the future as a result of this decision. The exercise is, in consequence, largely an "art of planning the unknown" within very variable ranges of uncertainty, ranges which will only be reduced in so far as an increasingly precise knowledge is acquired of the possible chains or networks of effects of each intermediate action in the short, medium and long term.

The material impossibility of predicting all the probable consequences of a measure which changes the environment makes it necessary, moreover, to maintain a permanent watch or supervision over the places affected in order to take new measures to deal with unexpected changes. This calls for an administrative system with sufficient capacity and flexibility to react to unexpected situations discovered during the supervision if it is desired that this exercise should be useful.

The best way to formulate plans for the management of natural resources --minimizing ranges of uncertainty-- is to work with professional groups of different disciplines and obtain the direct participation of the potential beneficiaries of the plans, as for example in the system adapted from a referential model developed by ILRI 25/ (see figure 4).

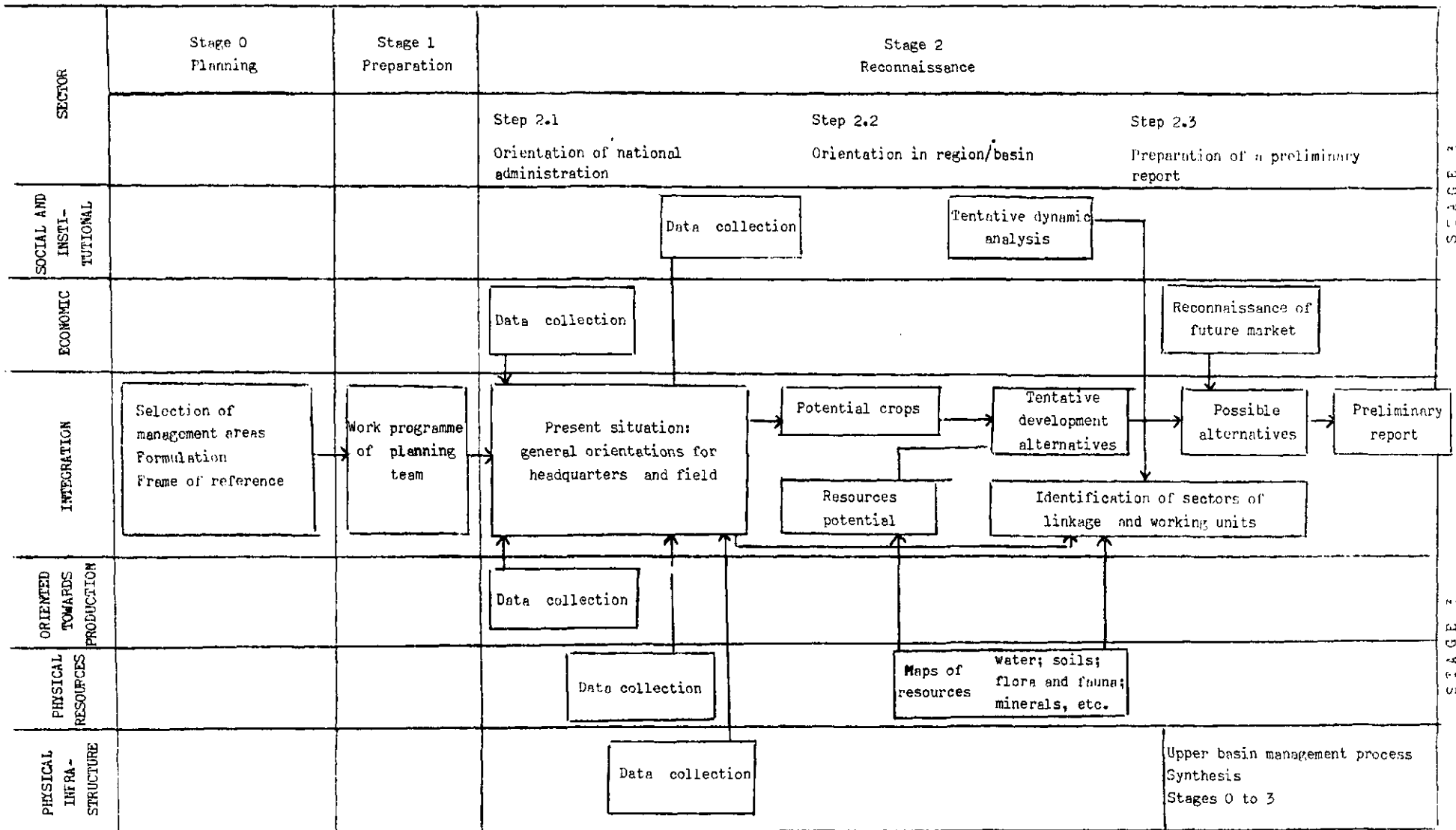
In the final analysis, water resource planning must concern itself with the implementation of policies which involve "software", e.g. pricing and tax, and "hardware", e.g. water regulation and distribution structures. In the development of water resource utilization there are three clear and differentiated stages (see figure 5). In the first stage, studies are made and projects formulated; in the second or intermediate stage, the project is constructed or executed, and in the third stage, permanent or periodic, the water works constructed are put into operation and maintained and the water resources are managed and conserved.

Respecting basin planning, it should be noted that the biophysical features of a river basin form relatively coherent hydroecological system which make them the basic unit for water resource management. For planning to be effective the management plan must be integrated, that is, it must include the co-ordinated and harmonious treatment of all the forms of water use, management and control, such as irrigation, drainage, the production of hydroelectricity, navigation, flood control, erosion control, the management of the flora and fauna of the basin, the domestic and industrial use of water, recreation and the conservation of the environment. It is also essential that it should form part of regional or national development plans.26/ Nevertheless, if the basins are very large, as in the case of the River Amazon or the River Plate, which encompass different political, socioeconomic and cultural frontiers, these areas are inappropriate as units of planning.27/

The units of planning are the same as those described in point 2.

Figure 4

REFERENCE FOR THE FORMULATION OF A MASTER PLAN FOR UPPER BASIN MANAGEMENT



STAGES

STAGES

Figure 4 (continued 1)

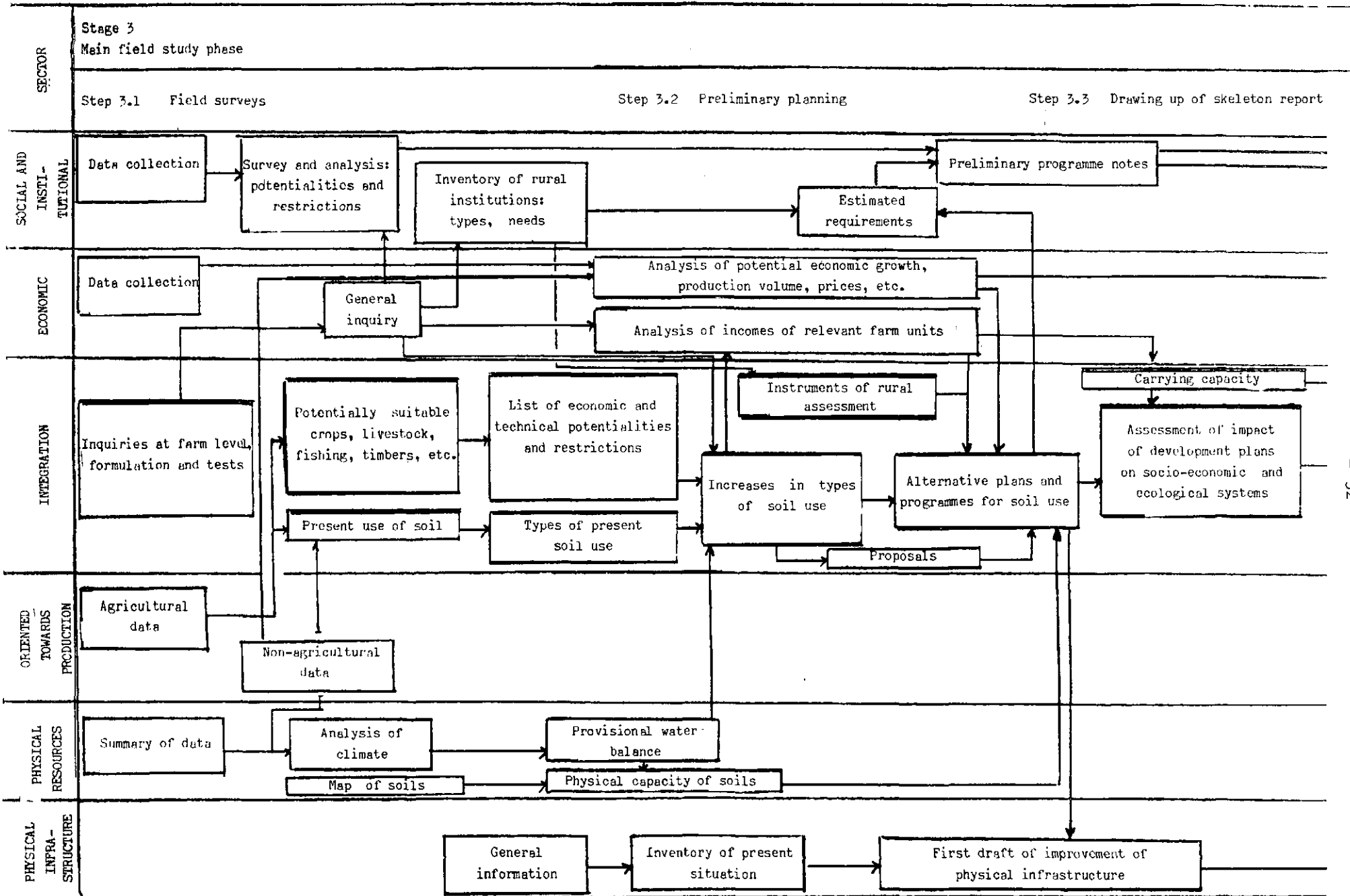


Figure 4 (continued 2)

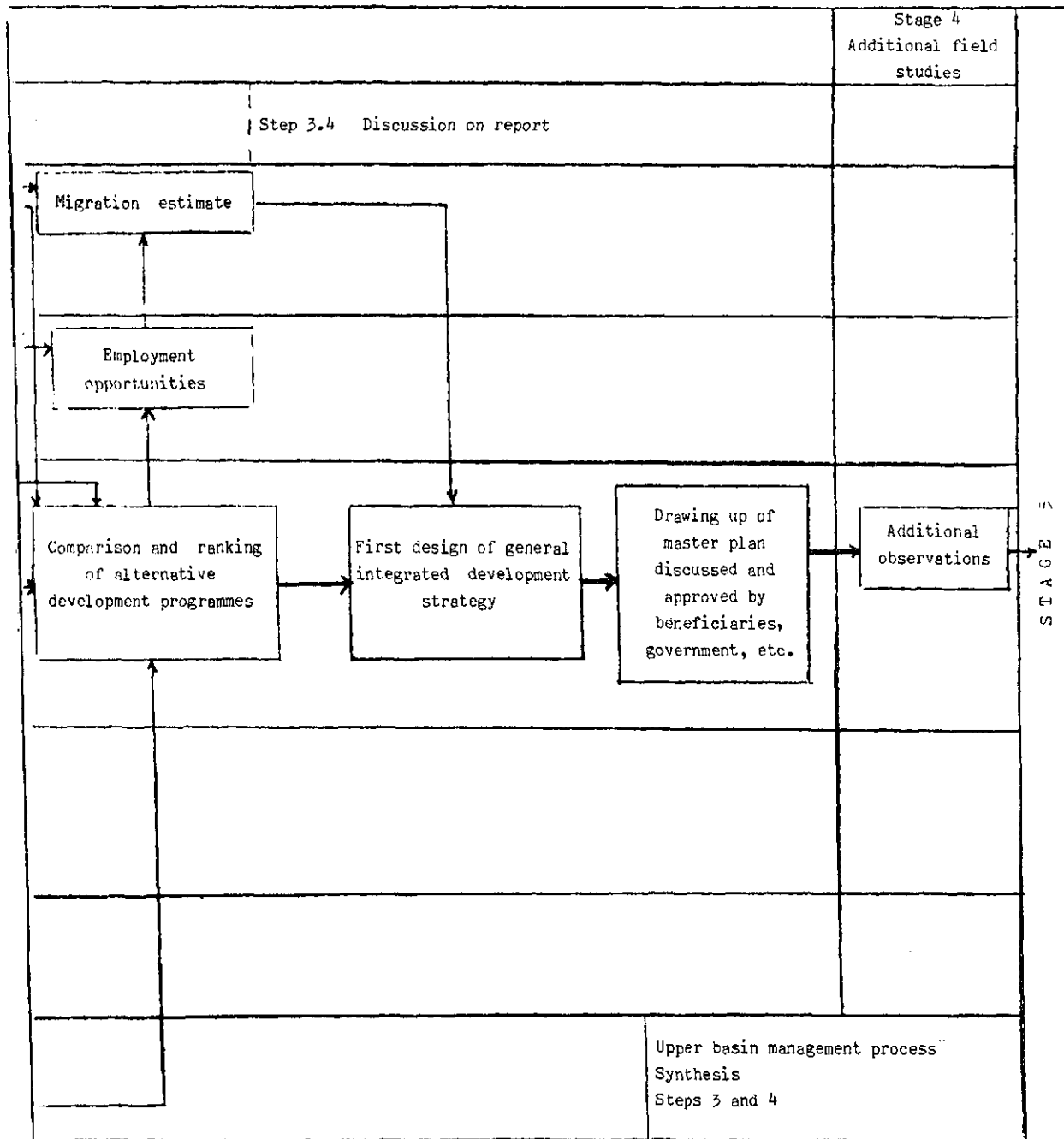


Figure 4 (continued 3)

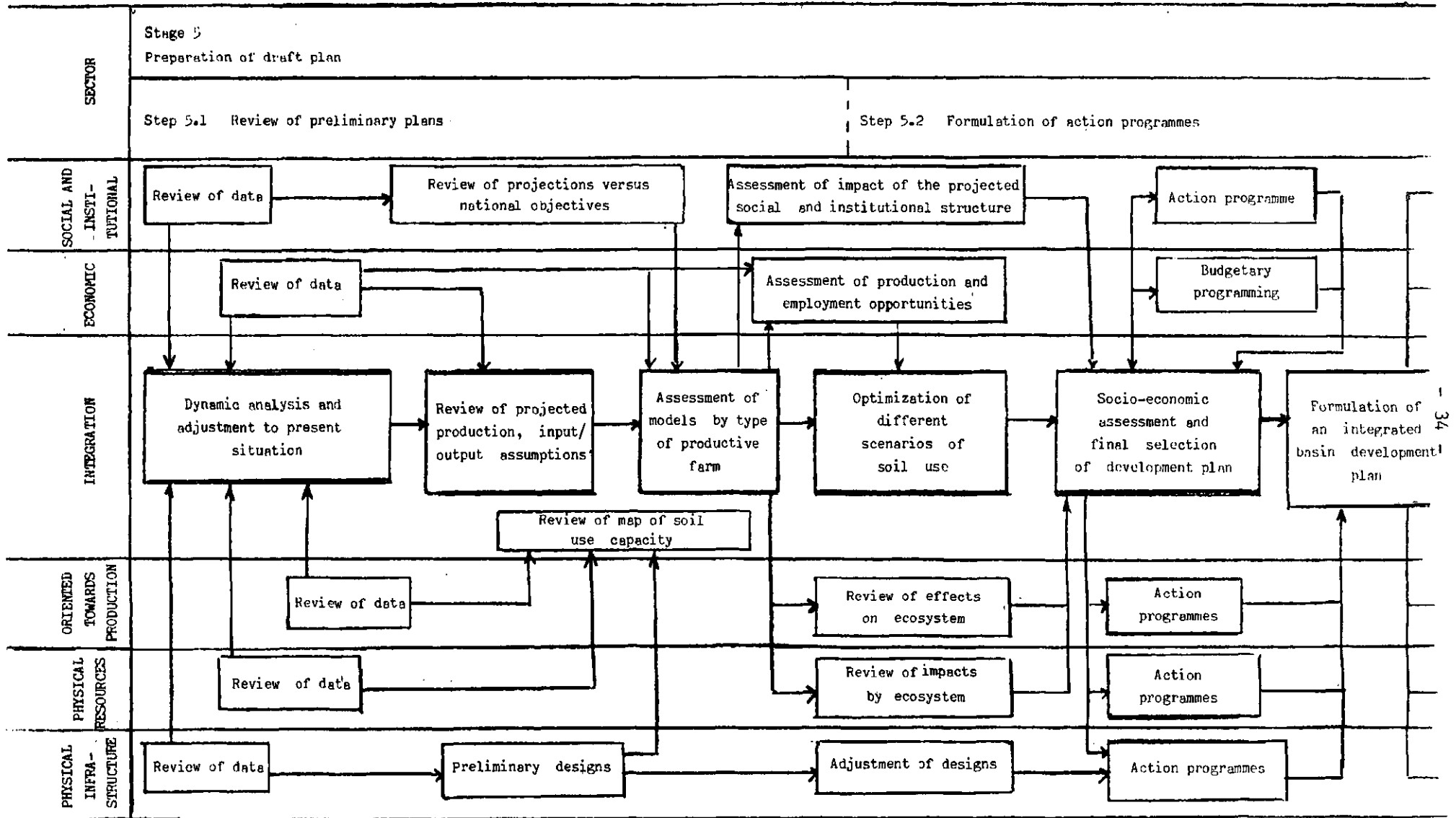
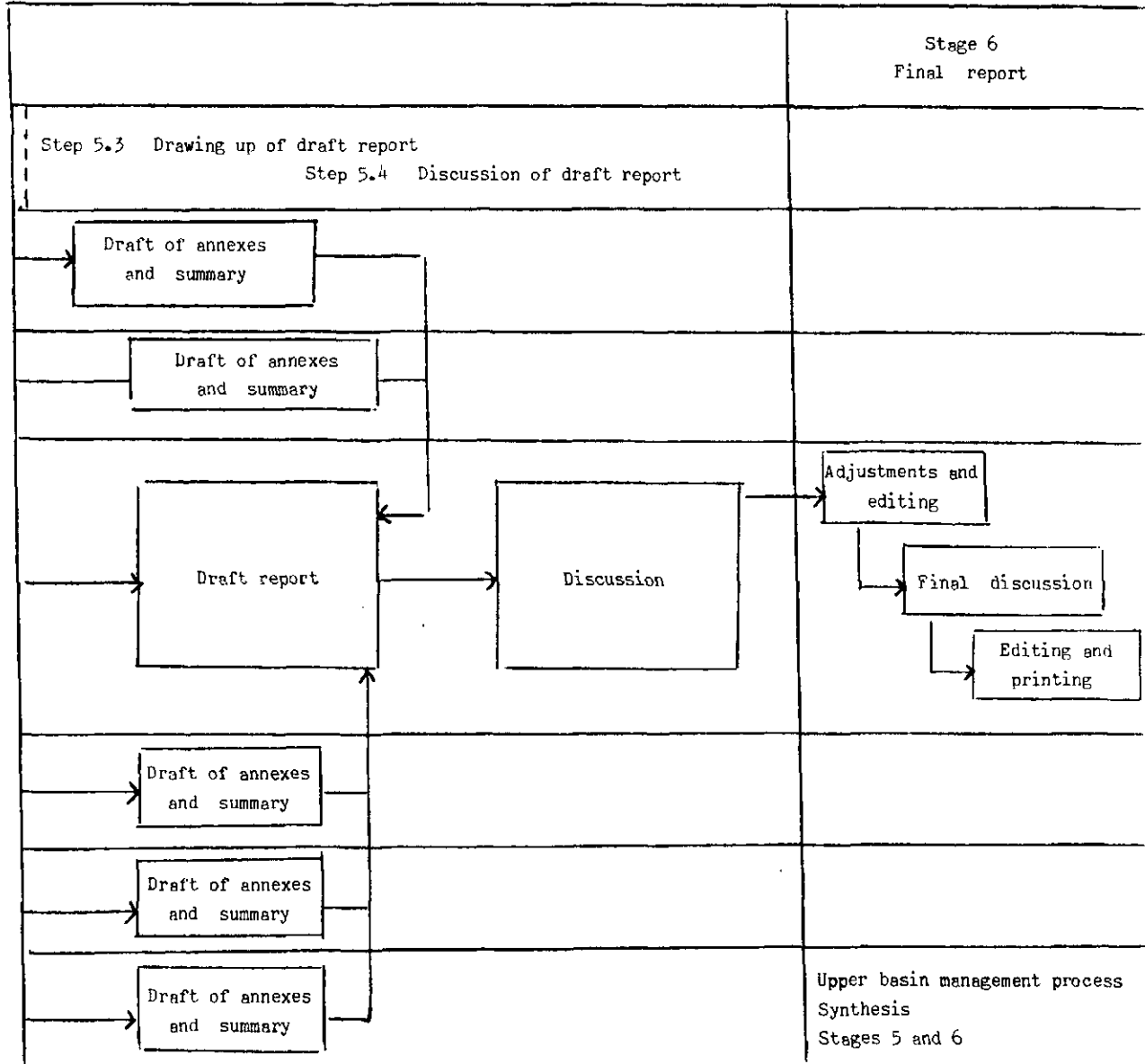


Figure 4 (concluded)



Source: Adapted from Institute for Land Reclamation and Improvement (ILRI), "Framework for regional planning in developing countries", Publication No. 26, Wageningen, The Netherlands.

Figure 5

SEQUENCE OF TECHNICAL ACTIVITIES NEEDED FOR THE DEVELOPMENT AND MANAGEMENT OF A BASIN OR AN AREA WITHIN A BASIN

Order of Activity	GENERIC NAME of activity	MEASURES INCLUDED IN EACH ACTIVITY				RESULT <u>a/</u>
PRELIMINARY ACTIVITIES	Assessment of the basin (first stage)	Inventories	Studies (Semi-detailed and/or detailed reconnaissance)	Assessment of the resources	Diagnosis for their utilization and conservation	Knowledge of present and potential situation
ACTIVITIES	Formulation of projects (second stage)	Determination of objectives and goals	Execution of specific studies	Designs and plans for execution	Economic and financial analysis and preliminary budget	Planning of the future situation
INTER-MEDIATE ACTIVITIES	Execution of projects (third stage)	Construction of camps and auxiliary works	Construction of major and minor infrastructure	Equipment of project	Incorporation and starting up of system constructed	Execution of the projects in the time proposed
PERMANENT ACTIVITIES	Operation and maintenance of structures (fourth stage)	Organization of State and/or enterprise users	Operation of the structural and auxiliary systems	Periodic maintenance of the structures and equipment in operation	Repair of auxiliary structures and equipment	Permanent efficient use of the physical investment
ACTIVITIES	Management and conservation of natural resources (fifth stage)	Regulation of the basin use according to its capacity	Management of water, soil, crops, pastures and woods, fauna, mining, energy, and other resources	Protection of resources against negative effects	Recovery and rehabilitation of zones affected by bad use or natural phenomena	Permanent quality, quantity and frequency of supply of resources of basin or area administered

Source: CIFCA/ILPES/ECLAC, La planificación para el desarrollo, aprovechamiento y manejo de los recursos hídricos, document No. CDA-24, presented to the Course on the Environmental Dimension in Development Planning, held in Santiago, Chile, between 20 October and 28 November 1980.

a/ The overall effect of all the results is the uninterrupted supply of water and production (agricultural, energy-related, etc.) over time.

III. A COMPARATIVE ANALYSIS OF THE NATIONAL PLANS FOR WATER RESOURCE MANAGEMENT

This chapter is based on a series of technical studies conducted in Argentina, Bolivia, Cuba, Colombia, Ecuador, El Salvador, Honduras, Trinidad and Tobago, Haiti, the Dominican Republic, Peru, Paraguay, Mexico and Venezuela, as well as information published on the other countries (see table 13). The planning of multisectoral water use at the national level is carried out with varying degrees of advancement in almost all the countries, although an appreciable number have placed greater emphasis on plans of a sectoral national type, mainly concerned with energy or irrigation or integral plans in some selected river basins.

The countries studied which have the more advanced multisectoral national plans are Mexico,^{28/} Venezuela,^{29/} Peru,^{30/} and El Salvador,^{31/} of which Mexico and El Salvador have recently published their final reports. Next come Ecuador,^{32/} Colombia,^{33/} Honduras,^{34/} Jamaica,^{35/} and the Dominican Republic,^{36/}; the first has already prepared the basic documents for the realization of long-term plans and Honduras has a plan for the medium term.

The purpose of this preliminary comparative assessment of these plans is to identify possible spheres of mutual co-operation among national bodies with a view to improving the planning process and highlighting the chain of decisions involved in the development and management of water resources. Some of the factors regarded as of special importance in the attempt to establish some comparisons between the different national plans for the management of available water resources are the following:

- a) The aims and goals set forth in the plans for water resource utilization and the way in which they are related to objectives of national or regional development.
- b) The relative degree of experience and progress in the formulation and application of plans at national level.
- c) The organization and method used for the formulation of national plans.
- d) The structure and content of the national plans.

1. Aims and goals of the plans

Table 13 sets out the situation regarding the formulation of water management plans by countries of the region. In an initial examination of this table it will be observed that the titles of the plans in Spanish differ appreciably in several terms, which does not necessarily indicate changes in the objectives or in the scope of the plans but certainly implies problems of form. Respecting the aims of the plans indicated in the titles, it will be seen that some employ the terms "desarrollo", "ordenamiento" and "aprovechamiento", while others use none of these terms. Moreover, the terms "aguas", "hidráulico", "recursos hidráulicos" and "recursos hídricos" are used as equivalent terms in practice. It is evidently a question of language rather than meaning.^{37/} It would seem that the most appropriate and least

Table 13

PLANS FOR WATER RESOURCE MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN

Country	Name of plan at national level	Starting year	Publication year version 1	Publication year version 2	Co-ordinating body	Executing bodies	International Advice/ Assistance	Observations
Argentina	No plan	Tentative 1986	-	-	-	-	-	-
Bahamas	No information	-	-	-	-	-	-	-
Barbados	" "	-	-	-	-	-	-	-
Bolivia	No plan	-	-	-	-	-	-	-
Brazil	" "	-	-	-	-	-	-	-
Colombia	Plan Nacional de Aguas	1982	-	-	Departamento Nacional de Planeación	National Consultants	ECLAC	-
Costa Rica	No plan	-	-	-	-	-	-	-
Cuba	Plan de Aprovechamiento Hidráulico	1970	n/i	n/i	-	Instituto de Hidroeconomía	n/i	-
Chile	No plan	-	-	-	-	-	-	-
Ecuador	Plan Nacional Hidráulico	1982	-	-	Instituto Nacional de Rec. Hidráulicos (INERHI) Ministry of Agriculture	INERHI	OAS/Government of Spain	-
El Salvador	Plan Maestro de Desarrollo y Aprovechamiento de los Recursos Hídricos	1979	1983	-	-	Ministry of Agriculture	UNDP/TAHAL	-
Guatemala	No plan	-	-	-	-	-	-	-
Guyana	No information	-	-	-	-	-	-	-
Haiti	No plan	-	-	-	-	-	-	-
Honduras	Plan Nacional de Recursos Hídricos	1979	1979	-	Consejo Superior de Planificación Económica (CONSUPLANE)	CONSUPLANE	-	Only short-term plan (1979-1983)
Jamaica	National Water Resources Development Master Plan	1984	-	-	Water Resources Division	Water Resources Division	UNDP in first phase	Project document
Mexico	Plan Nacional Hidráulico	1972	1975	1981	Comisión del Plan Nacional Hidráulico	Comisión del Plan Nacional Hidráulico	-	-
Nicaragua	No information	-	-	-	-	-	-	-
Panama	No plan	-	-	-	-	-	-	-
Paraguay	No plan	-	-	-	-	-	-	-
Peru	Plan Nacional de Ordenamiento de Recursos Hídricos	1977	-	-	Comisión Multi-sectorial del Plan Nacional de Ordenamiento de los Recursos Hidráulicos	Various State entities	Government of Venezuela and OAS	-
Dominican Republic	No plan	-	-	-	-	-	-	-
Suriname	No plan	-	-	-	-	-	-	-
Trinidad and Tobago	No plan	-	-	-	-	-	-	-
Uruguay	No plan	-	-	-	-	-	-	-
Venezuela	Plan Nacional de Aprovechamiento de Recursos Hídricos	1968	1972	-	Comisión del Plan Nacional del Aprovechamiento de los Recursos Hidráulicos	Working group of State entities	-	-

n/i = No information.

restricted of the phraseologies commonly employed, especially if one takes into account the desired scope of the plans, is the title "Plan Nacional de Ordenamiento de Recursos Hídricos" or "de Aguas".

In the objectives of the plans analysed two types of orientation can be discerned which are not always identifiable or separable.

a) The plans whose objectives are clearly linked with socio-economic development strategies at national, regional or basin level are of an integral and long-term character.

b) The plans whose objectives are mainly concerned with water resources of a sectoral or subsectoral nature are mainly directed to the priority ranking of projects for water resource utilization but they do not clearly establish their link with global development plans and are for the medium term.

The definition of the plans and their objectives reflects to some extent the scope attributed to them in each country. The apparently more integral definitions and objectives include the following:

"To establish a rational, equitable and effective utilization of water, in terms of the requirements of the different uses: social (urban, tourist, recreational, etc.), economic (agricultural, industrial, mining, etc.), and natural (flora and fauna) in the country, in accordance with priorities, overcoming the factors which restrict its availability (scarcity, excess, poor quality, etc.) and ensuring ecological equilibrium; all of which calls for a profound knowledge of its spatial and temporal availability".38/

"The national plan for the utilization of water resources is a frame of reference made up of a set of strategies and directives which, within the general policy of development and an adequate legal and institutional management, ensures the rational administration of the resource and therefore establishes a logical and reasonable distribution between the supplies of water and the probable demands ... the plan is conceived as a process which seeks to define and specify the decisions concerning the resource in order to maintain a quantitative and qualitative balance between demand and availability, so as to prevent the conversion of water into a limiting factor in the economic and social development of the country ...". The objective of the said plan is summarized as "... the maintenance of a dynamic balance between supplies and the different demands which may need to be met in the development of the country".39/

Other definitions and objectives point in general to the same aspects, such as:

"The general objective of the national water plan is to enable the country to complete or develop the instruments for a coherent, technical and forward-looking planning of the water resource in order to a) meet future demands in respect of supply and quality of water for human consumption, b) ensure the flows and qualities needed for the generation of hydroelectricity, navigation, aquaculture, irrigation, recreation and the sustained improvement of ecosystemic productivity, c) ensure defence against the destructive action of water and protect water and soil from human action when this is detrimental to these resources".40/

The following are also indicated as immediate objectives of a plan: "to increase the knowledge of the country's water resources and their potential, to promote the rational utilization of these resources in order to ensure the water balance, to strengthen institutional aspects and co-ordination in respect of water administration and to train personnel".41/

Some plans indicate as objectives a set of measures designed to achieve water management integrated with land and forestry resources, to promote a better utilization and preservation of water in each of the user sectors, improve water management, improve the participation of the different sectors of the population in the efficient use of the resource, and intensify research and training in order to deal with aspects of the operation and maintenance of hydraulic works and the handling and conservation of the resources through an adequate organization and training of the users and those who are responsible for assisting them.42/

In sum, the intentions set forth in the different plans analysed can be listed as follows:

a) To maintain a dynamic equilibrium between supplies and the different demands for water implicit in the development of the country (water policy).

b) To conserve the ecological balance; to preserve, protect, conserve, and manage the resources efficiently; to make rational use of water, etc. (environmental aspects).

c) To ensure defence against the destructive action of water, to be protected against damaging effects, to control the discharge of water (an aspect relating to the control of natural problems or catastrophes).

d) To improve the management of water and basins; to achieve water management integrated with the resources of land and forests; to organize the users, train them, improve interinstitutional relations in respect of water administration with clear reference to the operation and maintenance of hydraulic works and the management and conservation of water and related resources (efficiency in the use of water and water systems).

e) To increase knowledge of the availability of water resources in the country and of their potential, to undertake research and other aspects associated with the systematic assessment of the water supply.

f) To determine priorities of investment in projects and activities to harmonize water supply and demand. In general, to give priority mainly to investment projects aimed at increasing the water supply.

Generally speaking, all the plans mention directly or indirectly the first point indicated above. The other aspects are not common to all the plans. For example, only three are categoric in emphasizing the need to improve and stimulate the operational phase of the water systems in order to achieve good water management with user participation.

2. The relative degree of experience in the formulation of plans

In all the countries of Latin America and the Caribbean there is some degree of experience in planning for the management of water or water resources, especially at the sectoral levels of health, agriculture and hydroenergy, on the basis of river basins. This has apparently enabled many governments of the region to execute or initiate the formulation of plans for the management of water resources both multisectoral in character and of national coverage.

Mexico is the country that has gone furthest in this activity, which must be attributed to the special needs of a country with extensive arid zones.^{43/} Cuba also has a plan which was initiated in 1970.^{40/} Then there are Venezuela, Peru and El Salvador to be considered. This last country has just published the final reports of its planning initiated in 1979. With regard to other countries, the majority have in fact embarked upon the formulation of their plans in a more recent period which includes the last five years; these include Colombia, Ecuador and Honduras, and there are several more which have at least preliminary studies at their command, such as Jamaica ^{45/} and the Dominican Republic.

At present Argentina and Brazil have no multisectoral plans of a national type. Both countries, however, have wide experience on the subject, especially as regards large river basins and at sectoral levels, particularly in respect of drinking water, energy and (more recently) irrigation problems. Chile has not programmed the formulation of a multisectoral national plan but it is known to possess considerable information and experience in sectoral and basin planning. Similarly, but on different grounds, Uruguay has indicated that its long-term water requirements had already been covered, especially in the energy field, and that its present supply of water made it unnecessary to formulate a plan of this kind.

In Bolivia and Paraguay the user sectors are interested in having a national water plan, but various factors have so far prevented a start being made on its formulation and execution. In Panama, Costa Rica, Guatemala and Nicaragua there are proposals for formulating a long-term plan but for diverse reasons they have not yet materialized.

3. The organization and methods used for the formulation of plans

The plans have usually been initiated in some institution associated with the water sector of the central planning sector. In Peru, for example, it began in the General Water Department (Dirección General de Aguas) of the agricultural sector and was then transferred to the National Planning Institute. In Mexico it was concentrated in the Secretariat for Water Resources. In Ecuador it is prepared through the Ecuadorian Institute for Water Resources (Instituto Ecuatoriano de Recursos Hidráulicos - INERHI). In El Salvador it was initiated in the agricultural and livestock sector and in 1981 a specialized office for water resources was set up in the Ministry of Planning.

Once the initiative has been taken multisectoral commissions are usually set up with one or another of the agency heads as chairman. These commissions are constituted at two levels: at a decision-making level, integrated by representatives of various sectors, and at a technical level, formed in many cases by personnel who have been specially hired for certain tasks. Examples of this are the commissions of Venezuela (see table 14), Peru (see table 15) and Mexico (see table 16). The direction of these commissions is distributed in the region among:

a) National planning institutes or their equivalents (Peru, Colombia, Honduras and El Salvador).

b) Secretariats, ministries or institutes for natural resources or the environment (Venezuela).

c) Secretariats or ministries of agriculture or energy or other sectors closely concerned with the field of water (in several countries the agricultural sector is responsible for natural resources).

d) Secretariats or national institutes for water resources or their equivalents (as in the case of Cuba, Ecuador and Mexico, although in this last case the Secretariat of Water Resources was subsequently associated with the Ministry of Agriculture).

The method of carrying out the plan differs from country to country in the region. In some cases the work is entirely carried out by State or semi-State agencies through a distribution of tasks. This is the case, for example, in Ecuador (see table 17), Peru (see table 18) and Mexico (see table 19), among others. In other cases the work is conducted partly by the State and partly by one or more consultant firms, as in El Salvador. Lastly, in Colombia the work was assigned almost exclusively to a consultant firm (see table 20), with the support of the national institutions. In other cases working groups are organized according to tasks as in the case of the Dominican Republic (see table 21).

Plans have usually been carried out in successive stages or phases, as in Ecuador (see table 17), El Salvador (see table 22) and Colombia (see table 23).

In practice the formulation of all the plans analysed has received some form of external assistance. Peru received assistance from the OAS, the Government of Venezuela, ECLAC and ILPES (for its prospective model). Ecuador received assistance from the Government of Spain, UNDP and ECLAC, Colombia from ECLAC, while the Dominican Republic was supported by the IICA through the mediation of the Consultant Warren Hall of Colorado State University. El Salvador received assistance from the UNDP and the consultant firm of TAHAL, while Mexico was aided by the UNDP and the World Bank and Jamaica by the UNDP.

Table 14

VENEZUELA: COMMISSION ON THE NATIONAL WATER
RESOURCE DEVELOPMENT PLAN

A. Composition

- Ministry of Public Works: Director of Public Works (Chairman)
- Ministry of Health and Social Assistance, Department of Malariology and Sanitation
- Ministry of Agriculture and Livestock: Director of Planning
- Ministry of Defence: Representative
- Ministry of Public Works: Representative
- Ministry of Agriculture and Livestock: Representative
- Ministry of Mines and Hydrocarbons: Representative
- Central Office of Co-ordination and Planning of the Presidency of the Republic: Representative
- National Institute of Sanitation Works: Representative
- Venezuelan Development Corporation: Representative
- C.A. de Administración y Fomento Eléctrico: Representative
- Private Sector: Representatives (4)

B. Organization

- Executive Office (Executive Secretary)
(Assistant Executive Secretary)
- Chief adviser

C. Working Groups

- Drinking water supply
- Agriculture and livestock
- Development of water resources
- Economy
- National inventory of land
- Legal studies

D. Advisory Committee

- Drinking water supply and waste water disposal
- Agriculture and livestock
- Development of water resources
- Ground water
- Economy
- Water legislation
- Soils

Source: COPLANARH, Plan nacional de aprovechamiento de los recursos hidráulicos, Caracas, 1972.

Table 15

PERU: MULTISECTORAL COMMISSION ON THE NATIONAL WATER
RESOURCE MANAGEMENT PLAN

1. National Planning Institute (Instituto Nacional de Planificación (INP)).a/
2. National Office for Natural Resources Evaluation (Oficina Nacional de Evaluación de Recursos Naturales (ONERN)).b/
3. Water and Land Department (Dirección General de Aguas y Suelos (D.G.A.S.)) of the Ministry of Agriculture (M.A.).
4. Irrigation Department (Dirección General de Irrigaciones) of the M.A.
5. Production Department (Dirección General de Producción) of the M.A.
6. Sanitary Engineering Department (Dirección General de Ingeniería Sanitaria) of the Ministry of Housing.
7. Tourism Department (Dirección General de Turismo), Ministry of Industry, Tourism and Integration.
8. Electricity Department (Dirección General de Electricidad), Ministry of Energy and Mines (M.E.M.).
9. Department of Mines (Dirección General de Minas) of the M.E.M.
10. Department of Health Programmes (Dirección General de Programas de Salud), Ministry of Health.
11. Fisheries Department (Dirección de Pesquería), Ministry of Fisheries.
12. National Meteorology and Hydrology Service (Servicio Nacional de Meteorología e Hidrología (SENAMHI)).

Source: COMPLANORH.

a/ Chairman of COMPLANORH.

b/ Executive Secretary of COMPLANORH.

Table 16

MEXICO: COMPOSITION OF THE COMMISSION FOR THE
NATIONAL WATER PLAN

Chairman
Vice-Chairman
Executive Member
Secretarial Member
Director General of National Planning
Director General of Regional Planning
Co-ordinator General of PRODERITH <u>a/</u>
Director General of Administration
Director of Communication Centre
Director of Information Centre
Director of Economic Analyses
Director of Plan Formulation and Verification
Director of Inventories of Water and Soil
Director of Training
Director of the Pacific Zone North and Centre
Director of the North Zone
Director of the Centre Zone
Director of the Gulf and Southeast Zone
Director of Finance
Director of Administrative Services
Co-ordinator of Studies of PRODERITH
Co-ordinator of Research and Extension of PRODERITH

Source: Comisión Nacional del Plan Hidráulico, op. cit.

a/ Programa de Desarrollo Rural Integrado del Trópico Húmedo. (Integrated Rural Development Programme for the Humid Tropics.)

Table 17

ACTIVITIES FOR THE DEVELOPMENT OF THE PLAN FOR THE
RATIONALIZATION OF WATER RESOURCES OF ECUADOR

Stage	Activity	Duration (Months)	Interinstitutional participation
Preliminary	National Water Planning	31.0	
	Preliminary	3.5	
First	Conditions	1.5	Co-ordination Commission
	Organizational structure	1.5	Co-ordination Commission
	General programming	1.5	Co-ordination Commission
	Preliminary hydrographic regionalization	1.5	Co-ordination Commission
	Norms and methodologies	2.5	Co-ordination Commission
	Report	1.0	INERHI
	Formulation	19.5	
	Socioeconomic frame of reference	7.0	
	Demographic indicators	5.0	CONADE
	Indicators of agricultural sector	4.0	CONADE MAG, PRONAREG
	Indicators of energy-industrial sector	4.0	CONADE, INECEL, INE
	Macro-economic indicators	4.0	CONADE
	Presentation of report	2.0	CONADE
	Diagnosis of development of water resources	8.0	
	National, sectoral and regional planning	3.5	CONADE, Regional entities
	Drinking water-sewerage subsector	6.0	IEOS
	Hydroagricultural subsector	6.0	INERHI
	Hydroelectric subsector	6.0	INECEL
	State of basic information	6.0	INAMHI, INERHI, INECEL, IEOS
	Knowledge of water resources	6.0	CLIRSEN, PRONAREG
	Juridico-institutional aspects	3.0	Co-ordination Commission
	Synthesis and priorities. Report	2.0	Co-ordination Commission
	Directive framework for national water development	9.5	INERHI
	Indicators for the water sector	3.5	CONADE, INERHI, IEOS, INECEL
	Regional orientation	3.0	INERHI, IEOS, INECEL
	Norms for regional planning	3.0	INERHI
	Report	2.0	INERHI
	Programme of immediate measures	4.0	CONADE, INERHI, INECEL, IEOS
			INAMHI
	Report on the first stage	2.0	INERHI

Stage	Activity	Duration (Months)	Interinstitutional participation
Second	Execution	3.5	
Third	Details of the terms of reference Estimate of resources	1.0	INERHI, INECEL, IEOS, INAMHI and others
	Achievement of interinstitutional participation: inclusion in operational plans and budgets	1.5	Co-ordination Commission
	Putting into operation	1.0	Several entities
	Evaluation and control	3.5	
	Selection of aspects for evaluation	1.5	Co-ordination Commission
	Evaluation and control procedures	2.0	Co-ordination Commission
	Regional water planning	48.0	Regional Co-ordination Commission

Source: Instituto Ecuatoriano de Recursos Hidráulicos (INERHI), "Plan de racionalización de los recursos hidráulicos", Términos de Referencia, Documento Preliminar, Quito, Ecuador, 1983.

Table 18

PERU: NATIONAL PLAN FOR WATER RESOURCE MANAGEMENT: ASSIGNMENT OF RESPONSIBILITIES
AND PERCENTAGES OF THE INVESTMENT ALLOCATED

Description of activity	Responsible agency	Percentage of investment allocated
Preliminary tasks	Executive Secretariat	0.8
Water regionalization	Executive Secretariat	1.4
Prospective model	National Planning Institute	4.8
Diagnosis of problems created by engineering works	National Office of Assessment of Natural Resources	2.0
National inventory of physical possibilities of development	Ministry of Agriculture - Water Department	3.8
Diagnosis of erosion problems	National Office of Assessment of Natural Resources	3.6
National inventory and assessment of groundwater	Ministry of Agriculture - Water Department	4.1
Diagnosis of drought problems	National Service of Meteorology and Hydrology	9.8
Water committed for ecological aspects	National Office of Assessment of Natural Resources	1.4
Water demand for energy generation	Ministry of Energy and Mines - Electricity Department	3.3
Water demand for public use	Ministry of Housing and Construction - Department of Sanitation Works	4.7
Water demand for agricultural use	Ministry of Agriculture - Water Department	11.0
Water demand for fishery use	Ministry of Fisheries - Extraction Department	9.1
Water demand for tourism and recreation	Ministry of Industry and Tourism - Tourism Department	2.5
Determination of volumes usable	Executive Secretariat	1.7
Total demands	Executive Secretariat	1.5
First draft report	Executive Secretariat	0.5
Balance between demand and availabilities	Executive Secretariat	1.7
Strategies of the Plan	Executive Secretariat	0.6
Final report	Executive Secretariat	0.5
Printing	Executive Secretariat	1.2
General total		100.0

Source: COMPLANORH, *op. cit.*, p. IV-6.

Table 19

MEXICO: STRUCTURE OF THE ORGANIZATION FOR EXECUTING THE PLAN

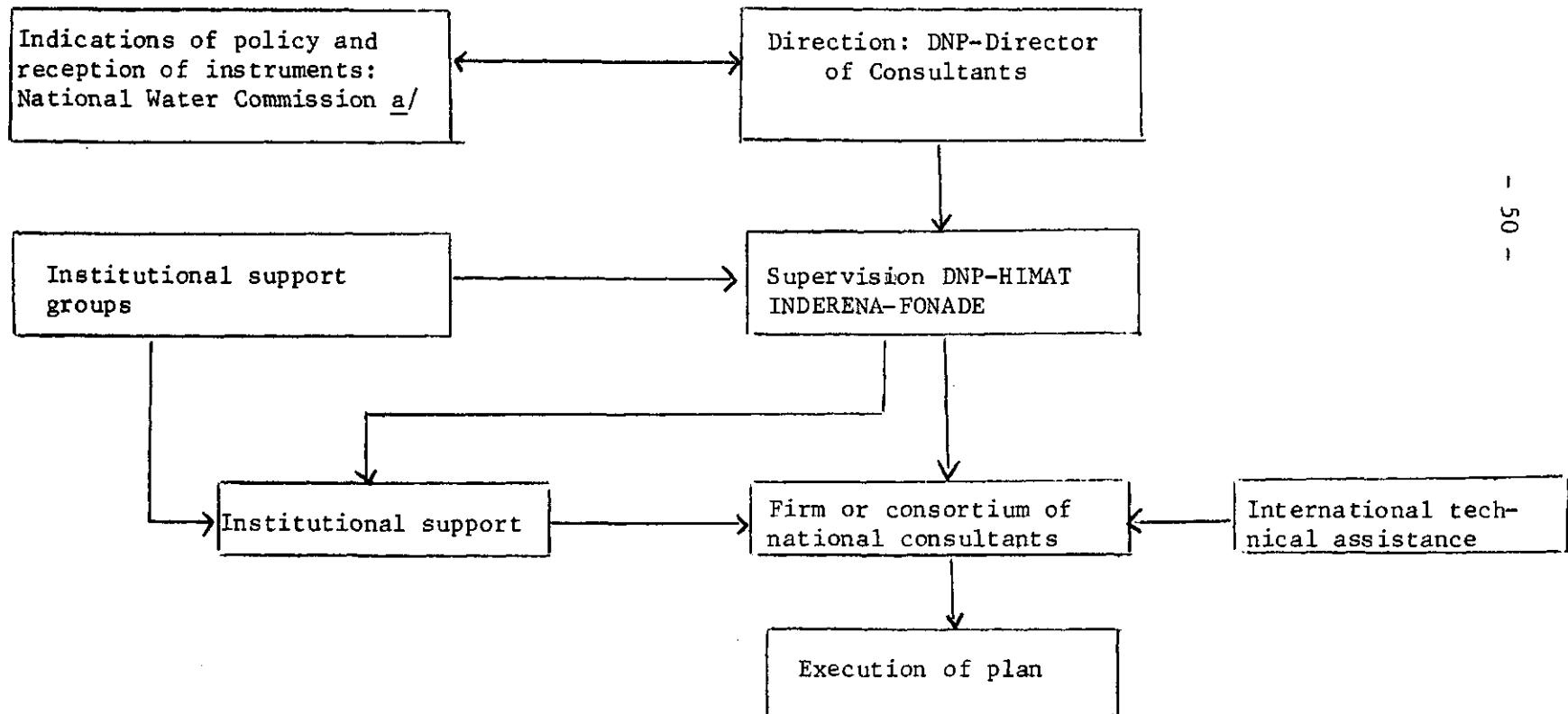
Agency	Composition	Functions
Executive Secretariat	<p>Directors of government agencies and offices concerned with water such as:</p> <ul style="list-style-type: none"> - agriculture - fisheries - human settlements - health - public works - industry - energy - programming/budget 	<p>To prepare the general outlines of the plan in accordance with national priorities and regional development needs</p>
<p>Advisory Group. Small group at the highest technical level</p>	<p>Professional specialists of recognized repute. (International advisers may be included.)</p>	<p>To advise the technical group on the preparation of work programmes and on the formulation of plans. To set up a line of communication with the Executive Secretariat</p>
Co-ordination Committee	<p>Representatives of public offices and of user systems; political representatives</p>	<p>To exchange information on policies, programmes, and projects of the different agencies using or managing water. To set up linkages between regional and sectoral plans. To identify points of agreement and conflict and propose solutions</p>
Technical Group	<p>Professionals of different disciplines</p>	<p>To formulate plans and programmes</p>
Information unit	<p>Interdisciplinary and balanced: between different fields and between experienced persons and others with new ideas</p>	<ul style="list-style-type: none"> - To collect and compile information for processing, developing and adapting analytical instruments - To disseminate results - To promote campaigns of public communication and information - To promote the best use of water

Source: Comisión Nacional del Plan Nacional Hidráulico, Plan Nacional Hidráulico 1981, México, D.F., March 1981.

Table 20

COLOMBIA - NATIONAL WATER PLAN

Diagram of administration

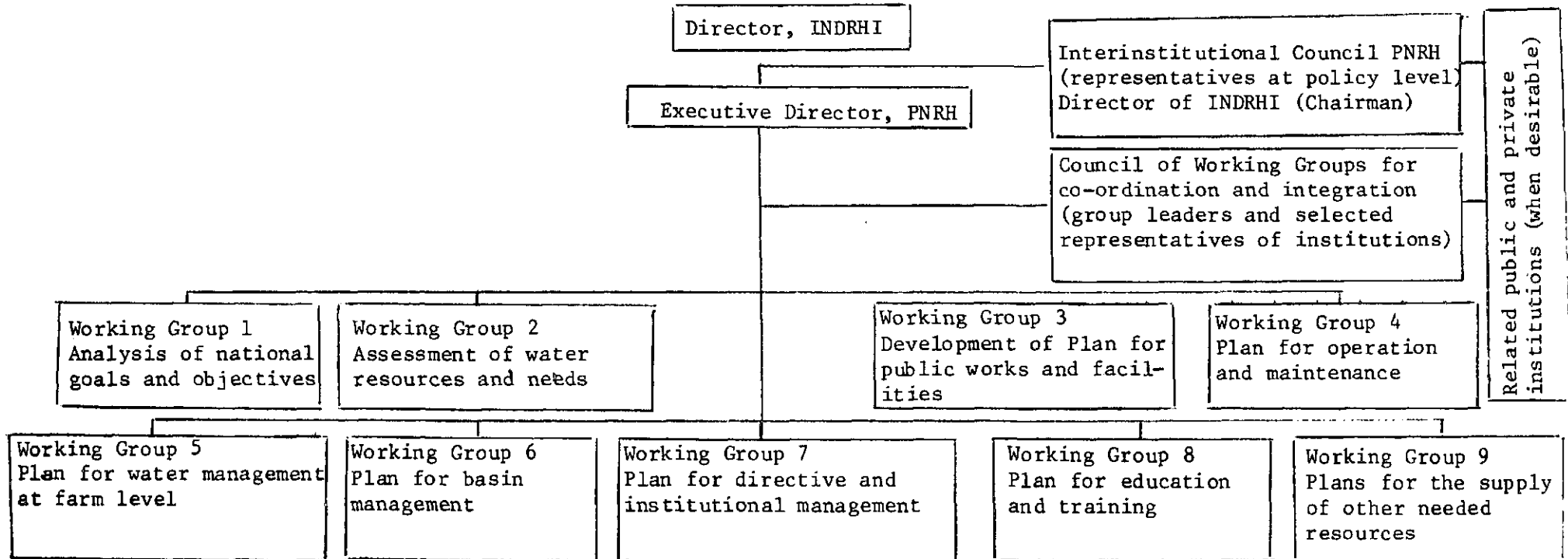


Source: Departamento Nacional de Planeación (DNP), op. cit., p. IV-3.

a/ The National Water Commission is composed of the following agencies: a) National Planning Department; b) Ministry of Agriculture; c) Ministry of Health; d) Ministry of National Defence; e) Ministry of Mines and Energy; f) Ministry of Public Works and Transport; Chairmanship: National Planning Department; Technical Secretariat: INDERENA.

Table 21

STRUCTURE OF ORGANIZATION AND DISTRIBUTION OF WORK OF THE NATIONAL PLAN FOR WATER RESOURCES OF THE DOMINICAN REPUBLIC (PROPOSAL)



Source: Instituto de Cooperación para la Agricultura/Instituto Nacional de Recursos Hídricos, "Lineamientos para un Plan Nacional de Recursos Hidráulicos y Recursos Naturales Relacionados, para la República Dominicana". Document prepared by Warren Hall, Santo Domingo, Dominican Republic, March 1981.

Table 22

PHASES OF THE STUDY OF THE MASTER PLAN FOR THE DEVELOPMENT AND
UTILIZATION OF THE WATER RESOURCES OF EL SALVADOR

A. PREPARATORY STAGE

Collection of existing information on the subject of hydrology, hydrometeorology, hydrogeology, hydroelectric installations, irrigation systems, urban and rural water supply, industrial water supply, actual and potential use of the soil, etc.

B. EXECUTION STAGE

Creation of a directive water agency, preparation of draft project of water law, updating and complementation of information, study on water quality by sub-basins and lakes (physico-chemical analysis, biological and bacteriological analysis, sedimentation, etc.); survey on the annual water demand, by sectors; strengthening of the data bank; recommendations for the control of water quality and recycling of treated waste water; recommendations for the control of flooding in the main basins; conditions of subcontracting.

C. FINAL STAGE

a) Preparation of the master plan for the integral utilization of water resources (subcontract); b) identification and assessment of financing projects and plans; c) operation of the data bank; d) follow-up of the recommendations of the master plan. (As it happened, the project did not wait for the termination of the plan to put into immediate application those recommendations which were pressing.)

Source: United Nations, Plan maestro de desarrollo y aprovechamiento de los recursos hídricos de El Salvador, Conclusiones y recomendaciones, DP/UN/ES-78-005/1, New York, 1983.

Table 23

PHASES OF THE STUDY OF THE NATIONAL WATER PLAN - COLOMBIA

FIRST PHASE: (nine months)

- a) physical studies: existing balances of demand and availability taking into account quality and quantity and methods for their projections;
- b) diagnosis of unsolved problems and lost opportunities;
- c) diagnosis of institutional difficulties;
- d) design of information system;
- e) detailed design of methods and models based on water balances.

SECOND PHASE: (twelve months)

- a) projections of demands and availabilities. Future balances;
- b) analysis of opportunities and problems for the future; special study of critical zones;
- c) development and implementation of the information system;
- d) formulation and development of institutional policies, norms and recommendations for the plan;
- e) development of specific and sectoral procedures based on the policies. Institutional integration of the solutions;
- f) design of the application of the plan. First results and recommendations on investments;
- g) final reports.

Source: Departamento Nacional de Planeación (DNP), Plan nacional de aguas: Términos de referencia, Bogotá, January 1982.

4. The structure and content of the plans

The comparative analysis of the management plans available reveals a general structure incorporating the elements considered in chapter II. To begin with there is the development of a logical sequence in the definition of objectives, the geographical area involved, and the restrictions and options in respect of action. For example, the "Master Plan for the Development and Utilization of Water Resources in El Salvador" mentions as inevitable tasks in the development of the plan the study of the available resources, the analysis of foreseeable needs, the study of solutions to meet these needs on the basis of the aforesaid resources and, in relation to all the foregoing, the adaptation of the legal and institutional infrastructure to permit the implantation and operation of these solutions in the long term. The "National Plan for Water Resource Management" of Peru ^{46/} is more explicit in setting out the following tasks for the execution of the project: a) the preparation of a prospective model which takes the form of a classification of the objectives of the plan through the projection of a future scenario desirable within the economic and social structure as a whole and determined by the policy lines put forward for the country in accordance with the prospects of achieving them; b) the regionalization of water, which comes to be the clarification and delimitation of geo-socioeconomic spheres, generally a basin or a group of river basins; c) the determination of demand by water-related regions and water-using sectors; d) the determination of the potential (supply) of water as a resource; e) the balance between demand and availability; f) specific studies mainly concerned with environment and protection, and g) the formulation of strategies and definition of a national water policy establishing principles and norms and proposing programmes for the utilization, conservation, protection and improvement of water resources.

Absolutely all the countries that have formulated national plans for water resource management, both multisectoral and sectoral, have subdivided the country into regions which have usually been described as hydraulic or hydrographic. In every case, moreover, river basins have been regarded as a starting point for this regionalization and then an attempt has been made to harmonize their natural or physical boundaries with those of a politico-administrative type.

The Peruvian plan has taken as its spatial sphere for water planning the river basins, designated "hydrographic analysis units". The interconnected water systems of one or more basins constitute the "operational areas" and one or more "operational areas" constitute a "hydraulic" (i.e., water related) region.

Following a similar criterion and also taking the hydrological basin as a basic planning unit, Mexico's water plan divided the country into 14 regions (see figure 6), each of which comprises the basin of a large river or several homogenous basins of secondary importance. The regions were divided in their turn into 104 subregions with a view to seeking similar areas from a socio-economic standpoint, which might be regarded as minimum modules of analysis. In the division into subregions political and municipal boundaries were taken into account. The regions were also grouped into four zones: Pacific North and Centre, North, Centre, and Gulf and Southeast. To carry out the aforesaid regionalization --as explained in the Venezuelan plan, which was one of the first to be implemented-- several criteria were used, the main one being the hydrographic basin and the operation of water systems, but also including environmental, demographic, economic, social and political criteria.

The progress made in the formulation of plans by a number of countries has already enabled them to place more emphasis on the development of policies and strategies. This can be seen in the Mexican report which, in comparison with other plans whose execution is not so far advanced, recommends concrete measures both in the field of general water management and in respect of specific projects, as part of the strategies derived from the diagnosis. By way of example, figures 6 and 7 give the conceptual schemes developed respectively by Peru and Ecuador. These, as can be seen, reflect a similar structure with different degrees of detail.

The theory underlines the importance of establishing ample time horizons and achieving an institutional co-ordination in the execution of plans, as well as achieving a relationship between plans, resource allocation and water management. In practice it has been found that the best strategy is for the national water management plans to include short-term goals among their objectives and not to limit themselves to medium- and long-term planning. This encourages the governments, which normally have a term of five years, to take more interest in supporting their execution. Generally speaking few plans regard it as beneficial to assess and quantify institutional problems in due depth; their authors frequently confine themselves to the study of physical aspects, which subsequently reduces the possibility of carrying out the plans.

With regard to the linkages of the plans with financial and technical resource allocation and possibly with the management of water and related resources, the plans are generally centered on capital investment policies, at the expense of operational and maintenance policies, etc., which may change the patterns or improve the effectiveness of water use.

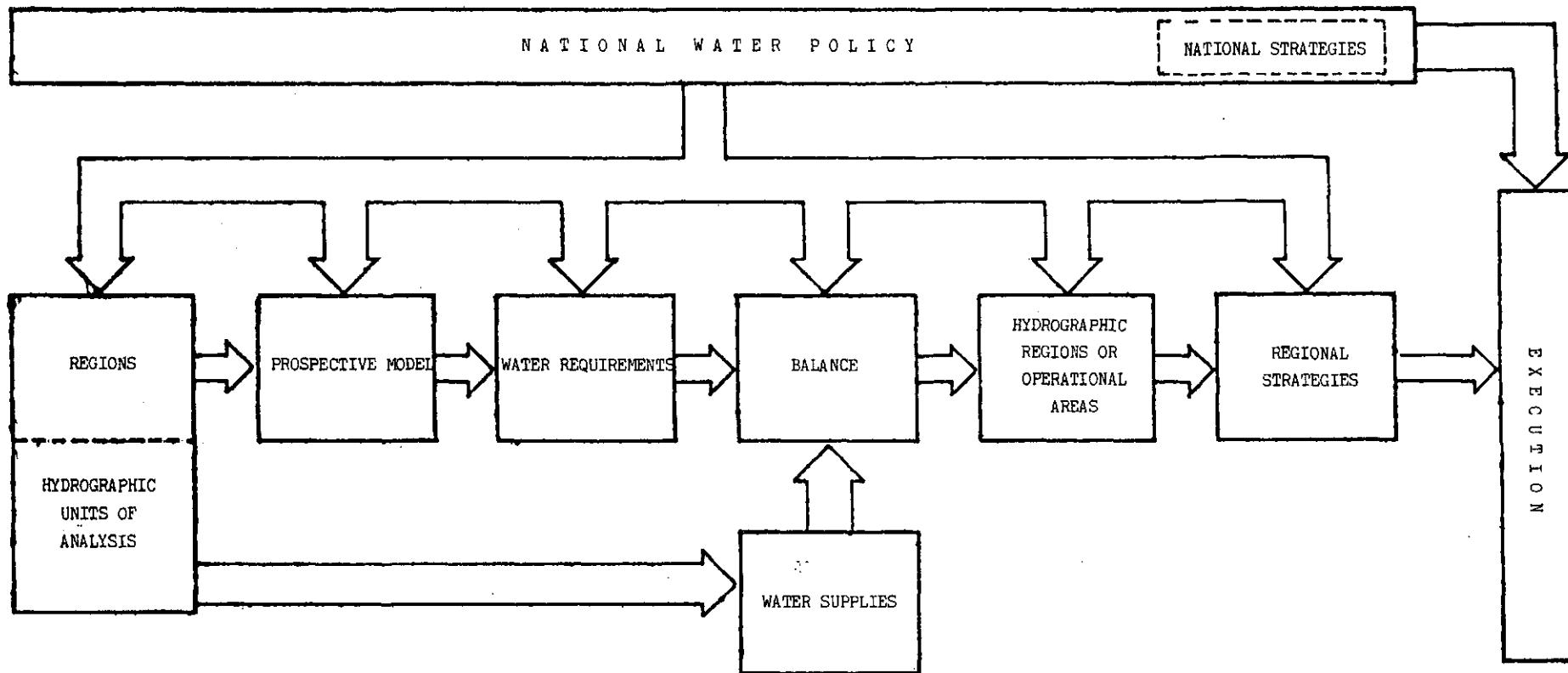
To illustrate this point, in a study made in Peru,^{47/} already outlined in chapter II, it was pointed out, for example, that in 1979 that country allocated 82% of its total investments in the agriculture and food sector exclusively to the development, use and conservation of water and soil. Nevertheless, out of this proportion, which indicates the very high priority given by the Peruvian government to this subsector, the State assigned only 0.9% to the assistance of users in the operation and maintenance of the hydraulic systems already constructed and the same percentage to the management and conservation of water and soil resources. The exception under the latter head is the attention at present devoted to the drainage and reclamation of land on the coast, 30% of which has been affected by progressive salinization as a result of the prevailing natural conditions and irrigation ^{48/} (see figure 8).

The distortion in investments is repeated in different degrees in other Latin American countries and in other water-using sectors, especially in the case of drinking water and sanitation, all of which results in the gradual deterioration not only of the works themselves but, what is still more serious, of the renewable natural resources.

The subject-matter included in each of the plans reviewed follows the same pattern as the conceptual schemes indicated above. Obviously some countries lay more emphasis on certain aspects relatively more important in their countries. Nonetheless, some schemes and contents do not clearly differentiate the phase of diagnosis and procurement of the water balances from the phase of formulation of

Figure 6

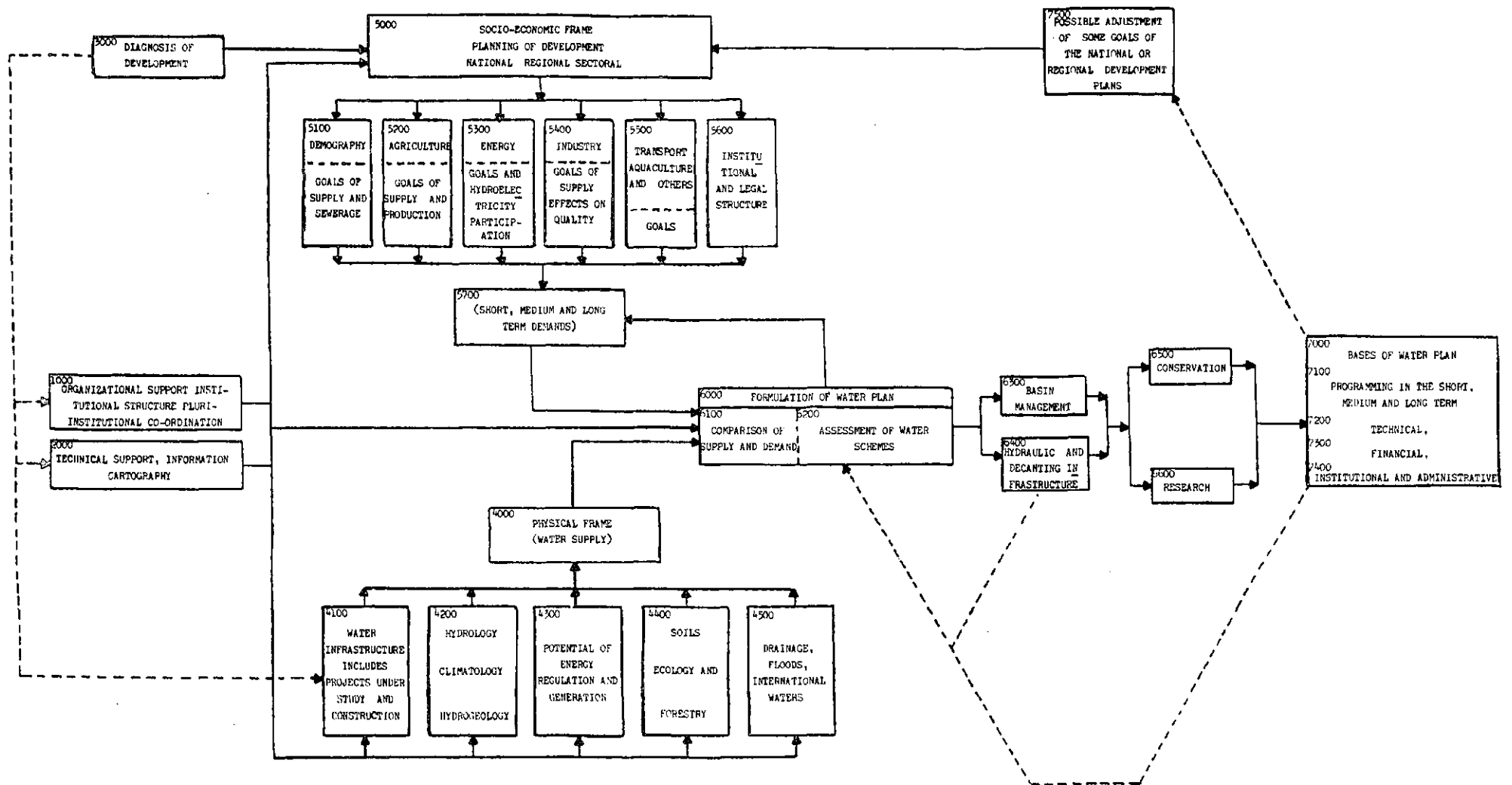
GENERAL DESIGN OF THE METHODOLOGY OF THE NATIONAL WATER MANAGEMENT PLAN OF PERU (1977)



Source: Comisión Multisectorial del Plan Nacional de Ordenamiento de los Recursos Hidráulicos, "Plan Nacional de Ordenamiento de Recursos Hidráulicos, Bases Técnicas y Económicas para su Formulación", Lima, Peru, 1977.

Figure 7

CONCEPTUAL DESIGN OF THE WATER PLAN OF ECUADOR

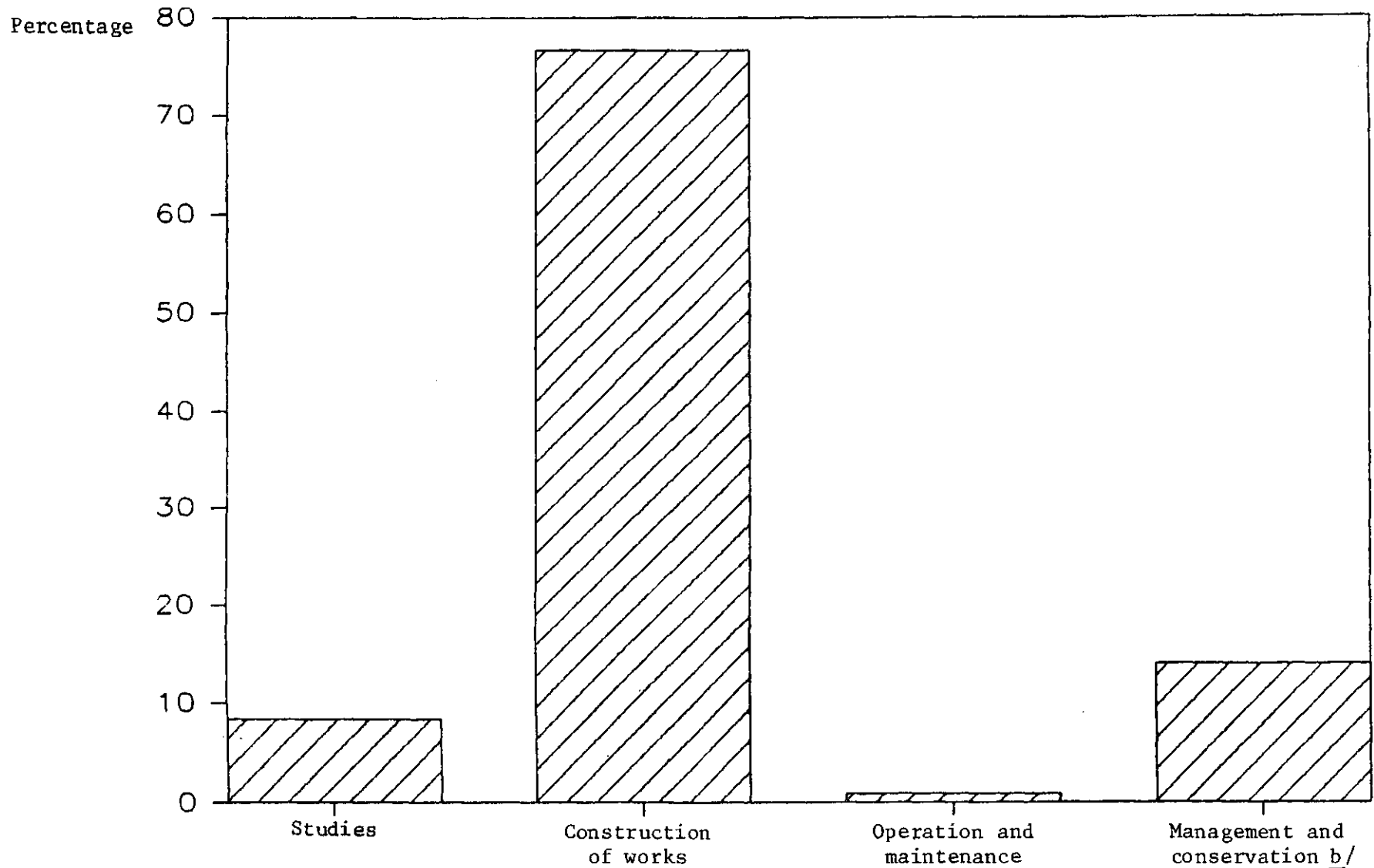


Source: Instituto Ecuatoriano de Recursos Hídricos (INERHI), "Marco general para la elaboración del plan nacional hídrico", Quito, Ecuador, 1981.

— DIRECT RELATIONSHIP
 - - - - - INDIRECT RELATIONSHIP

Figure 8

PERCENTAGE DISTRIBUTION OF INVESTMENTS IN WATER RESOURCES a/



a/ Investment budget of the Ministry of Agriculture and Food of Peru, 1979.

b/ 95% of this column relates to one project for the drainage and rehabilitation of coastal land.

strategies or water policies resulting from these balances. In general they concentrate more on the water balances, which reduces the value of the plan. Other countries, in analysing water strategies or policies, merely stress the need to programme investment activities in hydraulic works, or sometimes they limit themselves to giving priority to hydraulic projects. This likewise diminishes the value of the effort made, since no consideration is given to other policy options or to an analysis of the possibilities of creating short-term policies aimed at the better use of existing water systems. It is evident that the plans are strongly inclined to formulate policies which facilitate an increase in the water supply, to the detriment of policies for controlling the demand.^{49/} These imbalances tend to correct themselves when the demand for water cannot be satisfied by new supplies of the resource, whether through shortage of water or of money to build new works. In these situations the imbalances have to be reduced through the formulation of policies limiting the use of water or increasing the efficiency of the existing hydraulic systems. These policies are usually adopted in face of situations which are naturally difficult to correct when no steps to prevent them have been taken in advance.

IV. RELATIONSHIP BETWEEN NATIONAL PLANS FOR WATER RESOURCE MANAGEMENT AND OTHER PLANS

1. National economic development plans and water resource management plans

Theoretical plans for water resource management (multisectoral, sectoral or subsectoral) should be formulated in close association with plans for socio-economic development. This co-ordination should also be made between national and regional plans. This harmony is very difficult to achieve in practice, so that it has seemed desirable to make a brief analysis of the subject. The aim is to try to discover, in a very tentative way, the degrees of relationship or integration that exist between water resource management plans and other plans. This has been taken as the starting point for the analysis of the water resource management plans available at national, regional and river-basin level, whether their intention is to plan or programme the execution of sectoral activities or multisectoral, as in the case of Ecuador (figure 9).

The first step of the analysis was to try to identify the more usual difficulties found in co-ordinating socioeconomic development plans with water resource management plans.

Basically, the formulators of the national water resource management plans have had to face the following problems:

i) Lack of socioeconomic development plans in the country, region, microregion, locality and/or basin within which to establish the need to develop a water resource management plan.

ii) Socioeconomic development plans too incomplete for the establishment of water requirements and/or priorities for action in this field.

iii) Socioeconomic development plans with planning horizons shorter than those needed to plan the demand for water in the long term, which is usually over 20 years.

iv) Spheres of socioeconomic development planning (as, for example, districts and communes) which do not coincide with the spheres required for the planning of water resource management (such as river basins).

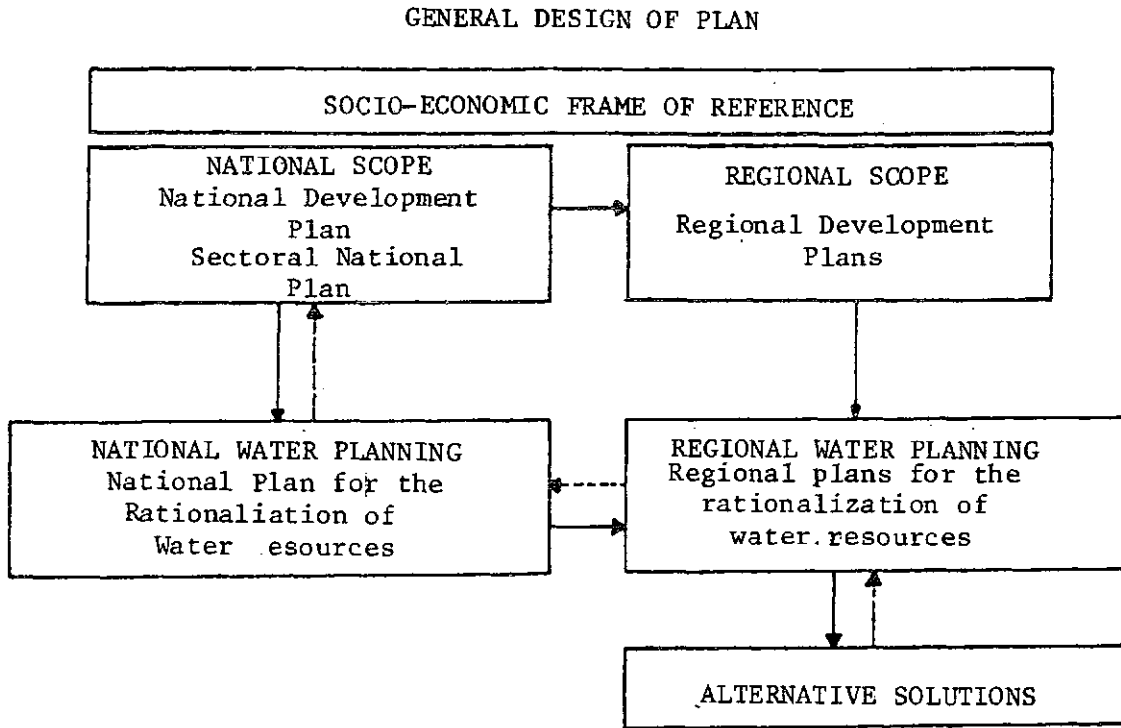
Similarly, the most usual difficulties of harmonization in formulating a socioeconomic development plan at national or regional level incorporating water as a variable are:

i) Lack of diagnoses to determine the potential and real supply of water for different uses in the spheres of planning for socioeconomic development.

ii) Lack of alternative techniques (projects) for harmonizing water supply and demand at the point in time when the plans for socioeconomic development are being formulated.

Figure 9

GENERAL DESIGN OF THE PLAN FOR THE RATIONALIZATION OF
WATER RESOURCES OF ECUADOR



Source: Instituto Ecuatoriano de Recursos Hidráulicos (INERHI), "Plan de racionalización de los recursos hidráulicos", Términos de referencia, Quito, Ecuador, 1983.

applied without previous notice. What is more, it is very rare for these investment "packets" in the subsectoral water field to have any co-ordination among themselves, with the result that three or four investment "lines" can sometimes programme the use of the same water for different purposes.^{51/} These examples, which are very numerous, give rise to several factual conclusions as regards the region:

i) That it is necessary to strengthen all the intersectoral co-ordination systems in order to anticipate the multiple use of water. This measure of co-ordination should be reflected in programmes and plans of work in every basin or water-related region and should be used effectively as an administrative instrument at national, regional or local level.

ii) That these measures of co-ordination should be taken even if only to avoid serious conflicts in the use of water in the short, medium or long term and even when there is no immediate purpose of trying to "optimize" investments or the operation of already existing water systems or basin management.

iii) That water utilization for multisectoral purposes has taken place in the region almost always by successive stages and not as a result of previous planning, with the obvious ensuing problems and costs.

iv) That the national plans and programmes put into operation are mainly sectoral or subsectoral and almost always relate to the construction of hydraulic works. The sectors may incorporate multisectoral elements when their design has been completed. Hence the sectoral investment programmes, chiefly for hydroenergy, drinking water and irrigation, have been in many countries the driving and controlling element on the basis of which other activities in the field of water have gradually been developed. This accounts for the enormous influence of sectoral water plans on the national plans for water resource management.

v) It is evident, moreover, that in several countries plans for water resource management which incorporate strategies for reducing, controlling and/or administering the demand for water are very few or non-existent. There is an excessive tendency to build new works rather than to make existing ones function properly or to manage and conserve river basins or catchment areas, or to encourage efficiency among water users.

vi) Finally there is a need to improve the relationship and co-ordination between socioeconomic development plans --especially at regional and basin level-- and plans for the management of water resources.

2. Sectoral and subsectoral plans for water use

In order to illustrate these points a review has been made of subsectoral plans in hydroenergy, agriculture and health (see table 24).

a) Plans for hydroelectric utilization

The South American countries which have completed inventories of hydroenergy resources as an initial phase in the formulation of plans for the use of these resources include Argentina, Brazil, Colombia, Chile, Ecuador, Peru, Uruguay and Venezuela. The Central American countries have made similar studies and have also

Table 24

LATIN AMERICA AND THE CARIBBEAN: SECTORAL PLANS FOR WATER USE

Country	Multi-sectoral National plan	Energy-hydroenergy sector				Agricultural sector				Health sector				
		Name	Responsible body	Plan horizonzons, Year	Year of formulation	Name	Responsible body	Plan horizonzons, Year	Year of formulation	Name	Responsible body	Plan horizonzons, Year	Year of formulation	Name
Argentina	No	Potencial hidroeléctrico estimado del país	Min. de Economía	2000	1979									
Bahamas														
Barbados														
Bolivia	No					Plan Nacional de Riegos	Min. Agricultura y Asuntos Campesinos (MACA)	1982/1986	1982					
Brazil	No	O potencial hidroeléctrico do Brazil	Min. Minas e Energía (ELECTROBRAS)	1990	1980		Min. Interior/Min. Agricult.	1982/1986	1982					
Colombia		Inventario Nacional de Recursos Hidroeléctricos	Depto. Nacional de Planificación	2000	1979					Plan Nacional de Acueductos y Alcantarillado	Instituto de Fomento Municipal (INSFOPAL)	-	-	
Costa Rica	No													
Cuba	Yes													
Chile	No													
Dominican Republic	No													
Ecuador	Yes	Plan maestro de electrificación	Instituto Ecuatoriano de Electrificación (INECEL)	1985	1980	Plan Nacional de Riegos	Instituto Ecuatoriano Rec. Hidráulicos (INERHI)	2000	1979	Plan Nac. de Agua Potable y Saneamiento Ambiental	Instituto Ecuatoriano de Obras Sanitarias (IEOS)	2000	1980	Plan Multi-sectorial a nivel de términos de referencia
El Salvador	Yes													
Guatemala	No	Instituto Nacional de Electrificación (INDE)												
Guyana														
Haiti	No													
Honduras	Yes					Plan Nacional de Riegos y Drenaje	Min. Recursos Naturales, Div. Hídricos	2003	1978					Plan Multi-sectorial 1980-1987
Jamaica	Yes													

Cuadro 24 (concl.)

Country	Multi-sectoral National plan	Energy-hydroenergy sector				Agricultural sector				Health sector			
		Name	Responsible body	Plan horizons, year	Year of formulation	Name	Responsible body	Plan horizons, year	Year of formulation	Name	Responsible body	Plan horizons, year	Year of formulation
Mexico	Yes												
Nicaragua													
Panama						Plan Nacional de Riegos	Min. Desarrollo Agropecuario		En formulación				
Paraguay	No		Adm. Nacional Electric. (ANDE)			Plan Maestro de Area de Influencia Yaciretá	Min. Agricultura y Ganadería		- 1982				
Peru	Yes	Evaluación Potencial Hidroeléctrico Nacional	Min. Energía Minas, Direc. Gra. Electric	-	1979	Opciones e inversiones prioritarias en el área de riego a/	Min. Agricultura Instituto Nacional de Desarrollo						
Suriname													
Trinidad and Tobago	No												
Uruguay	No	Evaluación Potencial Hidroeléctrico Nacional	Adm. Nacional Usinas y Transporte Elect. (UTE)		2000								
Venezuela	Yes	Inventario Nacional de Potencial Hidroeléctrico	Min. Ambiente y Recursos Nat. Renovables (MARNR)		1980								

a/ Proyecto Interregional del PNUD: INT/82/001.

iii) Existence of water resource management plans that are incomplete, through being excessively sectoral and limited in their strategies, and therefore unsuitable for use in plans for socioeconomic development.

iv) Lack of information on aspects relating to the administration of water resources, such as organization and the role of the State and of individuals in the administration of water, sources and forms of financing, potential of suitably trained manpower and the like.

The cause of these incompatibilities is the result of the different aims, clients, actors, conceptions and formulators of plans both in the field of water and in that of social and economic development.

The formulators of plans for water resource management at national, regional or water-basin level who have considered development strategies mainly to project their own demands, have resorted to several alternative solutions: recommending the execution of development plans which will serve the turn of information; designing, in co-ordination with the planning sectors, prospective models for water demand for 5, 10 or 20 years, and projecting, without any particular co-ordination, their own sectoral or subsectoral water needs.

Most of the water projects in Latin America which aim at increasing or controlling the supply of the resource unfortunately overlook development plans --even if they are available-- and project their activities independently and in response to diverse interests, such as:

- Political pressures, mainly regional, to build works for hydroenergy generation, irrigation, flood control and the like.

- Investment interests on the part of State enterprises or departments, mixed or private, which in one way or another "sell" their line of business (sale of hydraulic equipment, pumping equipment, advisory services, etc.).

- Response to international or national "credit lines" which encourage investment with a view to the direct or indirect expansion of water use for certain sectoral purposes or interests, such as credits for irrigation in order to produce a particular crop.

In the first case described, that is, when the water project is in response to regional demands and is on a large scale, the development planning has been conducted from below upwards, resulting from these demands. A typical evolution is to initiate a subsectoral project in the field of water such as, for example, an irrigation project through pressures from a region, which is then converted into a project of multisectoral water use, which may comprise irrigation, hydroenergy, fishbreeding, flood control and the like, which finally comes to represent a "Regional development project" or one for the "integral development of basins".^{50/}

In other cases, the water plans are formulated in "packets" or "investment lines" at national or regional level, and are aimed at the execution of only one type of activity in the water field, usually small in size but repeated on a large scale, such as small projects for irrigation, drainage, piped water supply, small hydroelectric power stations, etc. These plans, programmes or lines can also have a marked impact on the orientation of the development of certain regions or basins, in which they are

produced a joint project of electrical interconnection which includes hydro-electricity.^{52/} The other countries of the region are also in process of forming plans, bearing in mind the ever increasing need to plan energy development. The hydroenergy inventory of the countries mentioned includes, as common elements of study, the following:

- estimation of the total hydroelectric potential of the country;
- estimation of the hydroelectric potential of priority basins;
- identification of hydrographic basins of special hydroelectric interest;
- compilation of basic information on hydrology, cartography, and geology for the whole country;
- preparation of a catalogue of hydroelectric projects, and
- estimation of the investment costs of the projects.

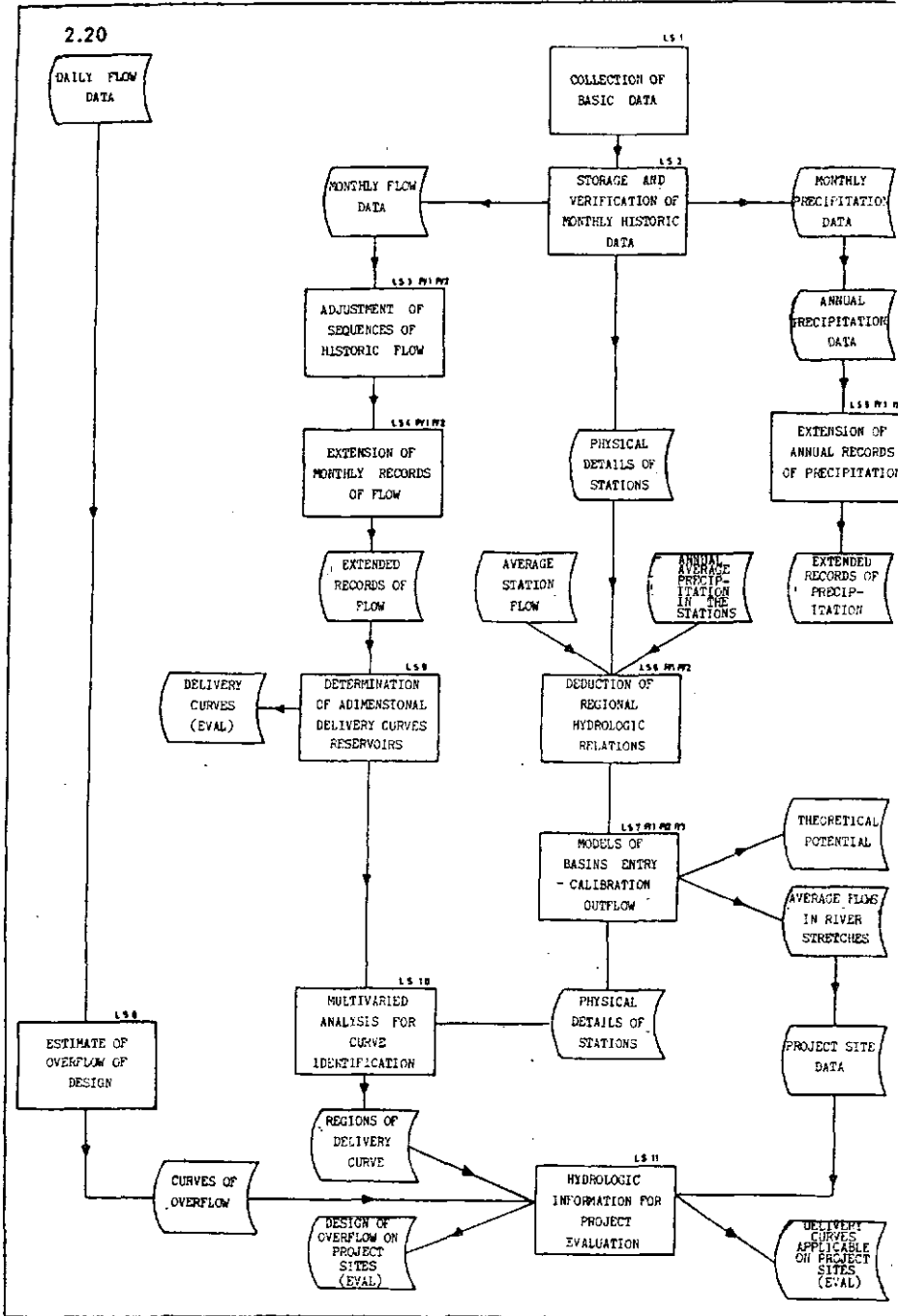
The most recent study is that of Peru.^{53/} The average monthly flow of the rivers of the country which are important for hydroenergy has been estimated by using the hydrological model known as the HEC,^{54/} which has been modified for processing in a micro-computer, a system increasingly used in Latin America.^{55/} As a matter of interest, figure 10 shows the diagram of the flow corresponding to the analysis of hydrological data for a study on hydroelectric potential. Argentina has a national plan for the equipment of systems of electric-energy generation in which it is emphasized that the water resource is still one of the most important sources of energy despite the fact that this country has developed several other forms of energy generation. With regard to hydroelectric energy, it is stated that "...according to the latest estimates the conventional hydroelectric potential technically usable in the country is equivalent to the production of 200 000 kWh per year".^{56/} It is added that this potential would in itself alone suffice to meet the demand for electric energy up to the beginning of the next century.

In Ecuador, at the end of the 1970s, the Ecuadorian Institute for Electrification (INECEL) undertook planning studies for the electrical subsector, of which the basic objectives were to procure sufficient energy for the sustained development of the country and to create an efficient system of energy distribution. The activities of INECEL included the study of hydroelectric resources, for which basic measures were proposed such as: to obtain topographical maps of the beds of all the rivers and their affluents, to draw up registers of water-flows and precipitations reflecting energy availabilities, and to ascertain the geological conditions of all the river beds. The Master Electrification Plan has a planning horizon of 20 years and adopts as a starting point a thorough knowledge of all hydroelectric resources. This includes a firm plan for the period 1980-1984. The objective of the short-term plan is that by the end of 1984 the country should have an installed capacity of 1 990 000 kW through an increase of 900 000 kW, of which 638 000 kW will be of hydroelectric origin.^{57/} Among the publications of INECEL on the subject of hydro-electricity the following may be mentioned: "Catálogo de proyectos hidroeléctricos", March 1983; "Optimización de los recursos hidroeléctricos en el Ecuador", March 1983, and "Modelo matemático de regulación energética de cuencas hidrográficas".

The conclusions of the study on energy for Brazil are somewhat similar to those on Argentina; in fact, the Brazilian study points out that, according to long-term estimates (the first decades of the next century), the role of hydroelectricity will become even more important than at present or in the medium term, since it is considered on the one hand that, although the cost of electric energy production

Figure 10

DATA FOR ASSESSMENT OF HYDROLOGIC POTENTIAL



Source: Ministry of Energy and Mines of Peru, "Evaluación del potencial hidroeléctrico nacional", Lima, 1974.

through hydroelectric power stations will be greater, the cost of production through the use of fuel or nuclear fission will be greater still, and on the other hand, that the estimate of the water potential available may rise considerably in the coming years, which will increase its relative importance.58/

As regards the Central American Isthmus, the Regional Project for the Electrical Interconnection of the Central American Isthmus comprises the study of the development of the electrical systems of the six countries of the Isthmus through the integrated operation of some 60 hydroelectric projects identified in the subregion in conjunction with thermo-electric and geo-thermal plants.59/

Finally, it means repeating that it is hoped both in the near and distant future the generation of hydroelectric energy will increase its importance in the development of the countries. Fortunately the region has a very rich experience in the planning of hydroenergy resources and horizontal co-operation is promising in this field.

As can be seen from the foregoing, the programmes for the construction of hydroelectric power stations are designed and inserted within the national electrification plans, and, more generally, within the energy development plans. Nevertheless, as they are water-using installations, they ought also to be inserted within the general plans for water use so as to achieve integral utilization and avoid conflicts with other sectors interested in water use, such as irrigation, drinking water and sanitation, navigation, etc. This, however, has not occurred up to the present, basically owing to two facts: first, to the abundance of hydroelectric resources spread over wide areas of the continental countries; and second, as a complement to the first, to the present possibility of transporting electric energy over great distances to the major centres of consumption. In this way it has been generally possible to select the places for energy generation in basins that do not conflict with other uses, some of which, such as water for sanitation (drinking water supply and sewerage) and irrigation, have priority importance over that of energy. At all events, if in a particular place there was simultaneous interest in energy and irrigation (which is another of the more important uses of water), it was usual to reconcile this by appropriate hydraulic works. In general, it has been the use of water for energy that has led to the creation or improvement of irrigation areas in many regions and not the reverse.

The fact that the hydroelectric sector has developed much more dynamically than the other water uses has made a very significant, almost crucial, contribution to the knowledge of the water resource in general by means of:

i) The formation of hydrological data banks, most of which are totally computerized.

ii) The development of hydrological models owing to the need to process a large quantity of information, which has compelled the use of computers and has given rise to the ensuing promotion of the preparation of computer programmes.

iii) The execution of a complete inventory of all the surface water resources of the country.

iv) The delimitation of river basins and the knowledge of their geology, which has contributed to the regionalization of the country.

At the same time the advance of the hydroelectric sector has been a factor in the formation of local personnel, trained in the compilation, analysis and processing of data.

The large programmes for the construction of hydroelectric power stations, along with the increasing demands for food and drinking water for the growing population of the region, could lead more and more to situations of conflicting interests. Nonetheless, the criterion prevailing at present in the design of hydraulic projects is that these should fulfill objectives of multiple use and meet the needs of all the possible sectors interested: energy, irrigation, drinking water supply, sewerage, navigation, recreation and flood control.

b) Plans for water use in agriculture

Plans concerned with the rational use of water in agriculture are generally aimed at programming irrigation and drainage activities, even though it is also necessary to incorporate in this classification the programming of measures to improve the use of water through water catchment from rain and mist --which are the basis of agriculture and stock-raising in rainfed agricultural zones-- and the control of surface run-off.

Theoretically a national or regional irrigation and drainage plan should enable a government to programme the necessary measures for promoting the development of zones in the country suitable for this purpose, whether by stimulating private investment or adopting measures and making investments on its own account.

Plans of this nature are usually intended to achieve goals relating to a specific number of hectares which have to be irrigated or drained in a country, region or basin. In these plans a distinction is made between the new areas to be incorporated and those which are already under irrigation or crops but can be improved. A distinction is likewise made between areas which, although they receive a certain amount of rainfall or groundwater, need complementary irrigation, and those totally arid areas in which irrigation is the only possible source of water.

An irrigation and drainage plan adequately formulated should form part of a sectoral and agricultural plan and include the programming of physical-technical activities such as studies, projects, works and operation of hydraulic systems. It should also include politico-administrative activities, such as the adaptation of regulations, credits, training, organization and other aspects directed towards the good use and conservation of water in agriculture.

In practice it is difficult to make a large-scale irrigation and drainage plan which will comprise all the aspects mentioned, so that it is usual to resort to the formulation of specific programmes and projects. In this respect it is of interest to outline the different motivations and means that tend to be involved in the promotion of irrigation and drainage development in Latin America and the Caribbean.

Taking as an example only two countries, Peru (see table 25 and figure 11) and Brazil (see table 24), it can be seen, inter alia, that the motivations and means employed comprise aspects in common, such as:

i) Promotion of the execution of large irrigation and drainage projects based on objectives of regional development and integral development of large basins,

Table 25

IRRIGATION AND DRAINAGE PROGRAMMES AND PROJECTS IN
PERU AND BRAZIL: SOME EXAMPLES

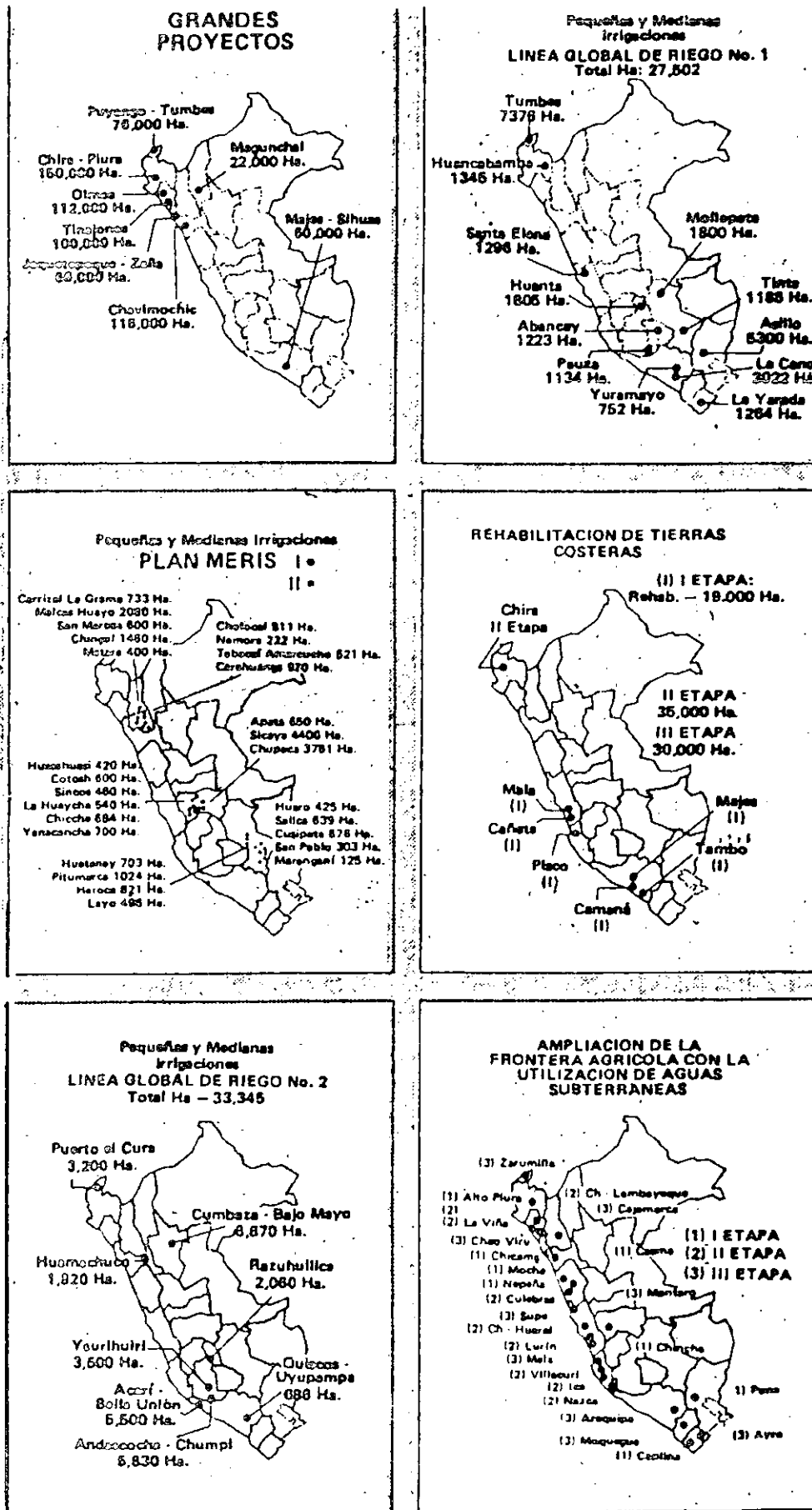
Brazil

1. Projects administered by the "Companhia do Desenvolvimento do Vale do Sao Francisco-CODEVASF" and other projects of integral basin development such as that of Araguaia-Tocantins (PRODIAT).
2. Projects administered by the "Departamento Nacional de Obras de Saneamiento (DNOS)".
3. Projects administered by the "Superintendencias de Desarrollo Regional" (SUDENE, SUDESUL, SUDECO).
4. Projects administered by the "Departamento Nacional de Obras contra as Secas (DNOCS)" (National Drought Control Department).
5. Programa Nacional de Aprovechamiento de Varzeas Irrigaveis-PROVARZEAS (Ministry of Agriculture).
6. Projects administered by the State governments and municipal plans and projects for development (e.g., Polo Nordeste, Projeto SERTANEJO, Programa de Recursos Hídricos and others).

Peru

1. Line of large projects of investment in water resources (various).
2. Global line of irrigation No. 1 and No. 2 (projects of 500 to 10 000 hectares).
3. Plan for irrigation improvement in the sierra-Plan MERIS (projects of 200 to 2 000 hectares).
4. Plan for the rehabilitation of coastal land-PLANREHATIC (projects for land drainage and reclamation of 200 to 60 000 hectares).
5. Expansion of the agricultural frontier with the utilization of groundwater (projects of 100 to 5 000 hectares on the coast and in the sierra of Peru).
6. Irrigation and drainage projects with public co-operation (various).

IRRIGATION AND DRAINAGE PROJECTS IN PERU - 1980



Source: Ministry of Agriculture of Peru, 1980.

Note: The fact that frontiers are shown on this figure does not mean that they are approved or accepted by the United Nations.

such as the irrigation projects of the Companhia do Desenvolvimento do Vale do São Francisco, Brazil 60/ and large irrigation projects on the Pacific coast of Peru.

ii) Promotion of the execution of medium-sized and small irrigation projects based on the stimulation of:

- the utilization of certain soils or geographic areas, such as the PROVARZEAS Project in Brazil;
- the utilization of certain water resources, such as the Project for the Enlargement of the Agricultural Frontier with Utilization of Groundwater, on the coast of Peru;
- the utilization of community participation and the generation of employment, such as the Irrigation Projects with Community Co-operation, in Peru;
- the benefiting of certain geographic areas, such as the Plan for Irrigation Improvement in the Sierra, PLAN MERIS, of Peru;
- the promotion of certain crops through the allocation of credit for irrigation, such as the credits for the sowing of rice in Brazil;
- the promotion of the use of specific technologies, such as the credits destined for the purchase of pumping machinery or equipment for irrigation by sprinkling and dripping;
- the promotion of certain technical or administrative measures, such as, for example, the improvement of the use made of irrigation areas, etc.

This list exemplifies sufficiently clearly that irrigation and drainage are promoted and developed according to very different rationales and patterns and in very different institutions. Although this is not necessarily an adverse factor there are at least some basic aspects that should certainly be considered by the governments if they are to contribute to the orderly development of irrigation and drainage in their countries. Among these aspects the following should be mentioned:

i) To ascertain the potential of the areas suitable for total or complementary irrigation and drainage, including their irrigation needs and availability and the demands for the washing of soils or the drainage of humid zones, in order to rank their utilization in terms of the country's development goals and thereby to select the most suitable projects for investment.

ii) To ascertain the present state of the hydraulic systems already built for irrigation and drainage and the efficacy of their functioning and maintenance so that the government may assist their users, for example, to improve the irrigation or drainage areas.

iii) To ascertain the state of the management and conservation of the water and soil resources of the whole river basin and not only of the perimeters irrigated. In particular the governments should inform themselves of the problems of water-logging, salinization, erosion and contamination, in order to programme activities which will forestall these effects or rehabilitate degraded resources.

iv) To ascertain the way in which the resources of the State are distributed in the promotion of irrigation and drainage: a) by geographic areas, b) within the agricultural sector, c) between research, building of works and operation of systems, and d) between irrigated and rainfed areas, in order to avoid serious distortions in the allocation of these resources.

v) To learn how the legal, institutional, financing, educational and budgetary systems, among others, effectively help to promote and facilitate irrigation and drainage in the country, along with the efficient use of rain water in rainfed zones.

It has been noted that several Latin American countries, aware of the need to foster the use and management of water in agriculture, have developed specific strategies to this end. The countries which have been longest in this field, such as Mexico, Peru, Chile and Argentina, in addition to their traditional policy of irrigation expansion, have now begun to consider the following:

i) A more balanced distribution of resource allocation for irrigation and drainage within their territory, avoiding the excessive benefit of certain regions, as in the north of Mexico and on the coasts of Peru, to the detriment of other regions in the country.

ii) A more equitable distribution of resource allocation for water management among irrigation zones, drainage zones and/or rainfed zones. In particular this last head should be duly considered with a view to improving upper-basin management, collect more rain water with better physical development of the land, and control run-off, erosion and floodings.

iii) The allocation of more resources to the operation and maintenance of existing hydraulic systems, together with the management and conservation of water and soil in the areas of irrigation and drainage, which comprise, as in Peru, the whole of one or more hydrographic basins.

Brazil, whose experience in irrigation and drainage is relatively recent in Latin America, intends to expand its irrigated surface from 1 100 000 to 3 000 000 hectares, for which it has drawn up a draft project called "National Irrigation Plan 1982-1986",^{61/} which seeks to rationalize this activity at national level, and which constitutes a very positive step towards the promotion of this activity. In some of the States of the Northeast, such as Piauí, there have even been specific programmes for the promotion of the multiple and rational use of water with emphasis on irrigation.^{62/}

In Venezuela irrigation is relatively less important than the drainage of zones with an excess of water. Hence the government is more interested in supporting the execution of drainage projects. Venezuela has an area of 1 227 000 hectares drained and 323 000 hectares irrigated.

Practically all the other countries of the region are equally concerned to improve the efficiency of water use in agriculture and it is to be hoped that co-operation among all the governments and specialists of the region will facilitate this objective.^{63/}

c) Plans for a drinking water supply

For a long time past the Latin American governments have recognized the importance of providing drinking water and sewerage services for their populations as a vital factor for the preservation and improvement of health. There has been considerable progress, particularly in recent years. Thus, for example, whereas 20 years ago only 60% of the urban population and less than 8% of the rural had access to a drinking water supply, in the year 1977 some 75% of the urban population and 34% of the rural had reasonable access to drinking water (although only 43% of the urban and 3% of the rural population had an adequate sewerage system).64/

More recently, the International Drinking Water Supply and Sanitation Decade, sponsored by the United Nations (1980), was instrumental in causing all the countries of the region to include within their planning activities the development of drinking water and sewerage systems for their populations both urban and rural. Particularly important is the assistance being provided by the World Bank, the World Health Organization and the Pan-American Health Organization in the achievement of the goals of this Decade.

A recent survey conducted by the Pan-American Health Organization (PAHO) revealed that all the 20 countries surveyed had set their goals for the International Drinking Water Supply and Sanitation Decade at the end of 1982. At the same time all the countries, excepting Brazil, El Salvador, Guatemala, Nicaragua, Peru, Trinidad and Tobago and Uruguay, were preparing their respective plans for achieving these goals either partially or totally, although only two countries, Argentina and Bolivia, had completed them (see table 26).

All the countries surveyed have set themselves goals of urban household connection to water systems; nonetheless, less than half have fixed goals for household connections in rural areas, so that the situation of the peasantry remains particularly difficult in the region.

The sewerage systems in the rural area are the least developed and there are no statistical data on the subject in many countries. In the region as a whole, however, the situation is diverse. Three groups of countries can be distinguished in accordance with the proportion of rural population existing now and projected up to 1990:65/

- countries with under 20% of rural population (Argentina, Chile, Uruguay, Venezuela);
- countries with 20% to 35% of rural population (Brazil, Colombia, Cuba, Mexico and Peru), and
- countries with over 35% of rural population (the remaining countries).

As regards the organization of the drinking water and sewerage sector in the countries of the region the study has revealed that there is generally one institution responsible for supervising measures and planning at national level. Nonetheless, the drinking water and sewerage services of some large cities, such as Mexico, Lima, Bogotá, Guayaquil, Quito, etc., through having services which supply very large communities, as for example Mexico City (14 million inhabitants), have considerable autonomy in the formulation of their plans.

Table 26

LATIN AMERICA: INTERNATIONAL DRINKING WATER SUPPLY
AND SANITATION DECADE: PLANS IN PREPARATION

Country	Goals established	Plan for developing drinking water supply and sanitation	
		Concluded	In preparation
Argentina	x	x	
Bolivia	x	x	
Brazil	Partially		
Colombia	x		x
Costa Rica	x		x
Chile	Partially		x
Ecuador	x		x
El Salvador	Partially		
Guatemala	x		
Guyana	x		x
Honduras	Partially		x
Mexico	Partially		x
Nicaragua	Partially		
Panama	x		x
Paraguay	Partially		x
Peru	Partially		
Dominican Republic	Partially		x
Trinidad and Tobago	Partially		
Uruguay	Partially		
Venezuela	x		x

Source: PAHO, Sectors Digest, December 1982.

The drinking water supply services for the urban areas of several thousand inhabitants generally depend on the aforesaid institutions or on the municipalities or local governments, while the drinking water and sanitation services for rural populations ranging from a few hundred to a few thousand inhabitants depend on the ministries of health.

This division of duties seems to function very well in all the cases analysed, but it hampers the execution of drinking water supply plans at national level.

The cases of Argentina, Brazil, Colombia and Ecuador are examples of the different ways in which the countries have organized their water supply and sanitation service.

In Argentina the main responsibility for the sector is in the hands of the Ministries of Public Works and of Social Welfare. In the former, the Subsecretariat for Water Resources has legal control of the Empresa de Obras Sanitarias de la Nación and the Servicio Nacional de Agua Potable y Saneamiento Rural. The second includes the Secretariat of State for Public Health, within which the Dirección Nacional de Saneamiento Ambiental is responsible for the preservation of the environment.

The Empresa de Obras Sanitarias de la Nación attends to the needs of 80% of the population which has a drinking water supply service and 90% of that which has sewerage, and is the main body in charge of the implementation of the policies and plans of the National Government for the sector.

The Servicio Nacional de Agua Potable y Saneamiento Rural was established in 1964 and was put in charge of the promotion, supervision and administration of the national plan for rural water supply and sanitation.^{66/} Under this plan, which at present extends to localities of up to 10 000 inhabitants, the intention is:

- in the short term, to provide a drinking water service for 400 000 inhabitants of rural communities;
- in the medium term, to meet the water supply needs of 1 700 000 inhabitants;
- in the long term, to provide services for the whole of the rural population, i.e., for 4 400 000 inhabitants within the next 20 years.

This plan which has the financial support of the Inter-American Development Bank (IDB), has been very successful and has fulfilled its goals, in which an important factor has been the participation of the same rural communities which have benefited from the projects of the plan.^{67/}

In Brazil the Ministry of the Interior has a Departamento Nacional de Obras Sanitarias (DNOS), which acting at the national level --not counting the Polígono de la Sequía-- includes the following among its aims and objectives:

- i) To establish norms and specifications for the drawing up of projects, the execution of works for the operation and conservation of basic sanitation services, especially a water supply, rainfall drainage and waste disposal; control of the contamination of the sea shore, in masses and water courses; control of erosion, improvement of areas and their protection against drought and flooding.

ii) To prepare studies and projects, as well as to guide, supervise and implement directly or indirectly works and services of irrigation and rural and urban sanitation, both general and basic, in collaboration with the States, territories and municipalities, and public and private bodies, in accordance with the regional development plans.

In the case of Ecuador, the year 1980 saw the beginning of the formulation of the bases of the Ten-Year Plan for the Supply of Drinking Water and Sewerage for the urban and rural zones of the country. For the period 1980-1984 the following goals were envisaged: i) to increase the water supply coverage to 65% of the population in the urban zones and 25% in the rural and, as regards sewerage, to increase the coverage to 80% in the cities and 30% in the countryside; ii) to construct in the urban zones 47 drinking water supply systems and 74 sewerage systems, both for rain drainage and waste disposal, and iii) to execute 400 joint projects of basic rural sanitation.68/

Colombia has the Plan Nacional de Acueductos y Alcantarillados (PLANAL), which contemplates a set of measures aimed at the structuring of a coherent policy at national level and gradually to increase the coverage of the services to all the communities in the country.69/

In conclusion, it may be said that the region has made progress in the preparation of plans and programmes for the rapid growth of water supply and drainage services during the International Drinking Water Supply and Sanitation Decade. The problem of tackling and implementing these plans and programmes, however, is still to be resolved. The recognition that there are numerous obstacles, particularly in respect of available finance and trained personnel for the achievement of these goals, shows that the countries of the region are aware that this challenge is very difficult to overcome. Undoubtedly the financial situation of the sector has been to some extent self-imposed owing to the failure to fix a charge which would adequately recover the costs of the service.70/ It has been said that technological innovation would be one solution; it is obviously not the panacea, however, particularly for the solution of the problem of lack of funds. The problem can only be finally solved by means of good administration. This should include the adoption of a stable policy for the sector, the application of long-term strategies for the development of the sector, the provision of well-trained personnel at all levels, but above all the operation of programmes to serve the rural population and the maintenance of rational management practices to conserve existing installations and maximize their utility.71/

d) Planning at basin level

There is a long tradition of basin planning in Latin America; at first it was centred almost entirely on the exploitation of the water resources, but recently it has been giving greater consideration to environmental aspects. These considerations are of more recent date, and have been particularly assisted by the Organization of American States (OAS) through its Regional Planning Department. Particularly important is the support given by this organization to the development of international hydrographic basins. From 1960 to 1982 this Department has conducted projects in several countries in the field of watershed development for multiple use,72/ as can be seen in table 27 and figure 12. Moreover, each country, using this or some other form of technical assistance or by its own means, has drawn up different plans of development for its hydrographic basins. Different approaches and different emphases have been

Table 27

TECHNICAL CO-OPERATION ACTIVITIES OF THE OAS IN THE
DEVELOPMENT OF RIVER BASINS

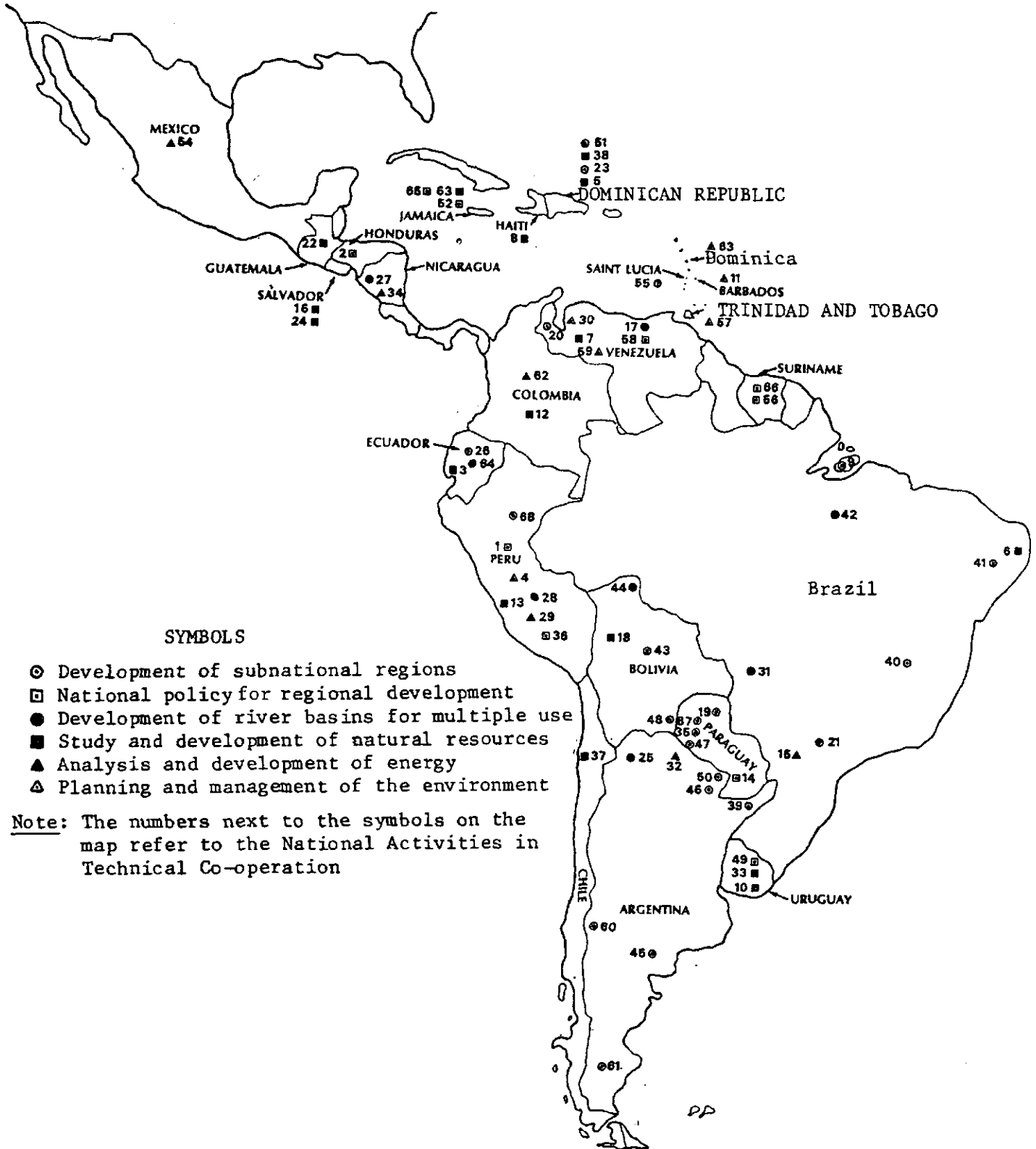
No.	Activity	Date of study	Date of publication
1.	Integrated assessment of natural resources: development possibilities of the basin of the river Guayas, Ecuador	1962	1964
2.	Development of the water resources of the basin of the river Santa Lucía, Uruguay	1969-1970	1971
3.	Assistance for the planning of river basins, Venezuela	1971-1973	-
4.	Study of the lower basin of the river Bermejo, Argentina	1973-1975	1978
5.	Regional development of the basin of the river Esmeraldas, Ecuador	1973-1976	1977
6.	Assistance for the planning of river basins, Peru	1975-1976	1976
7.	Study of the integrated development of the basin of the Alto Paraguay, Brazil	1977-1981	1981
8.	Environmental Quality and River Basin Development: A model for integrated analysis and planning, river Bermejo, Argentina	1975-1976	1978
9.	Irrigation projects in Canelón Grande and Aguas Blancas, Uruguay	1977	1977
10.	Programme for small dams, Dominican Republic	1978-1979	-
11.	Integrated development of the Paracatú basin, Brazil	1978-1980	1980
12.	Project for the Jatobá basin, Brazil	1978-1980	1980
13.	Project for the integrated development of the Araguaia-Tocantins basin, Brazil	1981	
14.	Agricultural development under irrigation in the Upper Basin of the River Pilcomayo (MACA), Bolivia	1980-1982	

No.	Activity	Date of study	Date of publication
15.	Regional Development Planning, Suriname	1979-1981	
16.	Advisory assistance in regional and physical planning for the Ministry of Planning and Co-ordination (CORDIPLAN), Venezuela	1979-1981	
17.	River basin planning, Ecuador	1982	

Source: OAS, "Actividades de cooperación técnica", Departamento de Desarrollo Regional, Energía y Recursos Naturales, Washington, D.C., 1981.

Figure 12

NATIONAL ACTIVITIES IN TECHNICAL CO-OPERATION, 1960-1982



Source: OAS, "Actividades de cooperación técnica", Regional Development Department, Energy and Natural Resources, Washington, D.C., August 1981.

formulated in accordance with their socioeconomic situations. The following cases are mentioned by way of example or for purposes of comparison.

a) In Ecuador there are numerous study projects for the utilization of basins, in which the water resource has been emphasized;73/

i) Study of the northwestern basins; planning of the exploitation of the land and water resources in the basins of the rivers Esmeralda and Santiago.

ii) Draft plan for the integral development of the basin of the river Pastaza, aimed at formulating a diagnosis of the natural and socioeconomic resources over an area of 22 000 km², stressing irrigation, drainage and hydroelectricity.

iii) Development plan for Region 1, directed to the use of the water resources in the basin of the rivers Santiago and Mira, and a development plan for the provinces of Esmeraldas, Imbaburra and Carchi.

iv) Plan for the upper and intermediate basins of the rivers Jubones, Cañar and Paute, including a draft plan for the utilization and management of the hydrographic basins.

v) Hydraulic plan for the Jubones basin, which forms part of the planning project for the hydrographic systems (with the OAS), one of whose objectives is the execution of studies and proposals for the rational development and multiple use of the water resources.

vi) Development plan for the Guayas basin.

b) In Brazil, in view of the importance assigned to the integral development of basins, it has been arranged that the management of water by hydrographic basins or sub-basins should be carried out through an agency which will reconcile the presence of all the parties involved in the water resources, harmonizing the central organs and entities and their counterparts at State and municipal level. This agency is the Special Committee for Integrated Studies on Hydrographic Basins (Comitê Especial de Estudos Integrados de Cuencas Hidrográficas (CEEIBH) formally created in March 1979.

The CEEIBH is in charge of the classification of the water courses of the Union, the integrated study and supervision of the rational use of the water resources of the hydrographic basins of the federal rivers, in the sense of obtaining multiple benefit from each one and minimizing the harmful effects on the ecology of the region.

The members of the CEEIBH are the Secretary of the Special Secretariat for the Environment MINER/SEMA, the Director-General of the National Department for Water Resources and Electric Energy, MME/DNAEE, the Director President of the Brazilian Electric Power Stations S.A., MME/ELECTROBRAS, the Director General of the National Department for Sanitation Works, MINER/DNOS, the Superintendent of the Regional Development Superintendencies in the respective geo-economic area of the hydrographic basin of the federal rivers, and the Secretaries of State nominated by the Governors of the States whose governments have special powers over the control of the environment and water resources in the respective hydrographic basin of the federal rivers.

Moreover, considerable experience has been accumulated as a result of the development project for the basin and valley of the river San Francisco (640 000 km²), which was initiated in 1964.74/ This is a multiple-use and far-ranging project. Other projects are those of the Araguaia-Tocantins basins and the Jatoba basin. Particularly in the latter project, the integrated development programme includes, inter alia, utilization of ground water, fish-breeding, improvement of rainfed agriculture, educational programmes, health, drinking water and sewerage supply services and community development. The Superintendency for the Development of the Northeast Region (SUDENE) and the Government of the State of Pernambuco have initiated the works and assigned the respective funds for the period 1980-1983. The pilot study and its follow-up measures are used to orient a general development strategy for the semi-arid region of the Northeast.75/

c) Colombia also, through its various corporations for regional development, has wide experience in the planning of river basins. One of the oldest of these bodies is the Autonomous Regional Corporation for the Cauca Valley (CVC), which was created in 1954 to develop the upper part of the Cauca Valley and its surrounding areas. At first the CVC centred its efforts on the development of hydroenergy, in order to create resources, but now it conducts multiple projects including flood control, irrigated agriculture and electricity generation as in the case of the Salvajina project.76/

d) In Peru there are several agencies in charge of the study, development and/or management of the resources of the river basins. In this respect, i) various studies have been carried out to assess, at basin level, the natural resources of the country, the study on the coastal basins having now been completed (National Office for the Evaluation of Natural Resources (ONERN)); ii) there are special projects for water development at basin level by sectors: for energy, the projects of the basins of the rivers Mantaro and Huallaga; for agriculture (irrigation), the projects of the basins of the Chira-Piura, Puyango-Tumbes, Cajamarca, Mantaro, Alto Vilcanota, Chumbao, etc.; for drinking water and energy, the project for decanting the Mantaro river; iii) the water management is conducted at basin level through the Irrigation Districts which depend on the Ministry of Agriculture; iv) there are special projects for regional development at basin level, such as those of the Huallaga and Alto Mayo; and v) finally, there are systems of control of natural conflicts likewise at basin level, such as those of the Santa Corporation, in the Department of Ancash.

It can be seen that there is a wide range of possibilities for undertaking and carrying out the development of river basins in Latin America and the Caribbean; moreover, several basins have been incorporated for the integral planning of a region, as in the case of the "micro-regions" of Mexico, in which the planning was carried on under the direction of the agency known as the Public Investment Programme for Rural Development (PIDER), which came under the Ministry of Planning and Budget.77/

An important conclusion that can be drawn is that some very intensive and far-reaching work is in progress on the planning of water use at basin level, which because of its character as a biogeographic unit is better suited than plans at national level to produce a really effective development of this resource.

V. CONCLUSIONS

1. The importance of planning in the region

One of the immediate results of the execution of a water utilization plan is to make manifest the role of this resource in the development of a country or region. In order to formulate a plan for the use of water resources this must necessarily form part of the development plans of the country, so that in those countries where there are water problems territorial management must be associated with the regionalization of water, in view of the close relationship between water use and development.^{78/}

The need to prevent conflicts in the use or control of water is certainly more evident in areas which have a high potential growth in respect of population, industry, agriculture, energy, etc., and which are situated in arid or high-altitude zones that have little available water, are subject to droughts or floods and have pollution or other problems. In Latin America this combination of conflictive areas is frequent, owing to the unequal distribution of the resource, to the phenomena which affect them and the growth of demand. Basically there is a considerable expanse of inhabited arid areas (see figure 13) situated north of latitude 16°N of Mexico, a narrow fringe on the Pacific coast, stretching from Ecuador to latitude 35°S, and a fringe to the east of the Andes from 18°S to Patagonia. On the side of the Atlantic and Caribbean, there are arid zones in Guajira and above all the extensive zone of the northeast of Brazil.

Many of these areas, in their turn, have related problems such as the settlement of communities high above sea-level, which reduces the water catchment area and/or causes the discharge of polluted water to affect communities downstream through the occurrence of long periods of drought interrupted by heavy rains and other extreme phenomena such as landslides or other erosive processes.

Flooding, at least in recent years, has led to the planning of water resource control. The north of Argentina, Paraguay, the south of Brazil, the north of Peru and Ecuador were the areas most widely afflicted in the region. In the Caribbean and the Gulf the hurricane phenomenon is equally well known. In addition, the problems of water pollution control in urban areas are increasingly acute. These situations leave no doubt as to the need to regulate the use of the resource and thus orient a policy of water control.

2. Effects of the formulation of plans for the development of water resources

According to the comparative analyses of plans and their results, it may be concluded that the drawing up of a national plan for the management of water resources is useful:

- during the process of drawing up the plan, and
- once the plan is completed.

At the risk of exaggeration, it might be said that the two stages are equally important. The stage of formulation of the plan is in many cases the first step

Figure 13

MAP OF ARIDITY INDEX ACCORDING TO BUDYKO-LETTAU a/



Source: U.N., United Nations Conference on Desertification, "Climate and Desertification", background document, Nairobi, Kenya, September 1977.

a/ Aridity index =
$$\frac{\text{Annual average radiation}}{\text{Annual average precipitation} \times \text{latent heat of vapourization}}$$

towards an institutional co-ordination previously non-existent in several countries. A sample of this integration can be found, for example, in the composition of the Commission on the National Plan for Water Resource Management of Peru. Another example of the importance of the preparatory stage can be found in the achievements during the formulation of the Master Plan for Water Resource Development and Utilization of El Salvador. This includes, among other projects, the creation of a specialized water department in the Ministry of Planning in 1981, the drawing up of a draft project on Water Law, and the creation of a data bank on water resources. Similar examples of benefits are found in the formulation stage of almost all the plans that seek the active participation of the State agencies and the water users themselves, as in the case of the Water Plan of Mexico.

The fact of possessing a completed plan marks a new stage which is by no means definitive in view of the need for a permanent feedback to the system created. The most important aspect of this stage is the possession of an articulated functional system which facilitates the taking of decisions on the utilization and management of water for development. The form in which the plans are applied in practice must certainly be carefully assessed before their real scope can be determined, a task which will entail a deeper study than the present one.

3. Strategies for strengthening the national and multisectoral planning of water resources

A national plan for water use must necessarily cover the long term, and embrace a series of economic sectors and the whole territory of the country, which means that it may encounter many obstacles that hinder or delay its preparation and application. To avoid this situation it is suggested that a strategy be adopted which includes the following aspects:

a) It should permit the execution of sectoral plans for water use, but with co-ordination, particularly at the level of basins or basin systems. In this connection precautionary measures should be taken to keep a record of on-going studies and projects programmed in relation to each basin. This record should serve as a register of supply and demand. Any new demand should be duly registered as an indication of possible conflicts.

b) Planning should be fostered for the management of water resources at the level of a river basin or of inter-linked basin systems. This is more advisable than planning by sectors since the result is more easily incorporated into a national plan.

c) A system of interinstitutional co-ordination should be formally established with its own budget. This system (commission, secretariat or the like), which should be permanent, is fundamental for the co-ordination and stimulation of interinstitutional participation both during the formulation and during the application of the plans.

d) It is politically important that the plans should take short- or medium-term measures into account as well as long-term measures, in order to obtain support and consideration from the government system and the specialized sectoral institutions.79/

e) It is important to foster public participation, through the operation of information and extension systems which seek to stimulate the participation of the water users in the processes of management. In this regard an observation by Azpúrua and Gabaldón may be quoted, which states that "public participation is an essential condition for improving the use and preservation of water, and becomes even more important in situations of water shortage or emergencies caused by droughts or floods. The experiences of other countries show that, in conditions of drought, the population has reduced its water consumption by as much as 50% when it has been made aware of the value of water, the problem to be faced and the measures for its solution, a result which has been achieved through intense publicity campaigns. This public awareness can then be transformed into a form of support for the efforts made by planners in the development of water resources".80/

4. State of progress in the planning of water resource management in Latin America and the Caribbean

A total of eight countries in the region have formulated or are in the process of formulating plans for the management of their water resources at national and multisectoral levels: Colombia, Ecuador, El Salvador, Honduras, Jamaica, Mexico, Peru and Venezuela. Another two countries, Argentina and the Dominican Republic, intend to initiate them in the future.

Practically all the countries of the region have formulated one or more plans for the management of their water resources, which have had national but not sectoral coverage. These plans mainly relate to the subsectors of hydroenergy, irrigation and drainage, and drinking water supply and sanitation. The formulation of plans in this last subsector was stimulated by the International Drinking Water Supply and Sanitation Decade.

All the countries of the region have experienced in the formulation of plans for the multiple or sectoral utilization of water at river basin level, both national and international. At national level, for example, there has been the formulation of plans for the development of the valley and basin of the River San Francisco in Brazil; the valley and basins of the River Cauca in Colombia and the basin of the River Guayas in Ecuador.

In some countries sectoral plans, mainly directed to energy or irrigation, have completely dominated strategies in the field of water. In these cases a single sector directs the water management plan and is so strong that it comes to have influence and priority even in the activities of regional or national development.

a) Procedures used in the formulation of plans for water resource management

i) The most frequently used measure has been the creation of "national co-ordination commissions" to formulate the plan. The members of these commissions are usually the directors of the different water-using sectors and have some type of executive secretariat. The head of the commission is generally a representative of the central planning sector or of a body responsible for the management of the resource (agriculture, environment) or of an institute specialized in water resources.

ii) One of the main benefits obtained on the initiation of a plan of national and multisectoral nature is the very fact that a national mechanism to co-ordinate water-resource activities is set up which was previously non-existent. This applies equally to planning processes in regions or in river basins.

iii) For a co-ordination commission to be successful it needs: i) to be created and to function at the highest level; ii) to have a specific budget to formulate the plan; iii) to have an executive secretariat with permanent staff, and iv) to have the effective participation of all the sectors involved in the formulation of the plan. As regards this last point, it may be said that if the user sectors do not participate in its formulation it is most unlikely that the plan will be taken into account in practice and the effect of an awareness of the multisectoral use of water will also be lost. Thus it is indispensable that the members of the commission should be the directors or heads of each user sector and not a representative.

b) The structure and content of the plans for water-resource management at national and multisectoral level

i) It has been noted that the structure of the plans follows a uniform pattern: in a first phase the water-related regions are marked out; in a second phase a diagnosis is made which includes the study of the water supply and demand in each region and among water-related regions for different time horizons; and in a third phase, strategies or policies are formulated to harmonize water supply and demand in the short, medium and long term.

ii) A plan without strategies or policies for the harmonization of water supply and demand should not be regarded as such. In practice, however, there are numerous documents under the name of plans despite the fact that they merely reach the diagnosis phase. Moreover, several plans which incorporate strategies limit themselves to a consideration of alternatives for increasing the supply of water through giving priority to investment in hydraulic works, and do not present alternatives for the regulation or control of the growth of demand for water, that is, for an increase in efficiency in the use of the systems constructed or a setting of limits to growth in specific urban, industrial or other areas.

iii) The so-called "incorporation of the environmental dimension" in the plans has a varied scope. In actual fact it is not an explicit or integral incorporation, even when it is directed to the management and control of environmental aspects such as water pollution problems (which affect health), problems of erosion and sedimentation, problems of land salinization, problems of overexploitation of groundwater aquifers and saline intrusion and problems concerning the conservation and preservation of water for ecological purposes.

iv) In almost all the plans, excepting the Water Plan of Mexico, too little consideration is given to the design of strategies for the operation and maintenance of hydraulic works in existence and the management and conservation of water resources, particularly in the catchment areas of the rivers. This is reflected in the meagre budgetary allocation of the governments to the performance of these activities, which contrasts with the high investment assigned to the construction of new hydraulic works.

c) The relative usefulness of plans for water-resource management

i) A plan for water resource management will be useful to the extent that it is used to take decisions which favour the socioeconomic development of a country or region and to avoid or prevent conflicts in the use of water. The policies that can be applied for this purpose, as was mentioned above, are aimed at increasing and controlling the supply of water and managing or controlling the demand.

ii) It is evident, however, that management plans in the region have been formulated or utilized almost exclusively to direct investment policies to increase the water supply and hardly at all to control the demand for water. Hence it can be stated that what has been done hitherto in the field of water resource management has been insufficient to avoid or prevent conflicts arising from an exponential growth in demands for water and to mitigate the effect of natural phenomena such as floods, droughts, and pollution problems.

iii) Nevertheless, it is clear that the increase in the demands for water in quality and quantity, above all in the large urban centres, can no longer be met merely by the construction of new and more costly hydraulic works. The solution inevitably calls for the application of strategies combining these works with a reduction in the demand. This reduction implies the creation of alternatives for improving the efficiency of water use, along with other more drastic measures to restrict its growth. The countries should draw up and establish this type of alternative in order to achieve a real "management of the resource" in their territories.

iv) Experience shows that despite the availability of national plans for water resource management, including the most complete and ideal, there has been no guarantee of their application. This is mainly due to the scant political usefulness of the plans, particularly when they suggest measures for controlling demand, as for example, through an increase in water charges, population redistribution, crop displacement, embargoes on the use of groundwater and other types of rationing. As regards the increase of the water supply, the most effective measure has apparently been the formulation and application of management plans for river basins or regions or for water-using sectors. In most of these cases the plan or programme is based on one or more concrete projects which are already accepted by public opinion or existing policies. The plan then serves to make requests viable and to incorporate complementary strategies.

v) It is also clear that measures for restricting demand have been applied in the region only when the situations of conflict in the use of water have become untenable, as in periods of drought and in general when demand exceeds supply. On these occasions strategies are put forward which should have been applied before in order to avoid the problem. This reveals a need for greater political and public awareness, in order to prevent conflictive situations. This promotion of awareness should therefore be a fundamental part of the formulation of the plans.

vi) It is obvious, likewise, that several of the plans studies are of little use from a political standpoint because they do not include strategies viable within a specific government period. Generally speaking they are only concerned with

planning long-term measures, without establishing a sufficient nexus between these measures and those of the short and medium term, that is, with the government in power. This robs the plan of its political weight since it does not take into account that long-term measures must be initiated in the short term.

vii) In practice a government has very little choice in the construction of large water projects, mainly because it inherits those already initiated under previous governments, but it can certainly make considerable improvements in the efficacy of water use and carefully programme the commencement of new works. This should be taken into account in order to improve the probabilities of application and facilitate the procurement of support for the implementation of the measures recommended.

viii) None of the above statements invalidate the importance and necessity of drawing up national plans for the management of water resources; on the contrary, they confirm the need. It is obvious, however, that the application of the plans can and should be improved, by implementing, in its context and with greater scope, the phase of formulation of strategies or policies and, within these, by giving more consideration to the strategies for the control of water supply and demand, in order to provide viable alternatives to the policies, and to create a public consciousness of the importance of water as a vital factor for development.

d) The linkages between plans for water-resource management and plans for socioeconomic development

i) In most of the plans for water resource management studied there has been no clear linkage with those for socioeconomic development. This lack of association is particularly observable in the need felt by the planners to project the demand for water in the medium and long term by resorting to the formulation of their own prospective models.

ii) In regions where socioeconomic growth has depended heavily on the control and use of water --as in arid or semi-arid zones or in flood-prone areas-- it is noteworthy that the plans have concentrated on creating alternatives for exercising this control. Subsequently, and only when the restriction of water has reached its limits, have plans been undertaken for regional development. In these cases regional planning has been adapted and conditioned to the plans for water management.

iii) In some sectors, especially those of energy and agriculture, the perfecting of demand projects has continued along with the selection and ranking of zones in which the projects can be established. In these cases the relationship between water management plans and development plans is more precise. The progress made in the formulation of plans for water resource management by sectors facilitates the improvement of this relationship.

iv) As long as there is a lack of instruments to improve co-ordination between socioeconomic development plans and water resource management plans, it is advisable that there should at least be a record kept of water supplies and demands --actual and projected-- in each river basin or water-related region, including all the existing and proposed projects for harmonizing these supplies and demands. The

permanent register of projects according to basins will at least help to avoid conflicts on the multisectoral use of water in the region.

Despite the powerful reasons put forward in favour of planning, there are few signs that this has had any significant influence on the policies for the development and management of water and water-related resources or on the application of these policies. Although there are no studies on the linkage of the national plans for water resource management with the decision-taking on policies and their application to the development and management of these resources, specific observations made on what has happened in the water sector in the region would support the opinion of the sceptics, outlined in the introduction to this paper, to the effect that the plans are frequently not inserted in the decision-making process which determines the way in which renewable resources are administered in practice. These observations include the unco-ordinated use for a single purpose of the same water resource by independent users; the scant attention paid to questions which have a bearing on the degradation of the upper river basin; the great importance attached to new capital projects at the expense of the performance and maintenance of existing projects; the tendency to concentrate resources on large projects and to overlook opportunities for achieving a greater dispersion and mobilization of local initiative; the importance given to increasing the supply of water-related services without paying due attention to policies which regulate demand and stimulate an efficient use.

This study has insisted, on the basis of well-founded arguments, on the importance of the planning of water resources at all administrative levels. There must be integration between these levels and the planning itself must be integrated with that of other renewable resources; it is likewise necessary to establish concrete linkages with the national and regional plans for economic development. Very considerable resources are devoted to the planning of water use in the region, although it is far from clear whether the resulting plans lead to the adoption of more efficient decisions on the utilization and management of water from the standpoint of the objectives of economic and social development.

A systematic analysis needs to be made of: i) the way in which water resource planning is carried out; and ii) the relationship between the planning process and the decision-making process which determines, in the first place, the concrete policies aimed at harmonizing supply and demand in respect of water-related services, and, in the second place, the way in which these policies operate in practice for those in the community (intra- and inter-generational) who are winners or losers in the solution of the inevitable conflicts of interests.

The analysis of experiences proposed here is regarded as a dynamic process which, from the outset, would assume the participation of the "actors" in the planning of water use and in the formulation and application of a policy in that sector. The first step would consist of a set of national monographs on the subject. The instruments for this stage would be horizontal co-operation through which a common methodology would be prepared with a group of local consultants from different countries in a short preparatory course. The local consultants, with the help of participants from all the national sectors and international specialists, would carry out the different studies.

The results of this work would be assessed halfway through the period, and, if it were necessary to complement it, the studies carried out for the said purpose would be directed vertically, that is, to the detailed study of specific aspects, or horizontally to obtain a greater geographical spread in the region.

5. The next steps

Interest in planning the management of water resources in Latin America and the Caribbean has certainly been on the increase. This has been mainly due to the increasing conflicts in respect of its development and control. Besides, the rise in the demand for water and the growing difficulties in satisfying it with the hydraulic works conventionally used to obtain and control more water resources --which are becoming more scarce and distant and therefore more costly-- have aroused the interest of the countries in improving the operation and maintenance of their already available water systems and in the better management and conservation of their surface and underground catchment areas. This alternative course is only recently being undertaken in many places and hence its effect is still very slight. In addition to the foregoing there is the increasing pressure to give more consideration to the interests of the inhabitants of the regions from which the water is obtained --especially those of the inhabitants of the upper basins and the basins in which large hydroelectric power stations are installed to "export" energy-- coupled with those of organizations concerned for the incorporation of greater environmental considerations.

All this, in the present context of a scarcity of economic resources to facilitate new and large investments and of social pressure to provide more equitable access to resource allocation, compels the governments to take effective measures for the regulation of water use. In practice it can be seen that they have been doing this and it is to be hoped that the work will continue and that the experience accumulated will be transmitted from one country to another. To achieve this it is suggested that as a first step a network of horizontal co-operation should be established between the government agencies responsible for the development and conservation of water resources in the region with emphasis on the role of water as an essential resource for development and human life.

Notes

- 1/ See Heyck, and Report on World Development, 1983.
- 2/ ECLAC, Las necesidades financieras del Decenio Internacional del Agua Potable y del Saneamiento Ambiental en América Latina, E/CEPAL/G.1165, 26 February 1981, table 5, p. 11.
- 3/ Ibid., table 11, p. 18.
- 4/ Miguel S. Wionczek, "La aportación de la política hidráulica entre 1925 y 1970 a la actual crisis mexicana", Comercio Exterior, vol. 32, No. 4, Mexico, April 1982.
- 5/ Ministry of Agriculture and Food, Dirección General de Aguas y Suelos, "Análisis sistemático de la problemática para el desarrollo, uso y conservación de los recursos agua y suelo", internal document prepared by A. Dourojeanni and J. Yáñez, Lima, March 1979.
- 6/ Marc Dourojeanni, Recursos naturales y desarrollo en América Latina y el Caribe, University of Lima, Dirección de Proyección Social, Lima, 1982, table 41, p. 116.
- 7/ Ibid., tables 42 and 43, p. 117.
- 8/ World Bank, Report on world development 1982 (ISBN 0-8213-0087-3; ISSN 0271-1737), Washington, D.C., 1982.
- 9/ OLADE-ECLAC, Hydro power: Energy Alternative and Industrial and Financial Challenge for Latin America, Quito, 1981, table 2.1, p. 7.
- 10/ Council on Environmental Quality and Secretariat of State, The World in the year 2000: President's Report, vol. 1, Washington, D.C., 23 May 1977.
- 11/ Aaron, Wiener, The Role of Water in Development. An Analysis of Principles of Comprehensive Planning, McGraw Hill Book Company, New York, 1972.
- 12/ Instituto Nacional de Ciencia y Técnica Hídricas, Centro de Economía, Legislación y Administración del Agua, Mar del Plata Action Plan, CELA/Do/14/1978, Mendoza, 1978, clause 41.
- 13/ Ibid., clause 43.
- 14/ Instituto Nacional de Ciencia y Técnica Hídricas, Centro de Economía, Legislación y Administración del Agua, Mar del Plata Action Plan, CELA/Do/14/1978, Mendoza, 1978, clause 47.
- 15/ Ibid., clause 50.
- 16/ The questionnaire was requested by the ACC Intersecretariat Group for Water Resources in compliance with resolution 34/191 of the General Assembly, 18 December 1979, entitled "Medidas complementarias y ejecución del Plan de Acción de Mar del Plata de la Conferencia de las Naciones Unidas sobre el Agua".
- 17/ In compliance with resolution 411 (XVIII), relating to the organization for stimulating the application of the Mar del Plata Action Plan.
- 18/ Miguel S. Wionczek, "La aportación de la política hidráulica entre 1925 y 1970 a la actual crisis agrícola mexicana", Comercio Exterior, vol. 32, No. 4, Mexico, April 1982, pp. 394-409.
- 19/ Subsecretaría de Planeación, Secretaría de Recursos Hidráulicos, "Plan Nacional Hidráulico 1975", Mexico, D.F., July 1976.
- 20/ Instituto Nacional de Ciencia y Técnica Hídricas (INCYTH), Centro de Economía, Legislación y Administración del Agua, various publications 1973-1983, Mendoza.
- 21/ Axel Dourojeanni, La planificación para el desarrollo, aprovechamiento, y manejo de los recursos hídricos, CDA-24, ECLAC, Santiago, Chile, November 1980.

- 22/ Fernando González Villarreal, "Central Planning in Water Resources Development", United Nations publication, Water Resources Planning. Experiences in a National and Regional Context, TCD/SEM.80/1, New York, 1980.
- 23/ Sandro Petricione, "Water Management Planning: The Regional and Central Approach", United Nations publication, Water Resources Planning. Experiences in a National and Regional Context, TCD/SEM.80/1, New York, 1980.
- 24/ United Nations, "The Demand for Water: Procedures and Methodologies for Projecting Water Demands in the Context of Regional and National Planning", Natural Resources/Water Series No.3, Doc. ST/ESA/38, New York, 1976; John C. Kammerer, "Estimated Demand of Water for Different Purposes", Water for Human Consumption, Report of the IVth World Congress of I.W.R.A., 3 to 12 September 1982, Argentina.
- 25/ Institute for Land Reclamation and Improvement (ILRI), Framework for Regional Planning in Developing Countries, No. 26, Wageningen, The Netherlands, J.M. van Staveren and D.V.W.M. van Dusseldorp, Eds., 1983.
- 26/ United Nations, Department of Economic and Social Affairs, "Integrated River Basin Development", Report of a Panel of Experts, New York, 1970.
- 27/ Gunther Schramm, "Integrated River Basin Planning in a Holistic Universe", Natural Resources Journal, Vol. 20, October 1980.
- 28/ Comisión del Plan Nacional Hidráulico, Secretaría de Agricultura y Recursos Hidráulicos, Plan Nacional Hidráulico 1981, Mexico D.F., March 1981. It should be noted, however, that this plan is a second version; the first was published around 1957. This means that Mexico began the planning of its water resources long before the United Nations Water Conference.
- 29/ Comisión del Plan Nacional de Aprovechamiento de los Recursos Hidráulicos (COPLANARH), Plan Nacional de Aprovechamiento de los Recursos Hidráulicos, Vol. 1, El Plan, Caracas, 1972.
- 30/ Comisión Multisectorial del Plan Nacional de Ordenamiento de los Recursos Hidráulicos, Plan Nacional de Ordenamiento de los Recursos Hidráulicos, Bases técnicas y económicas para su formulación, Lima, 1977.
- 31/ United Nations, El Salvador: Plan maestro de desarrollo y aprovechamiento de los recursos hídricos. Conclusiones y recomendaciones del Proyecto, New York, 1983.
- 32/ Dirección de Planificación del Instituto Nacional Ecuatoriano de Recursos Hidráulicos (INERHI), "Marco general para la elaboración del Plan Nacional Hidráulico", Documento PNRH 6, Quito, August 1981.
- 33/ Departamento Nacional de Planeación, Plan nacional de aguas. Términos de referencia, Bogotá, January 1982.
- 34/ Secretaría Técnica del Consejo Superior de Planificación Económica (CONSUPLANE), Plan Nacional de Recursos Hídricos 1979-1983, Tegucigalpa.
- 35/ UNDP, "National Water Resources Development Master Plan" project document, New York, January 1984.
- 36/ Instituto de Cooperación para la Agricultura/Instituto Nacional de Recursos Hidráulicos, "Lineamientos para un Plan Nacional de Recursos Hidráulicos y Recursos Naturales relacionados para la República Dominicana", document prepared by Professor Warren A. Hall, Santo Domingo, March 1981.
- 37/ In general the term "ordenamiento" would seem to be the most appropriate in Spanish since it does not limit the plan to water use, as does the term "aprovechamiento", but permits the inclusion of other aspects associated with conservation, preservation and protection of the environment and prevention and control of adverse natural phenomena such as floods, droughts and the like. The term "aprovechamiento" however, is also considered adequate if it is implicitly assumed that it refers to a rational use that includes the aspects mentioned in "ordenamiento". The term

"desarrollo" is not considered necessary or even suitable for inclusion since natural resources such as water are not "desarrollados" per se but rather utilized for the purposes of development. It is apparently a literal translation of the phrase "Water Resource Development" commonly used in English. The omission of a qualifying term is also somewhat undesirable since there are no "resource plans" but plans to do something with resources, although in practice this is quite understood. As regards the terms "agua", "hidráulico" and "hídrico", the dictionary of the Real Academia de la Lengua states that the term "hidráulico" has a connotation of "arte de conducir, contener, elevar y aprovechar las aguas" and would therefore exclude the idea of preservation, conservation and protection of the quality and quantity of water (environmental aspects) and would rather be focused on fluid mechanics. For this reason, as a variant of the term "agua" and to convey the idea of value to society, Latin America commonly uses the term "Recursos Hídricos" although this does not figure in the official dictionary and is also a translation adapted from the English phrase "Water Resources".

38/ COMPLANORH, "Plan nacional de ordenamiento de los recursos hidráulicos", Lima, August 1977, p. XI.

39/ COPLANARH, "Plan nacional de aprovechamiento de los recursos hidráulicos", Caracas, 1972.

40/ Departamento Nacional de Planeación, "Plan nacional de aguas - términos de referencia", Bogotá, January 1982.

41/ UNDP, "Plan maestro de desarrollo y aprovechamiento de los recursos hídricos", project document, San Salvador, March 1979.

42/ Comisión Nacional del Plan Nacional Hidráulico, Plan nacional hidráulico 1981, Mexico D.F., March 1981.

43/ Some important aspects of the Mexican plan are given in annex 1.

44/ The documents relating to the Cuban plan are not for publication.

45/ UNDP, "National Water Resources Development Master Plan", Project document, New York, January 1984.

46/ Instituto Nacional de Planificación del Perú (INP), "Plan nacional de ordenamiento de los recursos hidráulicos", Bases técnicas y económicas para su formulación, COMPLANORH, Lima, August, 1977.

47/ Ministry of Agriculture and Food, "Análisis sistemático de la problemática para el desarrollo, uso y conservación de los recursos agua y suelo", Lima, 1979.

48/ Ibid., "Plan nacional de rehabilitación de tierras costeras - PLANREHATIC", project financed by the World Bank, Lima, 1979.

49/ This is undoubtedly the weakest aspect of the plans for water resource management in the region and likewise the key factor that needs improvement.

50/ Universidad del Pacífico, Estudio sobre las perspectivas y alcances del proyecto Majes-Siguas, Centro de Investigación, Lima, 15 February 1980.

51/ Frequently this happens because the State directs the action of the public sectors towards "priority development areas" without specifying or establishing interinstitutional co-ordination mechanisms for working simultaneously in the areas selected.

52/ United Nations, ECLAC, "Proyecto regional de interconexión eléctrica del Istmo Centroamericano", Mexico, March 1979.

53/ Ministry of Energy and Mines of Peru, Evaluación del potencial hidroeléctrico nacional, 19 volumes, Lima, 1974.

54/ The "HEC-4" (originating in the Hydrologic Engineering Center, of the United States Engineering Corps in California) is a monthly autoregressive stochastic model, multivariate, which generates synthetic sequences of a hydrologic variable, and fills information gaps by employing correlations with other stations.

- 55/ Hydrocomp, "Microprocessors in Simulation", Newsletter Mountain View, California, April 1983.
- 56/ Ministry of Economy, "Plan nacional de equipamiento para los sistemas de generación y transmisión de energía eléctrica, período 1979-2000 - Descripción metodológica - Módulos utilizados - Producción hidroenergética", Buenos Aires, September 1979, P. 105.
- 57/ INERHI, "Experiencias en planificación hidráulica en el Ecuador", Written communication, Quito, July 1983.
- 58/ IPEA-IPLAN-CPS, "SME: energía eléctrica na década dos 70", Brasília D.F., March 1982.
- 59/ United Nations, "Istmo Centroamericano. Programa de evaluación de recursos hidráulicos", Informe regional, New York, November 1978.
- 60/ Ministry of the Interior, Companhia do Desenvolvimento do Vale do São Francisco - CODEVASF, "Inventario do projetos de irrigação", Brazil, 1982.
- 61/ Ministry of the Interior, "Projeto do I Plano Nacional de Irrigação -IPNI-1982-1986", Brasília, 1982.
- 62/ Secretarías de Planeamiento y de Agricultura del Estado de Piauí, "Programa Estadual de Irrigação e Recursos Hídricos - PROIRPI", Decree 4903 of 21 May 1982, Piauí.
- 63/ Both the Instituto Interamericano de Cooperación Agrícola (IICA) of the OAS and FAO are agencies which actively promote this type of activity in Latin America.
- 64/ ECLAC, Agua potable y saneamiento ambiental en América Latina 1981-1990, Estudios e Informes de la CEPAL, No. 25, June 1983.
- 65/ ECLAC, The provision of drinking water and sanitation to the rural population in Latin America, Interregional Seminar on Rural Water Supply, Uppsala, Sweden, October 1980 (E/CEPAL/L.232).
- 66/ Argentine Republic, "Evaluación del estado actual de los servicios de abastecimiento de agua y saneamiento y de las previsiones de desarrollo sectorial", International Drinking Water Supply and Sanitation Decade, Buenos Aires, November 1978.
- 67/ Servicio Nacional de Agua Potable (SNAP), "Plan nacional de agua potable", Buenos Aires, 1972.
- 68/ Instituto Ecuatoriano de Recursos Hidráulicos (INERHI), "Experiencias en planificación hidráulica en el Ecuador", Written communication, Quito, 1983.
- 69/ Instituto Nacional de Fomento Municipal (INSFOPAL), "Informe", Written communication, Bogotá, May 1983.
- 70/ ECLAC, Avances hacia el logro de los objetivos del Decenio Internacional del Agua Potable y del Saneamiento Ambiental, 1980-1983, E/CEPAL/G.1263, December 1983.
- 71/ ECLAC, Agua potable y saneamiento ambiental..., op. cit.
- 72/ OAS, op. cit.
- 73/ INERHI, "Experiencias en planificación hidráulica en el Ecuador", Written communication, Quito, July 1983.
- 74/ SUVALE, Reconhecimento dos recursos hidráulicos e de solos da Bacia do Rio São Francisco, Rio de Janeiro, 1970.
- 75/ OAS, op. cit.
- 76/ Colombia Information Service, "Colombia's Cauca Valley to benefit from Salvajina Multipurpose Project", Colombia Today, vol. 18, No. 5, New York, 1983.
- 77/ Gunther Schramm, op. cit.
- 78/ Instituto Nacional de Planificación (INP), "Plan nacional de regionalización del Perú", Diario Oficial El Peruano, Lima, February 1983.
- 79/ P.P. Azpúrua and A.J. Gabaldón, Recursos hidráulicos y desarrollo, Ed. Tecnos, Madrid 1975.
- 80/ Comisión del Plan Nacional Hidráulico, "Plan nacional hidráulico", Mexico, D.F., March 1981, p. 130.

