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9. ABSTRACT <p>Examines means for improving water management at the small farm level in Ecuador. The objectives of the study were to discover the different types of irrigation institutions operating in the Andean Region of South America, to identify the relationships between them and water users, and to identify common characteristics of irrigation organizations which facilitate or inhibit the efficient use and management of water. Part one describes the geography, climate, population, agriculture, water resources, and irrigation institutions in Ecuador. Part II is an analysis of the survey data from thirty-five organizations and one hundred seventy-one personal interviews. Comparative costs of operation and maintenance of systems, forms of payments of water fees by users, comparative user attitudes, and life-style, and comparisons of delivery infrastructure characteristics are discussed. Recommended assistance which a government program could offer a private irrigation institution are presented. The appendix contains the two questionnaires and comparative readout tables prepared from the statistical results of the field surveys in Bolivia, Chile, Colombia, and Ecuador.</p>		
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IRRIGATION INSTITUTIONS
AND
WATER USERS IN ECUADOR

by

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The contents and conclusions of this report do not necessarily represent the views of USAID or Utah State University.

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P A R T I

GENERAL INFORMATION

INTRODUCTION

Improving efficiency in the distribution of irrigation water is a significant aspect of increasing food production, especially in the small farm sector in Latin America.

Under contract AID/ta-c-1103, Utah State University has investigated means for improving water management at the small farm level in Latin America.

One component in Utah State University's research activities consisted of empirical studies of small farm irrigation organizations. These studies were preceded by a theoretical analysis of water laws in the Andean Pact countries.

In general terms, the objective of this study of irrigation institutions was to discover the different types of these organizations which operate in the Andean Region of South America and identify the relationships between them and water users. The study was also designed in such a manner that the data would identify common characteristics of irrigation organizations which facilitate or inhibit the efficient use and management of water. It is hoped that this study provides the basis for future detailed studies in this area of interest.

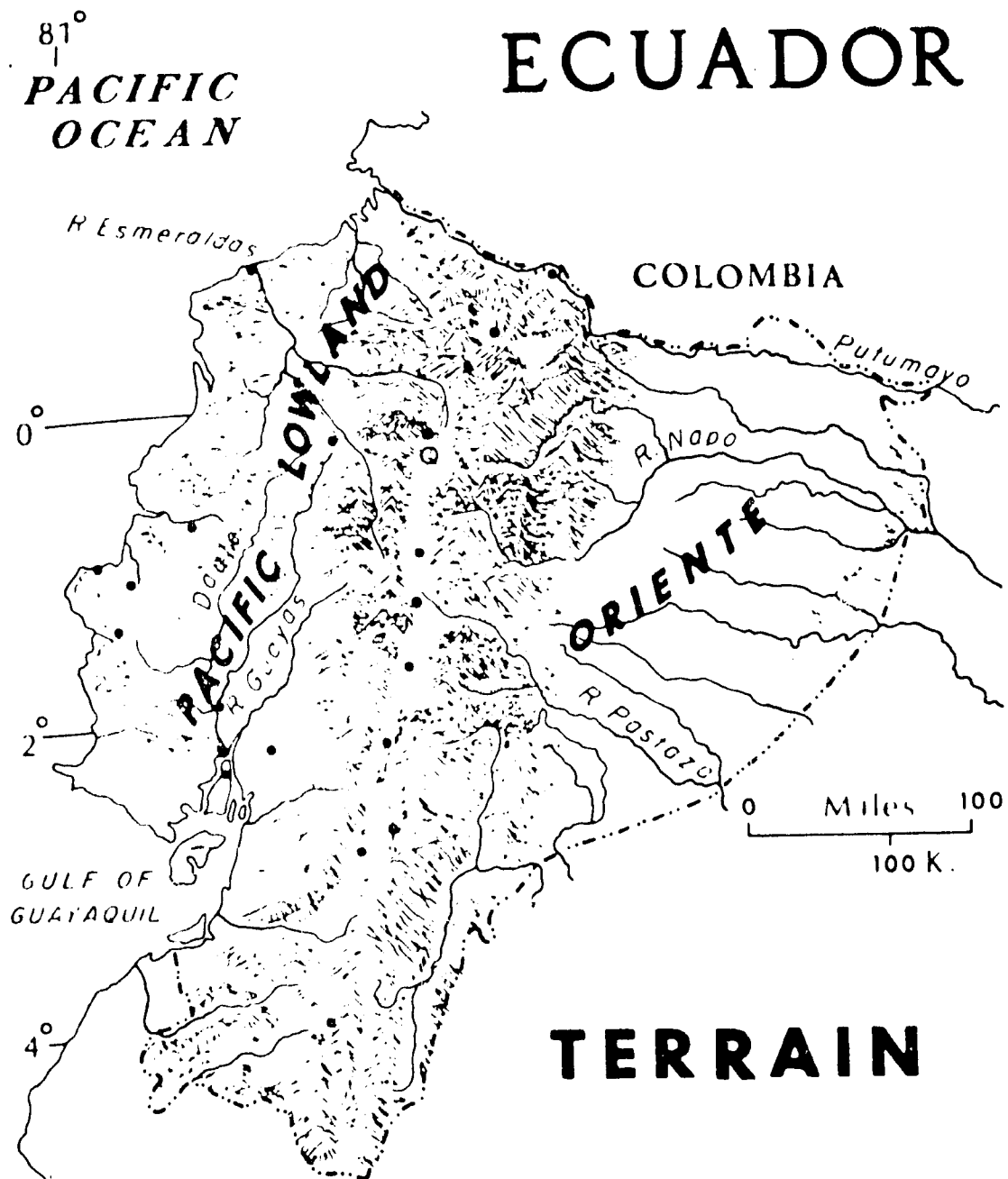
This report deals only with irrigation organizations in Ecuador, the primary country included in the study. It is the result of an analysis of all the information generated in Ecuador during the research period. The following sections of Part I review general information regarding Ecuador with special emphasis on irrigation and agriculture. They provide background information which helps form a basis for understanding the data analysis of Part II.

GEOGRAPHY

Ecuador, the second smallest country in South America, is bordered on the north by Colombia and on the east and south by Perú. The Pacific Ocean forms her western border. The total land area is 109,483 square miles and is divided into three distinct areas; the Sierra, Coast, and Oriente. The Galápagos Islands, lying some 600 miles off the Pacific shore, also belong to Ecuador. However, we shall only be concerned with the continental territory in this section.

Similar to her Andean neighbors, the giant Andes form the backbone of Ecuador, running north and south through the center of the country in two parallel cordilleras or ranges. Between these Andean peaks lie the inter-mountain basins. These mountain valleys average approximately 8,000 feet in altitude and are the population centers in the sierra, or highlands. Surrounding these basins are numerous volcanoes which cap both cordilleras. Chimborazo, the highest of these volcanoes, rises 20,577 feet above sea level.





Immediately west of the high sierra lies the coastal plain called costa, which consists of swampy lowlands and low rolling hills. Two primary rivers flow into the Pacific from this region. To the north the Esmeraldas River provides natural drainage for the upper portion of the country. The huge Guayas River to the south is the largest river flowing into the Pacific Ocean in South America, draining approximately two-thirds of the country west of the Andes.

Opposite the coastal plain, to the east of the high cordilleras lies the nearly impenetrable oriente, a tropical rainforest in the upper Amazon Basin.

The oriente is only sparsely populated by scattered Indian tribes. However, it is an area rich in natural resources. Since 1972 Ecuador has been exporting petroleum from vast oil fields in the oriente, and this resource has proven to be a valuable asset and source of income for the national government.

CLIMATE

In some regards, Ecuador's climate conditions are as diverse as its distinctive geography and topography. Its location along the Equator, the high Andes cutting through the country, and the climatic effects of the Humboldt and El Niño ocean currents off the Pacific shore, are responsible for this diversity. Generally speaking there are only two annual seasons throughout the country. They are verano, the dry season of relatively little rainfall, and invierno, the rainy season. These generally run from June through October and November through May, respectively.

Due to their low altitudes, the coast and oriente are generally classified as tropical. It is interesting to note, however, that as one moves southward a relatively short distance along Ecuador's coastal plain the climate changes from tropical rainforest in the north to desert in the south.

On the other hand, Ecuador's sierra enjoys a climate which has often been described as eternal spring. A series of mini-climates ranging from north to south along the highland basins account for slight variations in this pattern, but generally the sierra is characterized as sunny, even though there are some rainy days and cool nights. Although the amount of rainfall is less in verano than invierno, the weather in the highlands is nearly constant year-round, a condition which would permit two harvests per year in most areas, especially with supplemental irrigation.

POPULATION

According to figures taken from the latest population census of 1974, Ecuador has a total population of 6,552,046 of which 59 percent are classified as rural and 41 percent as urban. Of the total population, 49 percent inhabit the coastal plain, nearly one half of whom live in the province of Guayas surrounding the important port city of Guayaquil, the largest city in Ecuador. Forty-eight percent of the Ecuadorians reside in the high mountain basins of the sierra, the area of traditional Indian habitation. In fact, the coastal plain has

only reached importance as an area of general settlement during the past few decades. The oriente and Galápagos Islands account for the remaining three percent of Ecuador's total population.¹

Data from the 1974 census indicate that of the population which is economically active, 46 percent are engaged in agriculture, hunting, and fishing. Several other reliable sources estimate that of the total population, 54 percent are involved directly in agriculture. The vast majority of these people are small farmers with land holdings of less than five hectares*.²

AGRICULTURE

It is interesting to observe that the Ecuadorian sierra has traditionally been an agricultural area. The cool yet somewhat moist climate is ideal for a wide variety of crops, many which are grown without artificial irrigation. Corn, potatoes, other vegetables, wheat, barley, fruits, and alfalfa are the most common crops. Most of these crops are either consumed by the farmer himself, or sold to local markets for local consumption. Very little of these products reach international markets. In addition, the dairy industry is also very significant in the sierra.

On the other hand, due to its more humid tropical climate, the coastal plain produces an abundance of bananas, rice, and sugar cane.

* 1 hectare = 2.5 acres

Ecuador is the world's largest producer and exporter of bananas. Coffee and cacao are also important cash crops which are exported.

In recent years, the coast has become more and more important as an agricultural region, but there are several physical factors which impede farming. In the huge Guayas Basin, heavy rains and runoff during the invierno create a flood plain in the entire basin, and inadequate drainage poses a severe problem to agricultural development. On the other hand, the dry months of verano make artificial irrigation necessary. Construction of drainage and irrigation infrastructure on such a large scale is costly and time-consuming and creates a tremendous challenge for the future economic development of the basin.

Agriculturally speaking, the oriente of Ecuador is insignificant, although its oil reserves and forest resources make it a valuable economic asset to the nation.

Farm size and farm unit statistics taken from the 1968 National Agricultural Survey may also help describe the status of agriculture in Ecuador.

TABLE 1
Farm Size and Number of Farm Units in Ecuador

Size of Farm (Ha.)	Farm Units		Area	
	No.	Percentage	In 1,000 ha.	Percentage
Less than 1.0	206,273	32.6	93.0	1.3
1.0 - 4.9	264,074	41.7	615.6	8.9
5.0 - 9.9	68,527	10.8	466.3	6.7
10.0 - 19.9	36,228	5.7	485.6	7.0
20.0 - 49.9	32,746	5.2	1,018.3	14.7
50.0 - 99.9	15,555	2.5	976.7	14.1
100.0 - 499.9	8,467	1.3	1,647.9	23.8
500.0 - 999.9	922	0.1	634.6	9.1
1,000.0 and more	426	0.1	999.6	14.4
Total	633,218	100.0	6,937.5	100.0

Source: Encuesta Agropecuaria Nacional 1968, Cuadro No. 1, p. 1

The table indicates there are approximately 6,900,000 hectares of farmland in Ecuador and some 633,200 individual farm units. The most striking feature of the table is the inequality of land distribution by farm sizes. Those farm units of less than 10 hectares each, minifundios, comprise 85 percent of the total yet occupy only 17 percent of the total farmland. In contrast, the medium and large multi-family farms (50 hectares and above) occupy 61 percent of the land but are only four percent of the total farm units.

This wide disparity has existed in Ecuador since the colonial era and will likely continue unless more stringent agrarian reform measures are taken. Although an agrarian reform law was established in 1964, to the present it has not been successfully implemented.

The real problem areas of minifundio are concentrated in the traditionally populated sierra, especially in the provinces of Cotopaxi, Chimborazo, Tungurahua, Cañar, and Azuay, all centers of Indian habitation. The costa, a relatively new agricultural area, is characterized by slightly larger average-sized farm plots, although many small farms exist there as well.

WATER RESOURCES

Ecuador has an abundance of water resources. In fact, as has been indicated previously, during the rainy invierno, too much water is often the problem. In addition to the abundant rainfall there are a number of lakes located in the sierra region whose resources have been relatively untapped to the present.

Eighty-four separate river basins have been mapped in Ecuador, the majority of which flow westerly into the Pacific Ocean. A few of these are only small intermittent streams. However, the 11 most important rivers flowing into the Pacific discharge some $107,039 \times 10^6 \text{ m}^3$ yearly, while the three large rivers flowing east to the Amazon have an annual flow of $98,245 \times 10^6 \text{ m}^3$.³

Few dams of any consequence have been constructed in the country, although CEDEGE (Study Commission for Development of the Guayas River Basin) is currently planning the Daule-Peripe Project which will construct a large multi-purpose dam in the upper end of the Guayas Basin. Another large project is presently under construction at Pisayambo in

the sierra but will primarily be used for the generation of electrical power.

STATUS OF IRRIGATION

Irrigation has long been practiced in the Ecuadorian sierra. Since the pre-colonial period some Indians of the highlands have practiced irrigation in some form. Crude irrigation systems were constructed and operated by the Inca Empire, whose northern headquarters was located in Quito. Nearly all the old canals and ditches were later destroyed and virtually all the irrigation works in operation today have been constructed in the post-colonial and modern eras. In contrast, it has only been during the last three or four decades that irrigation systems have been constructed and utilized in the coastal area.

Up until 1944, irrigation development in Ecuador was entirely dependent upon the private sector. However, in August of that year an autonomous government entity called the National Bureau of Irrigation was created to construct irrigation projects through public means. This was in compliance with the Water Law of 1936 and the Irrigation and Drainage Law of 1944, which placed certain obligations upon the state to develop irrigation. Until its demise in 1966, this organization constructed six irrigation projects, four in the sierra and two on the coast.

The Ecuadorian Water Resources Institute (INERHI) was created on November 10, 1966. This new entity assumed the role of the old NBI

and was given additional responsibility for the control and development of all water resources in the country. A more complete description and analysis of INERHI will be treated in a following section.

To compare the current respective roles of the public and private sectors in irrigation delivery and use, the following table is helpful. It demonstrates that nationwide, the private sector is responsible for about 77 percent of the total irrigation in the country.

TABLE 2
Irrigated Cropland by Sector and Region*

<u>Sector</u>	<u>Coast</u>	<u>Sierra</u>	<u>Total</u>
Public	29,900	10,700	40,600
Private	<u>52,500</u>	<u>83,600</u>	<u>136,900</u>
National Total	82,400	94,300	177,500

* In hectares: 1 hectare equals 2.5 acres.⁴

The above table indicates the fundamentally important role the private sector plays in irrigation. One can also note that 53 percent of current irrigation is in the sierra with a close 47 percent in the costa. It is interesting to compare these percentages to the following: of the total population economically active in agriculture as referred to in a previous section, 57 percent are in the sierra and 49 percent on the costa. This indicates that although the

costa has more people actively involved in agriculture, there is less irrigation practiced than in the sierra. Again, all irrigation infrastructure on the coast has been constructed during the last 30 years.

One more figure is important to complete the status of irrigation picture in the country. Only some 3,800,000 hectares of the total farmland in Ecuador is actually cultivated.⁵ Dividing that into the total number of irrigated hectares as shown in the above table indicates that only 4.6 percent is irrigated, a rather low percentage.

TABLE 3

Cultivated and Irrigated Area in Ecuador

<u>Cultivated Area</u>	<u>Irrigated Area</u>	<u>Percentage</u>
3,800,000	177,000	4.67

Source: 3, p.90

A detailed description and analysis of the various institutions of both the public and private sectors which administer irrigation water delivery will be presented in following sections.

WATER RESOURCES INSTITUTIONS IN THE PUBLIC SECTOR

Policy Level

Although there are several public funded institutions which deal to some degree with water resources administration, this study will primarily concentrate on the Ecuadorian Water Resources Institute (hereafter referred to as INERHI) because of its predominant role as the national water policy making and policy implementation institution.

INERHI is a semiautonomous government institution attached to the Ministry of Agriculture but with independent control over its programs and revenue expenditure. It was created by executive decree on November 10, 1966, for the purpose of "executing the best possible beneficial use and protection of the water resources of the country, as an essential element for its (the country's) economic development."⁶

According to the law creating INERHI, it was given the following responsibilities and characteristics:

- (a) Execute a National Irrigation Plan in conformity with the General Plan of the Economic and Social development of the country, in cooperation with the Director General of Agriculture and the National Planning Board.
- (b) Plan, study, construct, and exploit irrigation and drainage systems on its own or in cooperation with other institutions or entities.

- (c) Establish, according to forthcoming regulations, technical norms and specifications for persons constructing irrigation and land reclamation systems.
- (d) Determine whether or not such construction projects are in conformity with these norms before construction begins.
- (e) Promote organizations or entities consisting of water users; establish norms for the administration and conservation of irrigation canals; and approve the internal regulations governing Water User Associations in the country according to law.
- (f) Carry out, in conjunction with the National Meteorological and Hydrology Service, the evaluation of the water resources of the nation; establish a complete inventory of these resources and maintain it current at all times.
- (g) Collaborate with other entities for the beneficial use and protection of river basins.
- (h) Promote the establishment of private and mixed irrigation enterprises, including capital assistance, and stimulate the investment of capital in irrigation works.
- (i) Study and determine water requirement needs in irrigation and other water uses in order to establish just limitations upon water use rights and adjoining rights of way; set sufficient reserves for the irrigation of dry lands and for all other purposes necessary for the development of the country.

- (j) Transact requests for water use right concessions.
- (k) Maintain a register of water use concessions granted by the State.
- (l) Lend technical assistance to public and private entities and to private persons as set forth in regulations.
- (m) Contract loans with national, foreign, and international entities for the funding of works which the Institute (INERHI) must execute to fulfill its responsibilities according to legally existing directives.
- (n) Levy a water use tariff on users for its (INERHI's) services, and fix the amounts of said tariffs.
- (o) Exercise all other functions which may be established for INERHI by law.⁷

In addition to the above responsibilities, INERHI was given even greater jurisdictions over Ecuador's water resources, including irrigation control, by the Water Law of 1972, Title XVIII, Article 79 of the law, places responsibility for its execution directly on INERHI. This law eradicated all previous water use rights of any nature, both legal and assumed, and declared all water resources to be the sole property of the State. Water use right concessions are granted to individuals or entities by the state through INERHI. This law also gives INERHI the legal authority and obligation to protect and study river basins and all other national water resources, direct and control irrigation water user entities, prevent the contamination of water resources, con-

trol the use of subterranean water, and ultimately, be the judge in first, second, and even final instances when any litigation over the law occurs.⁸

As near as possible this is a de jure description of INERHI's legal duties and obligations. A de facto evaluation of INERHI in fulfilling these charges will follow in a later section.

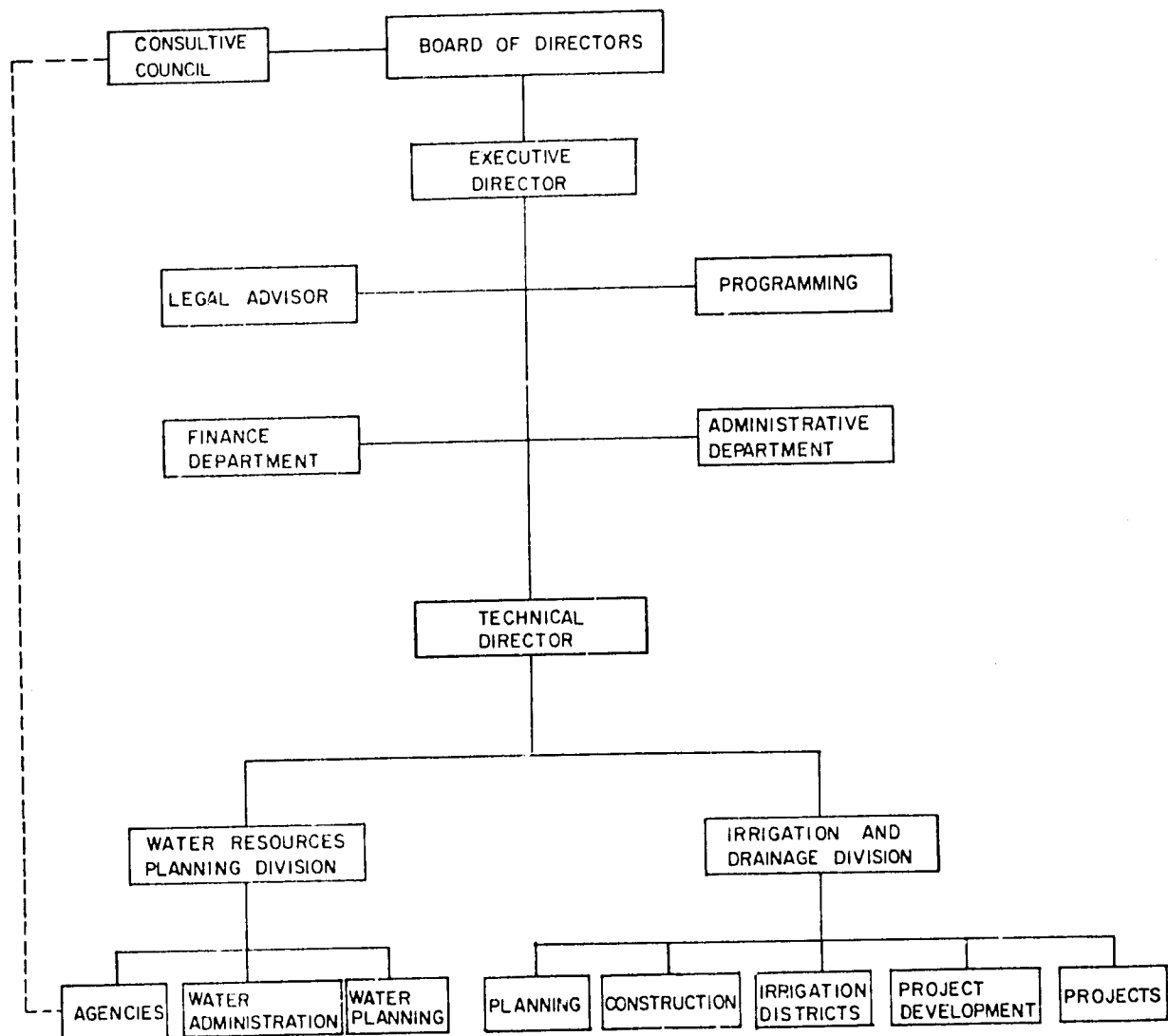
INERHI Organizational Structure

INERHI's organizational structure as set forth by law and legal regulations is as follows (See INERHI Organizational Diagram, Chart 1):

INERHI is governed by a five-man Board of Directors of which the President is the Minister of Agriculture. The other four members consist of: (1) a delegate from the National Planning Board, (2) the Executive Director of IERAC (Ecuadorian Agrarian Reform and Colonization Institute), (3) a representative from the agricultural business sector, and (4) the Manager of the National Development Bank or his representative. The Executive Director of INERHI is selected by the Minister of Agriculture and serves as Secretary of the Board. In his capacity as Secretary, he gives information and counsel but has no actual voting power.

It is important to note that Executive Decree No. 07 of January, 1976, provides for two additional members of the Board of Directors of INERHI, representatives from the agricultural farm worker's of the coast and the sierra. As of yet this has not become effective pending approval of a regulation to be prepared by the Ministry of Labor detailing the selection process.

CHART I
ABBREVIATED ORGANIZATION DIAGRAM : INERHI , 1976



Principal duties of the Board are to: (1) establish and approve the general policies and programs of INERHI, (2) approve programs involving government funds in excess of S/.1,000,000 Sucres or contracts of major importance, and (3) approve permanent personnel recommendations made by the Executive Director.

Although the Board sets forth general program policy, the Executive Director is left with wide discretionary power over actual program implementation. The Board is not a policy-implementing body. According to statute, the Board should meet on a regular bimonthly basis, but this has not always been possible so the periods between sessions are often longer.

The Consultive Council of INERHI has no direct policy or program decision-making authority over the Institute but should be mentioned here. The primary responsibility of this body is to act as the judge of second and last instance in the adjudication of cases arising from the application of the Water Law of 1972. It consists of three voting members and a secretary. The members of the Council are the Executive Director (or in his absence he can delegate this duty to the Director of the Division of Water Resources Planning), and two members from the Board of Directors, one of whom is to be the agricultural business sector representative. INERHI's Legal Counsel acts as the Secretary to the Consultive Council but is not a voting member. This body was established by the Water Law of 1972, Title XVIII, Article 81.

The Executive Director is the single most important individual in the INERHI organizational structure. He is the head of the organization both in theory and practice. He has discretionary power and authority over every policy and program. "All important and even many unimportant decisions are either made by him or eventually approved by him. He is the most powerful man in the organization and his orders are law."⁹

The Executive Director's office is a center of activity as department and division chiefs and their underlings move in and out for various reasons. Checks must be signed, authorizations given, advice requested, and urgent decisions made. These are a few of his daily activities.

Regarding his relationship with the guiding Board of Directors one past Executive Director explained that, "For the most part, the Board of Directors usually follows his advice and suggestions in the decisions it makes, so in effect, he becomes their director instead of them being his. This helps him have control over, and freedom of action in, the programs and growth of the Institute."¹⁰

However, it must be understood that the office of Executive Director is highly political and he serves at the will of the current Minister of Agriculture, whose position is also somewhat tenuous. Although the law states he will serve a four-year term, it is variable. During the 10 years since its creation, INERHI has had four Executive Directors. The first one served seven years.

Immediately under the Executive Director in line of authority is the Technical Director. He oversees the programs and activities of the Division Directors and their operations. He is the second in command in the Institute and replaces the Executive Director in his absence.

Each of INERHI's various offices, divisions, and departments can be classified as at either the administrative-support level or program-operational level. The different administrative and support departments and offices handle the everyday administrative affairs of INERHI's central office. They consist of Public Relations, Internal Auditing, Legal Counsel, Programming, Human Resources, General Finance, and General Administration as principal offices.

Directly under the Technical Director fall the operational level programs. The two main divisions are the Division of Water Resources Planning and the Division of Irrigation, Drainage, and Flood Control.

"The functions of the Irrigation, Drainage, and Flood Control Division are much the same as those of the old National Irrigation Bureau, primarily planning and study, construction, and exploitation of irrigation projects."¹¹ Its five departments are Planning, Projects, Construction, Exploitation, and the fifth consists of INERHI's irrigation districts. "This division is responsible for the technical aspects of everything from project study and design to the actual delivery of the water to the user."¹²

The Division of Water Resources Planning consists of three main subdivisions. Two are the Water Administration and Protection Depart-

ment and the Department of Water Resources Planning. The latter is primarily responsible for river basin planning while the former, together with area agencies which constitute the third subdivision, is charged with the execution of the Water Law of 1972.

The area agencies (agencias), which number ten throughout the country, are the principal offices through which the Water Law is applied. They are responsible for conducting all activities charged to INERHI by the law in their respective regions. They are the Institute's legal arm for implementing its responsibilities under the law regarding the granting use right concessions, the charging of water tariffs, and the overall control of water use throughout the country. The agencies, however, do not construct, operate, or maintain irrigation systems or canals of any kind, as do the irrigation districts. Agencies act as the first judge on any cases arising out of application of the law in their respective jurisdictions.

This concludes a brief description of the de facto organizational structure of INERHI. Except for the ten agency offices and six major irrigation districts, each of these offices are located in Quito. Since the agencies and districts are the actual field operation units of the Institute which have daily responsibility for application of the law and the administration of water delivery systems, an analysis of their operation and dealings with water users will be included in following sections. The purpose of this description is to set the stage for analysis of water administration in the public sector in Ecuador.

Other Public Irrigation Entities

There are several other entities in the public sector whose responsibilities partially deal with irrigation. They do not set irrigation policy as does INERHI, but rather are subject to INERHI's supervision in any activities regarding water.

Three of these organizations are regional entities designed to carry out social and economic development programs in specific areas of the country. Two have initiated limited irrigation programs as part of their overall activities.

The first of these entities is the Center for the Economic Development of Azuay, Cañar, and Morona Santiago, known as CREA, created in 1958. This entity operates three small irrigation canals which are relatively insignificant in capacity and distribution.

The second of these regional institutions is known as the Center for the Rehabilitation of Manabí, or CRM, which was organized in 1962. Among its other activities, CRM presently operates two canals constructed by the old National Irrigation Bureau, each with a capacity flow of 4.5 cubic meters per second, and three smaller canals each with a capacity flow of 2 cubic meters per second. At present, it services some 3,000 hectares of farmland in the Portoviejo Valley and is the most significant of these two regional entities in terms of actual irrigation water delivery. Neither of these organizations was included in the Ecuadorian field survey.

A third regional body, the Study Commission for the Development of the Guayas Basin, known as CEDEGE, was created in 1965. This agency administers general development projects in portions of five provinces on the coast. Irrigation is currently still in the planning stage, although some actual construction of a future irrigation system near Babahoyo has taken place. Therefore, as of yet, this organization is not distributing any irrigation water although it is destined to in the future.

IRRIGATION INSTITUTIONS IN THE PRIVATE SECTOR

Irrigation delivery by the private sector in Ecuador is very important since it is responsible for about 77 percent of the total irrigation in the country. A large number of private entities exist which distribute irrigation water either as their primary function or as one of several agricultural related activities. We estimate that 600 such organizations are currently in operation nationwide. They consist of both formal and informal types, formal being legal entities and informal being nonlegal bodies which are nonetheless organized and operate.

The vast majority of private irrigation organizations are in the sierra where farming and irrigation have been traditional for centuries. This is the area of predominant Indian ancestry where communal organization and mutual cooperation have long been customary. These irrigation entities are common throughout the sierra, most generally among the small and medium class farmers.

At the present, INERHI is endeavoring to register and control these numerous private organizations through its agency (agencia) field offices. Prior to 1972 INERHI did not have this legal mandate (it was given to the Institute in the Water Law, 1972); therefore, the control and registration has become a difficult task, especially among the informal type of entities of which no record exists. However, INERHI is slowly accomplishing its goal of registering these private entities.

By law, the Institute must not only register them, but (1) grant them a legal water use right concession, (2) levy and collect a use right tariff, (3) annually approve their statutes and internal regulating documents, and (4) generally perform other such supervisory activities over their operation. All this is to be done in spite of skepticism and fear expressed by many water users who previously have not been subject to public control. Before the Water Law of 1972, none of these controls existed. Because of this, implementation of the Water Law by INERHI has been slow and difficult.

The most common type of irrigation organizations among these people is the junta de aguas or directorío de aguas, which we shall term water user's association, and which serves much the same purpose as canal companies in the Western United States. This kind of formally structured institution began in Ecuador in the early 1930's and continues to be created even at the present time. A group of farmers in a certain area, having a common water need, would band together and form these user associations for the purpose of securing and administering a water source. They consisted of anywhere from a handful to

several thousand users. Many of these associations were organized according to legal statute and are recognized by the law as legal entities which have power to enter contracts and agreements. Others, however, have traditionally existed as informal organizations for many years and may or may not have internal operating statutes or regulations and are not legal bodies according to general laws governing such institutions. Study of informal and formal water user associations was a major portion of the field survey throughout the sierra.

There are, of course, other institutional arrangements for irrigation water distribution in the sierra, but they are much less numerous than water user associations and in comparison distribute relatively insignificant amounts of irrigation water. Some of these are agricultural societies (sociedades agrícolas), agriculture cooperatives (cooperativas agrícolas), small indigenous communities (comunidades), and family garden groups (huertos familiares). Since these few organizations are known to deliver little irrigation water they are not included in the field survey research.

The development of private irrigation institutions on the Ecuadorian coast has been quite different from the more traditional patterns of the sierra. Irrigation in general has a shorter history on the coastal plain and, therefore, so do private irrigation organizations. Although today there is a significant amount of coastal private irrigation, most of it is by individuals or private individual enterprise such as the large private sugar and banana plantations. They are primarily autonomous in their irrigation operations, however a few rent water from INERHI's coastal irrigation districts to supplement their own irrigation resources.

In reality, few entities composed of various private irrigators are in existence on the coast; for example, only one water user association similar to those in the sierra is known to operate in the entire area. Since 1972, several agricultural cooperatives have been created under a Ministry of Agriculture program funded in the beginning by USAID. Uncultivated land in the Guayas Basin was acquired and turned over to interested farmers to operate after organizing themselves in a cooperative arrangement. Credit was extended to them and technical advice was available. As a result, these cooperatives have constructed and currently operate limited irrigation canal systems as part of their overall activities.* Since they are some of the few private entities known to exist on the coast, several were included in the field survey study and will be described in more detail later in this section.

* For a review of these cooperatives as regards irrigation see a report prepared for USAID/Ecuador entitled Irrigation and Drainage Systems and Organization of Rural Cooperatives in the Lower Guayas Basin, Ecuador, Edwin C. Olsen III, and D. Craig Anderson, Quito, Ecuador, 1975.

P A R T I I

ANALYSIS OF SURVEY DATA

SURVEY METHODOLOGY

The investigation for this study consisted of field surveys among water users and their irrigation organizations in Ecuador. Two questionnaires were used to collect the data. One was an Institutional Data form requesting general information concerning the organizations studied. The other was a questionnaire administered to individual water users within each organization.

Thirty-five organizations were included in the Ecuadorian field survey, of which 29 were from the private sector. Of that number, 24 are water user associations throughout the sierra, and five are agricultural cooperatives in the Guayas Basin. The six public entities of the survey were irrigation districts of INERHI, four located in the sierra and two on the coast. The following table shows this breakdown in numbers of organizations by sector and area in the Ecuadorian survey.

TABLE 4

Ecuadorian Survey Irrigation Institutions by Sector

<u>Sector</u>	<u>Sierra</u>	<u>Costa</u>	<u>Totals by sector</u>
Public	4	2	6
Private	<u>24</u>	<u>5</u>	<u>29</u>
Total by area	23	7	35

In addition to general data and information on each of these 35 organizations, 171 personal interviews were conducted with water user members of these institutions. This information was used to analyze the de facto operation of irrigation institutions in Ecuador. Two tables have been prepared showing survey data results, one for each questionnaire comprising the survey. These tables consist of the questions and responses from the survey questionnaires and are located in the Appendix. They should be reviewed by the reader since they show the actual data results. For ease in the analytic process, data from the two survey questionnaires have been grouped into subject categories for discussion in following sections of this report.

It must be emphasized that the field survey results as shown in the data represent the attitudes, perceptions, and opinions of the interviewees. These data are important since a person's perception of reality is probably as important as reality itself.

Although a conscientious effort was made to insure that questionnaire responses were accurate, it was inevitable that some reflect only the individual respondent's knowledge or perceptions. In some cases this may differ slightly from actuality but is nevertheless the kind of information which the survey was designed to accumulate and analyze. It shows how the water user views his position in the surrounding world and from his standpoint, why things happen the way they do. Therefore, unless otherwise indicated, the data results quoted in this analysis represent only the tabulation of answers offered by survey respondents.

ORGANIZATION TYPES AND CHARACTERISTICS

As stated previously, there were 35 organizations studied in Ecuador of which six are irrigation districts operated by the Ecuadorian Water Resources Institute, INERHI. Of the remaining 29 private irrigation organizations, 16 claim to be formal in nature, that is, governed by legally recognized statutes or constitutions. They are recognized as legal entities by local law. The other 13 exist without such legal status and operate on an informal basis without written statutes or bylaws.

Governing Regulations and Customs

Similarly, approximately 62 percent of the water users interviewed stated that their organizations were governed by internal laws and

statutes while 34 percent felt they were not. In addition, 63 percent felt their institutions were governed by custom and tradition. Since these responses were similar, one can conclude that although many users were aware that their organizations had statutes and complied with them, custom and traditional practices also controlled their behavior.

This demonstrates the influence of social traits on traditional irrigation institutions in Ecuador. It is primarily the newer coastal public irrigation districts and private cooperatives which are not under these strong influences. Therefore, one can assume that as long as traditional user organizations exist among water users in the sierra, custom and tradition will play a major role in their operation inspite of the fact that they may have legal status on the books.

Only 46 percent of the 35 entities studied actually have legally approved regulating documents and 62 percent of the water users interviewed felt their organizations were governed by such statutes. From this, one can conclude that either some users are unaware of the status of their irrigation arrangement or some organizations have statutes which partially govern their activities; but they are not legal entities which have received government sanction.

Supervision by Other Entities

One must also note that only six of these private institutions stated they were supervised by some public or governmental authority.

This is interesting because INERHI is endeavoring to regulate private irrigation nationwide. Even though INERHI has had contact with a large percentage of these organizations, (the survey indicates that close to 50 percent have had some dealings with INERHI) only 17 percent feel they are actually supervised by a public authority. This percentage may increase as the Institutes' regulatory agency offices around the country become better equipped to handle the task. A relatively small percentage of INERHI's total operating budget, 3.6 percent, is currently earmarked for such purposes.¹³

Function of Organizations

Results of the field survey further indicate that 79 percent of the private entities studied declared that their sole function is the distribution and delivery of irrigation water while the remaining organizations also perform other functions in addition to their irrigation activities. This 79 percent, some 20 entities, are water user associations commonly found in the sierra. That has always been their traditional purpose for existence. Those having additional responsibilities are the agricultural cooperatives, native communities, or other kinds of farmer associations which take on irrigation as one of several activities. The percent of organizations studied which fit into each of these categories can be found on the institutional data comparative table.

Independence of Organizations

In addition to the preceding information, the data also show that none of the private entities are subunits of a larger organization and only two, or 5.7 percent, reported to have subunits under this control. This information suggests that the vast numbers of private irrigation delivering organizations throughout the sierra and the coast are very independent from one another, even though they may be located in close physical proximity and derive water from the same source or even a common canal. This trend will probably continue as new organizations are created to meet future irrigation needs and could pose significant problems for INERHI or other regulatory agencies. In fact, these organizations could become so proliferous and yet independent that unification may be both necessary and progressively more difficult to achieve. Unifying these various organizations for more efficient and harmonious growth should begin immediately, especially where there are current problems in order to diminish the severity of the situation in the future.

ORGANIZATION STRUCTURE AND OPERATION

Size and Efficiency

Item 2A of the institutional data comparative table demonstrates the number of members belonging to the organizations studied and in-

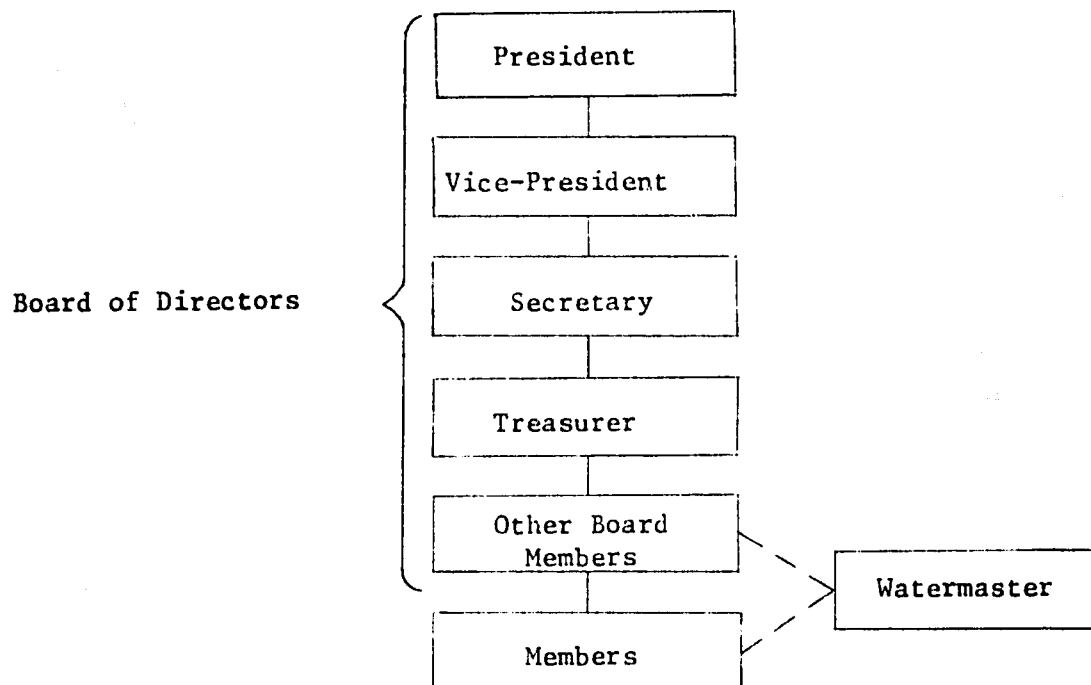
dicates that a good representative spread was maintained in the field study process. It is also indicative of the vast difference in sizes of these organizations from 19 members or less to more than 2,000. One private user association consisting mainly of indigenous people had more than 4,000 users and consisted of eight Indian comunas. However, the data as presently tabulated does not draw any correlation between total members and organizational efficiency, and it would be difficult to come to any conclusions on the matter. It appeared to the author that there were both efficient and nonefficient entities in all categories. Size may, therefore, not be a significant factor in efficiency, although later studies will have to measure it more accurately.

It is difficult to give a written description of the various organizational-structural arrangements of the 35 entities in the Ecuadorian field study for they are as varied as the number of entities. A few had no formal organizational structure whatsoever, operating entirely on an informal basis with no permanent or elected officers or representatives. The majority, however, had some form of organization. The following data have been extracted from the institutional data table for ease in demonstrating the various kinds of organization officers. The numbers given are the percentages of organizations which have each type of officer in their structure. Since the six irrigation districts of INERHI have no user organizations formed within their jurisdictions, the following percentages are all representative

of organizations in the private sector. Most of these officers are elected by members in a general assembly and serve for one year, although they may be re-elected.

<u>Officer Categories</u>	<u>Percent</u>
Board of Directors	74.3
President	80.0
Vice-President	60.0
Secretary	74.3
Treasurer	65.7
Manager/Administrator	37.1
Watermaster/Inspector	42.9

A typical Ecuadorian water user association is structured in the fashion shown in Chart 2.



General Membership Meetings

The survey data show that general membership meetings are held annually in approximately 25 percent of the organizations. Another 20 percent meet when the need arises. Others meet semiannually or monthly. Seventeen percent have no such general meetings. The latter are the irrigation districts of INERHI in which users are not organized for irrigation purposes; all decisions and activities are carried out by district personnel and the users have no administrative authority.

The primary purpose of the general assembly among private user institutions is to elect officers and consider major decisions affecting the organization in general. Members in organizations which meet more often in general membership assembly usually play a greater role in decision making, while decisions made in organizations which meet only annually or occasionally, are primarily made by the elected or appointed representatives.

Generally, between 50 and 100 percent of the members attend general assemblies when they convene, which demonstrates a high degree of participation by the general membership.

Officers of the organizations also meet together on a variety of schedules as can be seen in item 6 of the institutional data table.

Decision Making Functions

Decision making is an important function in any irrigation organization. Understanding who makes decisions can give a clue to the

power structure within the organization and helps one determine what its de facto internal operation is like. One goal of the survey was to determine who makes decisions with regard to certain items, such as: budget, expenditures, irrigation scheduling, maintenance of infrastructure, capital improvements, and conflict resolution. The survey results will be examined. Since decision making in the six irrigation districts of INERHI is done through public authority channels, they represent 17 percent of the total in every case.

The survey showed in 43 percent of the cases that budget decisions are made by the users or members as a group. In 20.1 percent of the organizations these decisions are made by the board of directors or some combination of other officers. In 25 percent of the cases, authorization for expenditure of organization funds is made by users and in 37.3 percent, authorization is made by the board of directors or other officers.

Capital improvements and outlay is another fiscal matter approved by users in 37 percent of the organizations and by the board of directors or other officer combinations in a total of 34.4 percent.

This demonstrates a high degree of member participation in decisions regarding fiscal matters, how and when funds will be spent. Apparently, if the users in general do not make these decisions they are made by a group of elected officials representing the users. In very few cases does one individual have the power to make decisions on fiscal matters.

It is interesting to note that 42.9 percent of the 35 institutions (15 entities) make no decisions regarding the scheduling of irrigation water delivery. Indeed, in many institutions there is no set schedule and members irrigate at will. There are complaints that this form of delivery is inadequate and unjust. In other organizations, especially the smaller ones, this poses no problem and common accord has long since decided this issue. Therefore, it is not a recurrent decision making problem. However, there is room for improvement by many organizations in this particular area since improved delivery scheduling would increase overall efficiency and availability of water. This must be coupled with efforts to increase user awareness of consumptive use requirements since it appears that many users irrigate more than is necessary or beneficial.

In those organizations which make delivery schedule decisions, 17 percent are made by the users and 17 percent by the elected board of directors. Of course, in INERHI's districts these decisions are made by district personnel.

Infrastructure maintenance decisions seem to be made by the same people who decide fiscal spending, the users (20.0 percent) and board of directors (31.5 percent). Most problems involving resolution of conflicts between users are decided by the elected officers in the following proportions: Board of directors, 28.6 percent; President, 14.3 percent, and combinations of other officers, 5.8 percent. Interestingly, 20 percent stated they have exercised no decision making power in this area since conflicts seldom occur.

The survey data reveal that by-in-large the members or water users themselves exercise a large share of the decision making authority in their irrigation institutions. Where they do not directly intervene, their elected representatives are empowered to make decisions on their behalf. This is interesting to note since most of the institutions studied in which users can participate in decision making (primarily in the private sector), are the traditional user associations common throughout the sierra. Most have existed for many years. They operate on democratic principles and common consent. It speaks well of private sector irrigation in Ecuador since the irrigation organizations comprising this important irrigation sector are managed and operated by those whom they benefit and in most cases, do not appear to be controlled by a small number of elite local leaders.

Executive Roles and Functions

Another item on the survey questionnaire was an inquiry as to whom actually carries out specific functions once decisions have been made. An analysis of the answers to item 9 indicates they are carried out by a variety of officers, for the most part, whose responsibility is to see that specific functions are performed. For example, once the board of directors or users approve an expenditure, the function of payment is performed by the treasurer of the organization in over 50 percent of the cases studied and by an administrator or manager in

another 17 percent. These same two officers are also responsible for investment of funds in almost all the organizations in which funds are available for deposit in a bank or other investment.

The task of maintaining irrigation canals and works is performed by the users themselves in at least 63 percent of the cases. In answer to item 26, 85.7 percent responded that users help in canal maintenance and cleaning, and that 83 percent of those contribute in labor. The rest may not actually perform the cleaning themselves but help by paying fees or other charges. In INERHI districts, the users pay a water rental fee which includes the cost to the district for hired labor to perform the cleaning and maintenance function. This accounts for 17 percent of the organizations studied.

Private irrigation organizations in Ecuador are similar to the general corporate-cooperative types common to much of the world. Treasurers pay the bills, secretaries, treasurers, and other officers keep the minutes and books, the president represents the organization in official matters, and decisions are made by the members in general or by a group of their elected officials. The survey results indicate that a high percentage of Ecuadorian irrigators participate actively in their irrigation institutions and take part in decision making and the performance of various functions. Later, we will look at their personal attitudes toward their organizations.

Organizational Linkages

Several items in the field survey turn attention to the linkages that the irrigation institutions have with other organizations.

A review of the responses to item 10 of the institutional data table reveals several significant observations. The vast majority of the organizations observed (94 percent) have had some contact with INERHI or IERAC either as organizations or members as private citizens. With few exceptions these contacts have been with INERHI. This would indicate that over 90 percent of the private organizations have had some contact with these government entities. Some 49 percent have had dealings with the National Development Bank (BNF) and 29.4 percent with some program of the Ministry of Agriculture. Since INERHI is an institution separate from the Ministry of Agriculture for program purposes, it has been kept in a separate category.

Another 20 percent have had some relationship to regional or local public agencies such as CREA or some municipality. Alarminglly, most of them have had little or no assistance from INIAP, the National Agricultrural Investigation Extension Service, since only 8.8 percent reported to have had some contact with that government agency. Nevertheless, public agencies in general have had at least limited contact with irrigation organizations and their members.

Item 10 also indicates that the percentage of relationships with private concerns is overall less than with public entities, the most common linkage with other private organizations being with local banks. Some (11.7 percent) have had dealings with farmer or producer type entities.

Technical Assistance Received

The various facets of item 11 help explain the intensity of the above relationships since item 10 does not clarify how extensive or pervasive they are. It asks what kinds of assistance the organizations or their members have received and from what source. A brief resume of the responses to this question is instructive.

Concerning assistance in irrigation and construction, only eight organizations (23 percent) have received any, and 55.6 percent of those eight received it from the Ministry of Agriculture. These were all rice cooperatives recently created in the Guayas Basin under a specific program in cooperation with USAID. Another one-third (33.3 percent) were assisted by INERHI. The remaining organizations received this help from CREA, a regional public entity in the Province of Azuay.

Eleven organizations (31.4 percent) reported to have received general types of agricultural assistance such as in use of fertilizers, improved seeds, and improved production techniques. Seven (63.6 percent) received it from the Ministry of Agriculture. Once again, five of these were the rice cooperatives in the Guayas Basin which were studied. Another 54.5 percent of the eleven have received help from INERHI. These are users of its irrigation districts who receive some assistance from the various agronomists on district staffs. Some members of one organization of the eleven received technical agricultural assistance from a private company to whom they sell their sugar cane. It is also located in the Guayas Basin.

Only four organizations have received assistance in improving their own administration, assistance which has come from various sources. Again, this has come primarily from the public sector although the low number makes the percentages almost insignificant. However, most of those organizations which responded positively to this point were again the coastal rice cooperatives who were created under a multi-lateral assistance program between USAID, the Ministry of Agriculture in its various programs, and the National Development Bank.

A total of 14 organizations (40 percent) indicated that either they or their individual members have received credit and in each case the source was the National Development Bank. Some had received credit from other institutions in addition to the BNF, primarily from a variety of local banks. Many of the organizations or their users which have received credit are located on the coast. All of the rice cooperatives operate on credit as do many users of INERHI's coastal irrigation districts, for their farms are larger than the average users in the sierra. When credit has been utilized on an individual basis and not by the organization as an entity, it must be remembered that many sierra organizations are not classified as legal entities, a pre-requisite for obtaining loans.

However, the striking point in the results of this inquiry is that 60 percent (21 organizations) of the 35 entities studied reported that neither they nor their members have received any credit, at least in any noticeable quantity.

As a comparison, item 29 from the personal interview table indicates that only 25.9 percent of the individual water users surveyed reported that they had previously used or are currently using credit. The problem is that credit from either the BNF or private banks is extremely difficult to obtain for a small farmer. Most of the users who comprise irrigation institutions fit into that category, especially in the sierra. On the coast, where farm units tend to be larger, credit is more readily available. Even in the sierra, farmers who use credit, for the most part, already have enough means to give them economic stability, almost a pre-requisite for obtaining lines of credit.

Twelve organizations (34.3 percent) have received some kind of assistance in their problems in conflicts over water use and another 23 (65.7 percent) have had assistance with legal matters. These types of assistance have been received from INERHI, to whom private organizations must go to have their use rights legally inscribed. In this process INERHI agency office personnel perform a technical study of the organization to determine irrigation needs. Since this inscription is a legal process, INERHI attorneys assist them. Agency offices also become convenient places to go to resolve conflicts between organizations or between users of the same organization. INERHI is legally empowered to review and resolve such conflicts. It appears that INERHI is becoming well-known among campesinos as the public agency with authority over water rights and use.

Water Rights Inscription and Tax

It is interesting to note in conjunction with the preceding point, that only 20 percent of the institutions in the survey currently have their use rights recorded with the government, and only 8.6 percent have ever paid a water tax as stipulated by the law. These percentages do not include any of INERHI's irrigation districts. A large number of organizations who do have some contact with INERHI do not have their rights inscribed. INERHI's process for legal inscription is slow. Even after inscription, many organizations still do not pay the water use tax imposed upon them. It should be pointed out here that a direct tax on water use is a new experiment in Latin America and perhaps the world, having never been tried elsewhere before.

Although INERHI is becoming more widely recognized in its role, the water law which it implements has not yet had a significant impact on the campesino or his irrigation institutions in all regards. Indeed, 72.8 percent of the water users interviewed know that a new water law does exist in Ecuador yet only 7.8 percent have paid the legal water tax, signifying that to date the law has not significantly altered their state of affairs as far as the tax is concerned. Interestingly, this same percentage, 7.8 percent, are the only users who stated they have had to some time fill out some document having to do with their water right.

Summary

All of the preceding survey results point out that many organizations and their members have had a variety of contacts with various public agencies and private entities but the impact on production of these contacts has not been significant. That is, there have been relationships with these bodies but in most cases little actual technical assistance has been rendered to the irrigation delivery organizations or their members. The linkages seem to have been generally shallow and only temporary. In general the organizations have a higher rate of association with public sector entities than with the private sector and the public sector has had a greater impact on their activities.

CHARACTERISTICS OF WATER USERS

One must understand the behavior, socio-economic conditions, and attitudes of organization members in order to comprehend water institutions. Many items in the field study provide an insight into the average user's economic and social status, and his attitudes toward various institutions. The following is a resume of some of the results of the survey data to aid in drawing conclusions as to some user characteristics.

User Attitudes

Ecuadorian water users in general express a positive attitude toward their irrigation institutions and their leaders. This demonstrates a high degree of confidence, trust, and feeling that their organization can and does benefit them, inspite of the fact that many recognize limitations and inefficiencies. Nearly 93 percent felt their organization benefited them personally and 83.2 percent had an overall positive opinion of their organization. The majority also felt their organization functioned well and was responsive to their individual water needs. Another 83.6 percent expressed faith in the organization's officers and leaders. This kind of support certainly has a positive influence on the organizations to which these users belong, and generally allows them to function in an atmosphere of good will and cooperation.

In addition, items 42 and 43 of the water user's survey indicate that in a dispute arising over water use the majority would go to their organization to resolve the matter in the first instance. Later, if a formal complaint or action was required, they would then go to some public authority. This supports what has previously been discussed regarding organization interreaction with public agencies but primarily demonstrates a trust in, or at least a dependence on, one's own farmer institution.

We must conclude that in general, user attitudes toward their institutions are positive. Private sector irrigation has enjoyed a

long history in Ecuador and its user institutions have therefore become well implanted in rural society. These strong ties among rural populations are not easily uprooted. They form an integral part of the campesino's world and he has a basic faith in their ability to provide for his water needs. This same feeling would extend to all the various traditional rural institutions which have existed over time.

Standard of Living

According to the results of the institutional data survey, most of the users who comprise the institutions of the study (70 percent and above) live primitively--no electricity, culinary water, or sewage facilities in their places of residence. To anyone acquainted with rural conditions in Ecuador this percentage is not shocking yet it does reveal the economic and social class of people who are generally members of irrigation institutions. Most tend to be subsistence farmers or close to it even though they may sell some products to the market (also see items 22 and 23 of the user's survey) and have to seek income from sources other than their farms to support themselves. Very few own private motor vehicles and even fewer own mechanized farm equipment, although more and more are beginning to rent tractors and other equipment when possible. This point will be discussed later.

These same characteristics are fairly indicative not only of members of irrigation organizations but of the general rural population and are significant in what they reveal about the agriculture sector as a whole. There are, of course, diversions from these patterns but they are exceptions. The majority of the agricultural population is typified by the above living conditions and life style.

Cultural Characteristics

Nearly all (91.4 percent) of the members of the organizations consist of mestizo population and speak Spanish as their principal language, the remainder being indigenous peoples who speak Quechua. Those interviewed estimated that on the average 71.4 percent of all users have four years of formal education or less. Officers tend to be of the same educational level as users although in 37 percent of the cases they reportedly were of a somewhat higher level than was average for the users in general.

Group participation is an indicator of social interaction among peoples. The survey showed that 83.4 percent of the users participate regularly in their water user group and/or some other agriculture or farmer related organization. This meant attendance at meetings and work projects. Significant percentages of users participate on a regular basis in local community programs, usually mingas, and in local church activities such as church mingas or religious festivities. One would expect this high level of group participation among rural populations in traditional societies in Ecuador. The minga, for exam-

ple, is a longstanding tradition among these people, a kind of community work project for the common or community benefit. This is a social institution which has become ingrained in rural society and in which water users, as all typical campesinos, participate regularly. It provides valuable insight into their social behavior.

User Spending Priorities

One item from the users survey, item 27, supplies us with some very interesting information regarding user priorities and gives an overall picture of their desires and aspirations. Responding to the questions of what they would do with more money if they had more, they offered a variety of answers as found on the Users Survey Comparative Readout.

When asked the "more money" question, many of those interviewed were at first reluctant to respond, stating that it was a dream or extreme unlikelihood. They couldn't imagine what it would be like to have more than the little they now have. Nevertheless, every interviewee responded to the question and their responses reflect their aspirations. On this question, respondents could give more than one answer and therefore the table reflects the total frequency of response to each category.

Home improvement and family education head the list of positive responses. Money invested in some kind of agricultural improvement and purchase of land were other frequent selections. Also, the pur-

chase of additional land was often mentioned. Only a few would invest in some nonagricultural activity, which indicates that the majority are only interested in agriculture as their primary economic activity. Other questions (items 15 and 16 of user's survey) also substantiate this general tendency. However, as indicated, nearly one-half of those users interviewed want to improve their home or living conditions and educate their children. It is interesting to note that only 3.6 percent would use excess income to improve their irrigation infrastructure.

Change Indicators

Item 29 from the users survey and item 22 of the institutional data survey also provide valuable insight. These items concern a change index, indicating changes or improved methods which water users have implemented in their farming and irrigation. No change generally indicates that primitive or traditional methods and customary practices are still being employed. The results are instructive.

Traditional irrigation practices as used by ancestors for innumerable years are still employed today by 90 percent of all users, even within INERHI's irrigation districts. These practices are the only ones they have ever known. Only 10 percent have modernized irrigation methods in some way or another. However, there has been

significant change in mechanization, use of fertilizers, and the use of chemical sprays on crops. The customary teams of oxen and wooden plow are slowly being replaced by tractors and other mechanized equipment. Although few users own such equipment they frequently rent it from time to time. Equipment rental is costly but the cost of an oxen team and master has also escalated tremendously making tractor rental more attractive to farmers. Many use a combination of tractor and oxen, each used for a different purpose at a different time.

Usage of some chemical fertilizers is becoming more popular. This is a break from the more traditional exclusive use of animal waste as fertilizer. Still, only 52 percent have changed in this area. Some 60 percent have used or are presently using chemical sprays such as fungicides and pesticides. The relatively high cost of chemical sprays and fertilizers to the average campesino, especially without credit, is an inhibiting factor in expansion of the use of these materials.

The fact that only 26 percent of all users stated they have used credit has previously been discussed in more detail. Available credit is a critical need if small farmers are to improve their conditions. Without some credit they cannot afford to obtain and use those items which could in turn increase their efficiency and productivity, and hence, their economic status. Properly administered small farmer credit would dramatically improve their income.

The data also show that traditional crops continue to be the most popular. This is not surprising for primarily subsistence farmers.

They can only afford to sell to the market a small portion of their product--that which they do not consume themselves. Although the data cited in this last section were taken from user responses information from the institutional data survey on these same items generally coincide.

Summary

It is not difficult to summarize the information on the social and economic characteristics which typify Ecuadorian water users. Generally, they are subsistence farmers, primarily consuming what they produce, and many seek employment off their own farms to augment their meager incomes. There is a notable absence of modern commodities and public services among these people, few having electricity, culinary water, or sanitary facilities available in or near their residences.

Large numbers of those water users interviewed expressed a desire to upgrade their life style by improving their homes and general living conditions. They also see the value of education as a tool to enhance the future social and economic standing of their children. Average levels of education among these people are low, the majority having less than 4 years of formal schooling. Many would first invest in improving their farms and increasing productivity in order to achieve their other goals.

There seems to be a general trend toward modernization of agricultural practices when circumstances permit, a departure from traditional farming and irrigating methods as passed down from generation to generation. Use of chemical fertilizers, sprays, tractors, and other automated machinery is slowly replacing oxen and the exclusive use of natural fertilizer. However, significant percentages of users continue to farm in the traditional fashion, perhaps because they are afraid to risk change. Contact with external influences such as government agricultural extension services has been minimal so they are ignorant of many up-to-date farm procedures which could increase productivity. In addition, without readily available lines of credit, almost nonexistent among the rural poor, they cannot afford to risk what little they now have on some new practice which they are not certain will succeed. Moreover, one cannot disregard the change-resisting power and influence of custom and tradition. Another prohibiting factor is the size of farm plot they own or operate. It is generally small and inadequate to support his family's needs. Farm sizes and characteristics will be discussed more fully in a following section.

Water users in Ecuador are generally satisfied with their irrigation institutions. They perceive them as beneficial and responsive to their needs. This positive attitude toward their organizations is demonstrative of their fundamental belief that such institutions are viable, that is, practicable and workable. They not only participate in them freely, but also participate in other traditional

group activities of the community. Participation in nontraditional groups is much less. This air of cooperation directly enhances the organization's ability to perform its duties to the satisfaction of users. Its administrative capabilities are thus strengthened and reinforced. Once again, tradition is also a strong force in the lives of campesinos, and social pressure to abide by custom is powerful.

All of these factors must be taken into consideration when successfully planning or working with irrigation organizations or their members. Future irrigation planning in Ecuador should provide for this kind of consideration. These factors can directly influence the relative success or failure of future projects. It seems that many technicians are aware of all the user characteristics reviewed above and yet they are often put aside or given little importance in planning.

An attempt has been made to describe and discuss the socio-economic characteristics of water users as members of irrigation institutions since institutions take on the characteristics of those who comprise them. Much of the information can be applied not only to water users but to the rural population in general.

FARM SIZE AND CHARACTERISTICS

Farm Size

Farm sizes and other farm characteristics of irrigation organization users also give one some valuable insight into organization composition and function.

More than 85 percent of the farm land of the 35 organizations studied is privately owned or operated. The remaining land is owned by coastal rice cooperatives and is either worked entirely in common by cooperative members (one case only), or members are assigned a parcel of land for which they are responsible. Outside of these few cooperatives, land is owned, rented, or sharecropped by private individuals. This is the case throughout the entire country. The comparative country table for item 17 of the user's survey indicates the farm sizes of those water users interviewed excluding members of cooperatives. It gives the figures for total land, land under cultivation, and land under irrigation.

The table reveals that 83 percent of the water users interviewed in the Ecuadorian field survey own or otherwise operate 10 hectares of land or less and 63.6 percent have under 5 hectares. Even more revealing, 35.3 percent fall into the category of less than 2 hectares, which also holds true for cultivated and irrigated land. These are indeed small farmers. When one considers that this is all the land base from which they must sustain themselves and their families, it is easier to comprehend their socio-economic standing. These people are for the most part poor and underprivileged, and have no choice but to consume what they produce and work off their land to supplement family income.

There is generally a direct relationship between size of land holding and living standards. As expressed by Ernest Feder, "The state

of nutrition, clothing, housing and sanitation among the underprivileged people in rural communities is at substandard levels. " ¹⁴ Most of this is because they are tied to their small land holdings and have little way of improving the situation. It often becomes even more severe as plots are broken up and given to heirs, thus increasing the minifundio (extremely small landholdings) problem in general and reducing the income producing base of the recipients.

Extremely small farm plots impede productivity and the use of modern agriculture techniques among Ecuadorian water users. Again, Feder states, "Rural poverty bears directly on productive efficiency because the conditions under which the campesinos' returns are earned provide them with no incentives for improving their performance." ¹⁵

For example, land sizes do not permit the wide use of mechanized equipment even if small farmers were able to afford it. Productivity remains low because credit is not available and meager incomes do not allow extensive purchase or utilization of items which would increase productivity. They continue to plant traditional crops, using old varieties and seeds saved from the previous year's crop. The list of limitations could go on and on. Many relate directly to the limited size of their farmland.

Small farm plots also have a negative effect on the operation of the irrigation institution itself. Such a situation impedes efficient delivery and creates multiple problems in scheduling water use. Consequently, a high number of organizations have no set delivery schedule.

These same problems are compounded further by the customary subdividing of land among heirs. In addition, more than one-half of all users interviewed have small plots in more than one location. These are all land-size related matters which inhibit efficient water management in numerous organizations both public and private. Several of INERHI's irrigation districts are confronted with these situations.

The data show that in many cases land sizes of nonmember farmers in the general area of some irrigation delivery institution tended to have farms of approximately the same size as those of members. However, nonirrigation organization members have more land on the average. Larger land holders tend to operate independent from other farmers in their irrigation activities, probably because they can, by virtue of their size, afford to construct or operate private canals and other irrigation works. Some organizations, however, consist entirely of what could be termed medium to large land owners.

Water Availability

Farmers recognize that sufficient water on the land is necessary for production. Perhaps for this reason only 36.8 percent of the Ecuadorian water users claimed to have sufficient irrigation water, the rest stating they did not have enough to meet their needs. This is only personal opinion and has not been proved or disproved through

technical studies. It does, however, record personal reactions and is important because over 60 percent believe they have insufficient water. Although a variety of explanations for this shortage were cited, natural causes of one sort or another were most common. Some 23 percent of reported shortages were attributed to deficiencies in the physical delivery infrastructure or to organizational inefficiencies. If correct, these are areas where shortages could be eliminated by institutional improvements.

Crops

It has been previously stated that traditional crops seem to be the most popular. These crops, of course, change from region to region. It must be noted that grains figured highest among the five most important crops planted by water users. This is not unusual since corn and barley are the most common crops in the sierra, as rice is on the coastal plain. Among small farmers in the sierra, corn, especially, is the mainstay of their production and consumption. Tubers and roots, grain legumes, and vegetables each share equal importance as common crops. Many agriculturalists are also beginning to pursue livestock related activities, primarily in dairy cattle and products.

The average number of harvests per year for each of the five orders of crops listed in the data is just slightly over one. These data are not conclusive but do indicate a rather low level of intensive land use in general and can perhaps be related to deficiencies in ir-

rigation or in traditional farming practices and methods.

Regarding crop losses, 59.2 percent of the water users had lost crops during the previous five years, most of them in the last two. The single biggest cause for such losses was lack of water, which accounted for more than one-fourth of the reasons cited. On the other hand, 28.6 percent complained of either too much water or of adverse weather conditions as the cause of their loss. It is not uncommon that during the wet invierno (winter), or rainy season, there is an overabundance of water and bad weather. Most organizations do not irrigate during this season at all. On the other hand, demand for irrigation is highest during the months of verano, (or summer), the season when it seldom rains and natural water resources are lowest. Since there are virtually no water storage facilities in the country, there is little possibility of sufficient water to sustain crops during these months.

Summary

Irrigation organizations in Ecuador generally consist of users who own or operate small land holdings. This pattern is typical of rural farmers throughout the country, especially in the sierra where many areas of intense minifundio exist. This situation is not only a land tenure problem but is a socio-economic one as well, and change will be difficult. Small farmers and minifundistas are caught in a vicious cycle, one which has kept them on the bottom of the socio-economic structure.

Farm size has implications for efficient irrigation management as well. Small land holdings create serious water delivery problems. Most organizations with these problems have no organized delivery schedule and farmers take water at will, certainly a deterrent to good irrigation management.

IRRIGATION DELIVERY SYSTEMS

Infrastructure Characteristics

The information concerning the irrigation delivery infrastructure of the survey organizations as found on the institutional data questionnaire and comparative table is fairly self-explanatory, and shows some very interesting facts.

Most of the institutions studied are characterized by old and rudimentary delivery infrastructures. Over 61 percent have canal systems at least 30 years old and the majority of those are over 98 years old. Many date back 200 years or more according to users. This situation exists primarily among private sector institutions, most of which have existed for as long as their canals. Tradition for using these canal systems stems back to their construction. Again, these old systems are located exclusively in the sierra where the tradition of irrigation has long existed.

Although some of these private organizations have permanent type main diversion works, most have rudimentary or temporary ones. Most

canals, both primary and secondary, are entirely unlined or only partially lined. Rocks, sod, sticks, and dirt are used to divert water from canal to canal, and from canal to the farm unit. Headgates or more sophisticated apparatus are virtually unknown.

Public sponsored irrigation districts tend to be of more recent construction than private organizations of the sierra. The private rice cooperatives of the Guayas Basin have also been formed only recently and are the exception. The oldest of INERHI's districts date back some 30 years and many were constructed by INERHI's predecessor, the National Irrigation Bureau. Since assuming control of these systems INERHI has improved them as much as possible within its means. In addition, it has also constructed, and is now constructing, other irrigation projects.

Almost all of INERHI's districts have permanent type main diversion works as compared to the relatively few in the private sector. Its canal systems are generally newer, more extensive, and tend to have a slightly higher percentage of lined canals. In spite of this, the major portion of INERHI operated canals are unlined. More developed control apparatus, metal and wooden headgates, are found in INERHI's systems than in private organizations, especially in the sierra.

These are the primary differences between the infrastructure of the private and public sectors. There are some significant similarities as well. For one, almost no organizations have facilities for water storage. There are virtually no reservoirs or other means by

which water reserves can be accumulated for later use in either type of institution. Most organizations have no alternate sources of water. Second, inspite of its somewhat more sophisticated and technically engineered systems, INERHI's districts, as well as those of the private sector, have no water volume measurement capabilities for each user. That is, water is delivered to users of public systems just as it is in private systems; there is no difference. Neither type is able to distribute water to users following technical criteria. In fact, no technical criteria are used to determine water needs.

Data quoted in previous sections indicate that users employ the same farming and irrigation methods regardless of the kind of institution from which they receive their water. The source of the water is not a factor influencing such methods. Therefore, although INERHI's infrastructure is more technically advanced in some aspects, once the water reaches the farm unit there is no difference in the way it is utilized. The user irrigates the same as he would if he were in a private user group. The differences in the cost of water to the user and the cost of constructing, operating, and maintaining each type of system will be discussed later.

The above mentioned infrastructure characteristics have a direct bearing on the operation of irrigation institutions and the management of water delivery and use. (See tables 5 through 9 for comparative information of selected infrastructure characteristics between private and public irrigation entities). The fact that most

canals are either old and/or primarily unlined is a significant factor in water loss and one must suppose that a great deal of what water is diverted is lost during conveyance. The volcanic and porous nature of the soil in the Ecuadorian sierra certainly contributes to this loss. Technical studies will have to be carried out to determine the exact amount of water loss through seepage and evaporation during conveyance but in all probability it is high. The resulting decrease in available water for use at the farm level signifies additional problems in management.

If more water could be preserved for delivery to the farmer, it would decrease the demands placed upon management and diminish pressures which users exert on leaders. It would mean more water for all,

TABLE 5

Condition of Primary Canal(s) of Organizations Surveyed-Ecuador

<u>Response</u>	<u>Private</u>		<u>Public</u>	
	No.	%	No.	%
Without lining	25	86	1	17
Concrete	0	0	1	17
Combination	<u>4</u>	<u>14</u>	<u>4</u>	<u>66</u>
	29	100	6	100

TABLE 6

Condition of Secondary Canals of Organizations Surveyed - Ecuador

<u>Response</u>	<u>Private</u>		<u>Public</u>	
	No.	%	No.	%
Without Lining	20	69	4	66
Concrete	0	0	1	17
Combination	0	0	1	17
No Secondary Canals	<u>9</u>	<u>31</u>	<u>0</u>	<u>0</u>
	29	100	6	100

TABLE 7

Number and Percentage of Organizations with Water Storage Facilities - Ecuador

<u>Response</u>	<u>Private</u>		<u>Public</u>	
	No.	%	No.	%
Yes (Have)	3	11	0	0
No (Do not have)	<u>26</u>	<u>89</u>	<u>6</u>	<u>100</u>
Total	29	100	6	100

TABLE 8

Number and Percentage of Organizations With Water Volume Measurement Capabilities for Each User - Ecuador

<u>Response</u>	<u>Private</u>		<u>Public</u>	
	No.	%	No.	%
Yes (Have)	0	0	1	17
No (Do Not Have)	<u>29</u>	<u>100</u>	<u>5</u>	<u>83</u>
Total	29	100	6	100

TABLE 9

Number and Percentage of Organizations Which Use Technical Criteria To Determine Water Needs for Users - Ecuador

<u>Response</u>	<u>Private</u>		<u>Public</u>	
	No.	%	No.	%
Yes	1	3	0	0
No	<u>28</u>	<u>97</u>	<u>6</u>	<u>100</u>
Total	29	100	6	100

theoretically, and users in general would be more content and tend to give more support to the organization. This would create a better atmosphere. In addition, more water, especially with technical support to insure correct use and application would probably lead to increased food production and improvement of the users economic condition.

The general lack of any water storage facilities simply creates problems for administrators and leaders during periods of water scarcity. A water shortage places a number of constraints on the system, some of which have been reviewed. Primarily, it prohibits the organization from providing water on a timely basis and in the quantity desired by the user. In addition, without the ability to store water, considerable water resources are lost during periods of minimum useage, especially during the night. Even though 88 percent of all users will irrigate at night if the need arises, significant quantities of water are lost. If stored, it could be used during periods of high demand. Also, where possible, farm level holding tanks would increase the individual users' ability to better manage his own irrigation practices.

The absence of water volume measurement devices and technical criteria in determining water needs of users deter water management efficiency, especially at the farm unit level. Users throughout the country are unaware of water requirements for their crops and how they can improve the use of available water. The organization cannot deliver measured amounts of water either. Remember, many do not

even have a delivery schedule which would theoretically, at least, inhibit excessive use by individuals. These two factors together contribute to inefficiency and water waste since there is no control over quantities of irrigation water applied to crops. Where water is in short supply improved production would result from measuring water use based on technical criteria. Excessive irrigation also reduces production.

Summary

To summarize, the preceding has been a review and analysis of the data concerning irrigation infrastructure generated by the Ecuadorian survey. Private irrigation institutions in the sierra tend to have old and basically unsophisticated canal systems, unlined and rudimentary in nature. Those of the coastal area are newer and more technically advanced and designed but are unlined as well.

The public irrigation districts operated by INERHI have permanent diversion works and are of more recent construction. Though they are technically designed, they too have great numbers of unlined or only partially lined canals. They do have more headgates and other modern control apparatus in their systems. These are the basic differences in the infrastructure characteristics of public and private organizations.

Virtually no irrigation organizations in either sector have water storage capabilities. Users employ similar irrigation techniques re-

ardless of the type of organization from which they receive their water, and water usage is not applied following technical criteria. There is no control over the volume of water users can divert to their farm units. In these aspects, public and private organizations are similar. The only comparative differences are in the design and condition of diversion works and canals, but even those differences are minimal.

In short, the generally poor condition (in technical terms) of irrigation infrastructure in the country inhibits good and efficient water management by institutions and contributes to water waste and insecurity of the resource.

THE PUBLIC AND PRIVATE SECTORS - SELECTED COMPARISONS

One of the purposes of the survey questionnaires was to extract information from water users which could lead to conclusions regarding the comparative advantages and disadvantages of public and private irrigation institutions. Such information is vital to future irrigation planning in the country. In recent years there has been a general trend toward the large and presumably more sophisticated public sponsored and funded irrigation projects. Meantime, the smaller, privately operated irrigation entities have received little or no attention. This trend has existed in many areas of the world, not just in Ecuador, and is therefore important to examine more closely in order to weigh its merits. Ecuador is a good case to review.

The comparative tables 10 through 22 located in this section are instructive and self-explanatory. They represent selected items taken from both the users and the institutional data questionnaires to show comparisons between the private and public organizations comprising the field survey. Comparative costs of operation and maintenance of systems, forms of payment of water fees by users, and comparative user attitudes, life-style, and progressiveness are important aspects to consider. Comparisons of delivery infrastructure characteristics between the two sectors were discussed in the preceding section.

Operation and Maintenance Costs

The data from Table 10 reveal that the majority of private entities studied are much less expensive to operate and maintain than state irrigation districts. Sixty-nine percent cost less than \$1,000 in cash outlay for the last full year of operation prior to the survey. A total of sixteen private organizations required less than \$500 for the year, and 13 operated on less than \$200. These figures represent actual cash outlays and demonstrate the remarkably low cost of water for users who are members of these organizations.

One common practice among private irrigation entities, especially the numerous juntas de aguas (water user associations) of the sierra, is that users themselves supply the labor necessary to clean and maintain the water delivery system and perform other functions regarding canal operation which require labor. This practice tends to remarkably reduce cash outlay for maintenance and operation. It

is relatively less expensive for the users to perform their own maintenance and operation than it would be to pay someone else for those same services. Organizations have devised various methods for apportioning this labor among users. Some pay their water quotas entirely in labor and others pay a combination of labor and cash contributions.

The operation and maintenance of public irrigation districts, on the other hand, is much more costly to their water users. They do not perform maintenance labor nor can they pay part of their water fee in donated labor but must pay in cash for those services.

The cost of irrigation districts are high and most of those costs are passed on to the users who receive the water. However, the fees collected by the district from its users do not cover operation and maintenance costs in 5 of the 6 irrigation districts studied. They required cash transfers of funds from INERHI's central office to operate. Conversely, 93 percent of the 29 private organizations covered their own costs of operation from the fees and charges, including labor, levied against their members. (See Table 11).

The figures on Table 10 are not conclusive evidence that public sponsored and administered irrigation projects are drastically more expensive to operate on a per capita basis than are private organizations. They are generally large systems with numerous canals and users, while the private entities are much more limited in size and geographic extension. Therefore, more detailed economic studies are needed in order to determine per capita costs to users and the cost/benefit ratio of public and private irrigation organizations. How-

ever, no one can dispute the tendency of public irrigation projects to be large, extensive, and expensive to construct as well as to operate and maintain. Table 10 figures only reflect the latter. Someone must pay those tremendous costs whether it be the public at large, the beneficiaries of the project, or a combination of the two. The general reaction of the author after having conducted the survey and worked with different types of irrigation organizations is that the user in the public irrigation institutions generally pays more for an equal amount of water and service than would his counterparts in a private junta de aguas.

There are a great many additional administrative costs associated with public irrigation district operation. These costs are buried in the budgets of administrative and support departments located at central headquarters which must also be considered as part of the cost of operating irrigation districts. When these personnel and other expenses are taken into account, the total costs, both direct and indirect, become even greater.

Water User Attitudes

Data regarding individual water user attitudes toward the organizations to which they belong generally indicate that all users tend to have positive attitudes toward both public and private irrigation organizations. The data also show that there is no radical difference between the agricultural progressiveness of users in public

and private organizations. In fact, in some instances users in the private sector appear to be better off than their counterparts. This is interesting since one of the big selling points for the large scale state irrigation projects is that water users and farmers within the area of the project will receive a whole package of technical assistance to make them appreciably more advanced than if they were outside the project. The survey results, however, demonstrate that it makes no difference. Water users are about the same in all categories regardless of the nature of their organization. They live in the same economic and life-style conditions and employ similar methods of cultivation and irrigation.

Infrastructure

In the preceding section we examined the differences and similarities between the physical delivery infrastructure systems typical to public and private irrigation organizations. That examination led to the conclusion that at the farm level there is also no appreciable difference between users of these systems.

Summary

These conclusions bring up several questions which need to be examined more closely through other studies. For example, if the real benefit to farmers in public type works is marginal then perhaps there

TABLE 10

Comparative Total Operation and Maintenance Costs by Sector

<u>Total Cost in U.S. Dollars</u>	<u>Sector</u>	
	<u>Private</u>	<u>Public</u>
No Answer	3	0
\$0 - - \$ 200	13	0
200 - - 500	3	0
500 - - 1,000	4	0
1,600 - - 5,000	3	0
39,000 - - 40,000	2	0
68,000 - - 80,000	1	4
100,000 - and above	<u>0</u>	<u>2</u>
Total	29	6

TABLE 11

Number of Organizations in Which All Fees and Charges Cover Annual Operation and Maintenance Costs

	<u>Private</u>		<u>Public</u>	
	No.	%	No.	%
Yes	27	93	1	17
No	<u>2</u>	<u>7</u>	<u>5</u>	<u>83</u>
Total	29	100	6	100

TABLE 12

Number and Percentage of Users Who Have Off-the-Farm Income

Response	Private		Public	
	No.	%	No.	%
Yes	71	53	12	34
No	<u>64</u>	<u>47</u>	<u>23</u>	<u>66</u>
Total	135	100	35	100

TABLE 13

Number and Percentage of Users With and Without Sufficient Irrigation Water

Response	Private		Public	
	No.	%	No.	%
No answer	4	3	3	8
Yes	43	32	17	49
No	<u>88</u>	<u>65</u>	<u>15</u>	<u>43</u>
Total	135	100	35	100

TABLE 14

Number of Users with Corresponding Personal Opinion of Organization
in General

Response	Private		Public	
	No.	%	No.	%
No answer	2	1	1	3
Positive	106	79	33	94
Negative	3	2	0	0
Intermediate	<u>24</u>	<u>18</u>	<u>1</u>	<u>3</u>
Total	135	100	35	100

TABLE 15

User Attitudes Toward Responsiveness of Organization to Their Water
Needs

Response	Private		Public	
	No.	%	No.	%
No answer	7	5	1	3
Positive	100	74	20	57
Negative	13	10	4	11
Intermediate	<u>15</u>	<u>11</u>	<u>10</u>	<u>29</u>
Total	135	100	35	100

TABLE 16
User Attitudes Toward Benefits They Receive from Their Organization

Response	Private		Public	
	No.	%	No.	%
No answer	1	1	1	3
Positive	122	91	34	97
Negative	6	4	0	0
Intermediate	<u>6</u>	<u>4</u>	<u>0</u>	<u>0</u>
Total	135	100	35	100

TABLE 17
Number and Percentage of Users Who Have Changed Their Irrigation Methods

Response	Private		Public	
	No.	%	No.	%
Yes	16	12	1	3
No	<u>119</u>	<u>88</u>	<u>34</u>	<u>97</u>
Total	135	100	35	100

TABLE 18

Number and Percentage of Users Who Have Changed Farm Mechanization

Response	Private		Public	
	No.	%	No.	%
Yes	72	53	23	66
No	<u>63</u>	<u>47</u>	<u>12</u>	<u>34</u>
Total	135	100	35	100

TABLE 19

Number and Percentage of Users Who Have Changed User of Fertilizers

Response	Private		Public	
	No.	%	No.	%
Yes	71	53	17	49
No	<u>64</u>	<u>47</u>	<u>18</u>	<u>51</u>
Total	135	100	35	100

TABLE 20

Number and Percentage of Users Who Have Changed Types of Crops

Response	Private		Public	
	No.	%	No.	%
Yes	5	4	0	0
No	<u>130</u>	<u>96</u>	<u>35</u>	<u>100</u>
Total	135	100	35	100

TABLE 21

Number and Percentage of Users Who Have Changed in Use of Chemical Sprays on Crops - Ecuador

Response	Private		Public	
	No.	%	No.	%
Yes	75	56	28	80
No	<u>60</u>	<u>44</u>	<u>7</u>	<u>20</u>
Total	135	100	35	100

TABLE 22

Number and Percentage of Users Who Have Changed in Use of Credit -
Ecuador

Response	Private		Public	
	No.	%	No.	%
Yes	27	20	17	49
No	<u>108</u>	<u>80</u>	<u>18</u>	<u>51</u>
Total	135	100	35	100

should be a re-examination of policy which supports their creation and expansion. In cases where the beneficiaries of the project would otherwise be without any irrigation service and the government is willing to assume project costs as a general public good then perhaps the cost could be justified. Even in those cases, the data reveal that projects generally only reach a par with private institutions and do not surpass them as they should according to project design. However, it seems that governments would look for alternative courses of action in order to more effectively use the limited fiscal resources they invest in irrigation improvement, especially where the private sector has demonstrated the ability to operate efficiently.

CONCLUSIONS AND RECOMMENDATIONS

There are some general conclusions which can be reached and recommendations to be made in addition to the summaries at the end of each of the preceding sections. The purpose is not only to sum up the data analysis but to draw it to a meaningful completion by recommending action based on the conclusions. The goal is to make use of the information through appropriate application so the small farmer can increase food production.

All irrigation in Ecuador is theoretically controlled by the government through the Ecuadorian Water Resources Institute, known as INERHI. It is ultimately responsible by law for the administration and legal control over all water use in the country, including irrigation, and is the single public entity endowed with such authority. All private sector irrigation is subject to its legal control and supervision although in reality its de facto control has been limited. However, INERHI is in the process of implementing the law more fully and exercising to a larger degree its supervisory powers in the private sector. The primary tool for accomplishment of this end has been the establishment of agency offices throughout the country, one of the purposes of which is the inscription and legal concession of all water use rights currently being exercised. This could be termed its "indirect" control over irrigation use.

In addition to its legal authority and power to control irrigation, INERHI also operates various irrigation and drainage districts, irrigation projects where water is "directly" controlled, administered, and delivered to the individual irrigator. In this regard, INERHI performs a dual function for it has "indirect" control over all waters, which by law belong exclusively to the State, and "direct" control of some irrigation delivery as well.

In addition, INERHI acts as judge for all water dispute cases. The combination of these functions gives INERHI a broad range of legal powers and responsibilities.

There has been an increasing number of public financed irrigation projects by INERHI since its creation. Emphasis has been placed on constructing irrigation delivery systems where previously they have never existed and operating and maintaining them. Users pay for this operation through water assessments levied against them. These irrigation projects are usually costly to construct and successfully exploit and therefore the beneficiaries have not been able to meet all funding requirements with their assessments. Transfers of funds from INERHI in Quito are, therefore, necessary even after construction.

Public irrigation works are more costly than private systems. INERHI's users generally pay more for their water than do their counterparts in the private sector, primarily because they must pay for a large number of district personnel and other administrative costs. Private organizations are generally much smaller in size, all labor

and other rendered services are voluntary, and the infrastructure is simple and easy to maintain. These tend to keep the cost of operation and maintenance down, but this does not take into consideration the initial cost of construction which is high in public systems. Most private canals were built years ago through voluntary or forced labor and, therefore, does not cost current users or the government.

However costly, most public financed and operated irrigation projects are relatively successful because they have provided irrigation to people who have not previously enjoyed its benefits. This in effect justifies the relative high cost of such projects to both government and user. If the government assumes from the outset that it will bear these costs as a general public benefit, then users are benefited. But if the government tries to pass costs on to the consumer, in this case poor farmers, then the advantages become less and less until perhaps the user is not benefited by the project. To date INERMI has not required users to amortize construction outlays but to only pay for a portion of operation and maintenance costs. Users are therefore benefited by the presence of irrigation districts. Nevertheless, these projects remain costly and someone must bear that cost.

Private sector irrigation in Ecuador is very much alive and thriving. Although the extent and number of public controlled irrigation projects is growing, private irrigation is still predominant and will remain so in the future. There has been a long history of irrigation by Ecuadorian farmers, especially in the mountainous sierra, and the irrigation institutions which have developed over the years

have become deeply rooted in the agricultural society. As viable social institutions among rural populations, they are not likely to disappear or become nonfunctional. On the contrary, they are more likely to increase as the irrigation needs of a growing rural population expand. Since these organizations form the backbone of private sector irrigation, one can conclude that they will remain active in the future. Irrigation planners are, therefore, compelled to recognize this situation and incorporate it into their planning.

Private irrigation institutions have been largely ignored in the past but must be taken into consideration in the future. Moreover, it would be unrealistic to suppose that the public sector could eventually assume the responsibility for all irrigation delivery in the country. The cost alone would be prohibitive. Therefore, the private sector must continue its important role in Ecuadorian irrigation. If this is the case, then public irrigation planners and administrators must look for ways to strengthen private sector irrigation.

The move in recent years has been toward increasing the number of state constructed and operated irrigation works. In addition, INERHI has also recently organized limited projects to assist a few private irrigation organizations to improve their delivery infrastructure. These programs should continue and should be expanded to include additional kinds of fundamental technical assistance as well.

In other words, more direct, meaningful assistance to the private sector from all appropriate public entities is necessary. Greater emphasis should be placed on helping them increase their productivity which will in turn stimulate the improvement of their personal welfare. The government should provide more real technical support, extension services, and lines of credit to irrigation institutions, services which should improve their own abilities to manage themselves.

The data show that for the most part water users are happy with their irrigation organizations and support them actively. In turn, their organizations function to their satisfaction and are fairly efficient in their management of the resource. They are capable of running themselves, at least in the eyes of their members. If one concludes that they will continue to operate in the future, then a small injection of helpful assistance from the public sector would greatly contribute to their operation. Those which now operate poorly could be improved and those which operate well could perhaps become even more effective. This would help improve efficient water management and use and, consequently, food production.

The following are recommended assistance which these suggested programs could include:

- 1) Creation and administration of orderly and adequate irrigation delivery schedules. The data show a general absence of such delivery schedules, perhaps because or-

ganizations do not know how to organize them. Their creation and execution would contribute to more efficient water management.

- 2) Technical assistance in improving water application and use at the farm level. This would include education of users on water requirements and need.
- 3) Assistance in straightening and lining canals and the general improvement of infrastructure, including construction of permanent diversion works where possible. This is not necessarily a wholesale restructurization of the entire water conveyance system but a general upgrading and improvement where needed and where availability and security of the resource would be enhanced.
- 4) Help in the creation of water storage facilities in appropriate locations, including small storage works at the farm level where appropriate and feasible.
- 5) Assistance with implementing or improving fundamental book-keeping systems and other general administrative procedures which would enhance the overall management of the institution being assisted.
- 6) More readily available credit to institutions which may desire to finance capital improvements in their irrigation infrastructure.

- 7) Improvement in public sponsored general crop extension services to water users of the irrigation institutions receiving the types of assistance specified above. Coupled with improved application of water to crops (item 2), this service would augment the farmers' capability to increase food production both for home consumption and sale.

The preceding items are examples of the most valuable types of assistance which a government program could offer a private irrigation institution. There may be others as well. The rule of thumb should be to keep the assistance simple, that is, to offer basic fundamental steps for improvement which are easily understood by the water user. They should be geared to his level of understanding and not too technical in nature.

The program should not attempt to completely revamp existing organizations or infrastructure. Rather, it should be kept simple, yet helpful. For example, even though an entire canal could be lined, and should be for maximum water use, improvement of the diversion work and some simple straightening and lining of the canal at the more critical points of water loss only, would perhaps be sufficient to increase water availability. Each case would have to be considered separately to determine the best kinds of assistance. Again, however, the key is to keep it simple--to move in and quickly assist an organization. The public technicians would provide the knowledge and the water users the manpower and capital whenever possible. The assistance would be simple, direct, appropriate to institution needs,

and be accomplished in a short period of time. This type of assistance to private irrigation delivery institutions would be a tremendous boon to private sector irrigation, and therefore to irrigation in general--a big return for a relatively small investment.

Another alternative course of action as a substitute for the creation of new public maintained projects in areas in which irrigation works do not currently exist, would be for INERHI to assist local farmers in proposed project areas in constructing their own canals. This would be technical as well as financial assistance. Upon its completion the system would be turned over to the users to operate and maintain as a private irrigation organization. Even if the government were to defray all the initial cost of construction it would not be obligated for future administration, operation, and maintenance costs, yet it would have performed nearly the same service.

Another conclusion which cannot be overlooked is the importance and usefulness of survey data of the type generated by this study. Information of the type provided by this particular field survey can be beneficial to INERHI and other public agencies as they approach the problem of how to assist private sector irrigation. The data can be consulted, considered, and reanalyzed according to need. It is there if needed.

Technical decisions and the success of technical projects often depend on other than technical factors, factors which can inhibit or facilitate the successful execution of a technical program. We have

looked at and examined a number of these factors in Ecuador in this review and analysis of the survey data. Many of these factors have legal, social, and economic roots. These facets should not be ignored. To the contrary, they should be incorporated into technical decisions since they may determine the success of a project. Irrigation projects are directed at helping people and therefore people and their institutions cannot be omitted as integral factors in the planning and decisions regarding such projects.

The field survey data upon which this study is based can perhaps serve as a model to planners for future similar surveys. It contains social, economic, and institutional information which can enable them to make intelligent decisions. In fact, this study is only the beginning of what could be done in acquiring statistical information about irrigation institutions.

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A P P E N D I X

PREFACE TO SURVEY QUESTIONNAIRES AND COMPARATIVE RESPONSES

The following questionnaire and comparative readout tables were prepared from the statistical results of the field surveys in Bolivia, Chile, Colombia, and Ecuador. There are two separate sections: a Water User's Questionnaire and an Institutional Data Questionnaire. These readouts consist of the questions asked in each questionnaire plus categories of the responses given to each question. These response categories were prepared after the raw data had been computerized.

In many instances, questions were open-ended and all responses were preserved in the computerization program. For purposes of completing the tables for data presentation, the multi-response or open-ended questions had to be closed in. In some cases, even though a particular answer possibility appeared on the questionnaire, it did not appear in the readout. It was seldom or never the selected response and therefore was either combined into another category or eliminated altogether. In no instances were the original questions changed.

There was a different number of surveys and interviews in each country, thus, the frequency of response to each answer on the tables was given in percentages. These percentages were based on the number of informative responses; that is, those who actually responded to the question. In some cases this may have differed from the total number of interviews due to no response to a particular question from an interviewee. Only in rare cases did this represent a significant percentage.

WATER USER QUESTIONNAIRE AND CATEGORIZED RESPONSES

WATER USER QUESTIONNAIRE AND CATEGORIZED RESPONSES

		BOLIVIA	COLOMBIA	CHILE	ECUADOR
Total Responses		135	42	161	171
		<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
1. Are you a water user-and/or member of an irrigation organization?					
1 Yes		100	100	100	100
2. Are you an official of that organization?					
1 Yes		32.6	34.1	11.3	39.0
2 No		67.4	65.9	88.8	61.0
3. Previous position					
1 Has previously never held a position		83.7	85.7	84.9	66.7
2 President or equivalent		1.5	0	4.4	7.9
3 Vice-President or equivalent		.7	0	1.3	3
4 Administrator or Manager		0	0	0	1.8
5 Member of Board of Directors		3.0	9.5	7.5	11.5
6 Treasurer		.7	0	6	1.8
7 Secretary		2.2	2.4	0	3.6
8 Lawyer or Advisor		0	2.4	0	0
9 Miscellaneous offices or positions		8.0	0	1.2	3.6
4. Present position					
1 Does not hold a position		65.9	66.7	79.9	61.8
2 President or equivalent		8.9	9.5	10.7	10.9
3 Vice-President or equivalent		3.0	0	.6	2.4
4 Administrator or Manager		.7	0	.6	1.8
5 Member of Board of Directors		6.7	14.3	5.7	11.5
6 Treasurer		2.2	2.4	1.3	4.2
7 Secretary		2.2	2.4	0	4.2
8 Lawyer or Advisor		0	2.4	0	0
9 Miscellaneous offices or positions		10.2	2.4	1.3	3.0
5. Is your organization governed by laws and statutes?					
1 Yes		33.1	54.3	43.0	61.8
2 No		57.1	11.4	19.7	33.8
3 Does not know		9.8	34.3	37.3	4.4

6. Is your organization governed by custom and tradition?

- 1 Yes
- 2 No
- 3 Does not know

7. What is your personal opinion of the organization in general?

- 1 Positive response (good, beneficial, productive, important)
- 2 Negative response (weak, non-productive, etc.)
- 3 Intermediate response
- 4 Does not know
- 5 Other

8. How does the organization function?

- 1 Positive response
- 2 Negative response
- 3 Intermediate response
- 4 Does not know
- 5 Other

9. Does the organization personally benefit you?

- 1 Positive response
- 2 Negative response
- 3 Intermediate response
- 4 Does not know
- 5 Other

10. Does the organization represent you personally?

- 1 Positive response
- 2 Negative response
- 3 Intermediate response
- 4 Does not know
- 5 Other

BOL	COL	CHI	ECU
135	42	161	171
%	%	%	%
82.2	0	44.7	62.7
10.9	100	14.5	37.3
7.0	0	40.8	0
79.3	75.6	77.9	83.2
1.5	0	4.1	1.8
19.3	24.4	12.4	15.0
0	0	5.5	0
78.4	57.1	78.0	61.9
3.0	16.7	4.3	13.1
17.9	23.8	13.5	23.2
.7	2.4	4.3	1.8
83.6	92.9	79.5	92.9
1.5	0	4.0	3.6
14.9	7.1	12.6	3.6
0	0	4.0	0
83.3	71.4	83.7	69.8
.8	0	2.8	22.2
12.9	28.6	9.9	3.2
3.0	0	3.5	4.8

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11. Personally, does the organization respond to your water needs?

- 1 Positive response
- 2 Negative response
- 3 Intermediate response
- 4 Does not know
- 5 Other

12. What is your opinion of the officers and directors of the organization?

- 1 Positive response
- 2 Negative response
- 3 Intermediate response
- 4 Does not know
- 5 Other

13. Are there other irrigation organizations in the area with which you are familiar?

- 1 Yes
- 2 No
- 3 Does not know

14.A How do they function?

- 1 No answer
- 2 Does not know - respondent knows other organizations exist but not how they function
- 3 Well
- 4 Poorly
- 5 Other miscellaneous responses

14.B If they function well, why do they do so?

- 1 No answer
- 2 Does not know - Individual knows that other organizations function well, but does not know why.
- 3 Good leadership and/or well organized
- 4 Have enough water and cost of water is less
- 5 Other miscellaneous responses

BOL 135	COL 42	CHI 161	ECU 171
%	%	%	%
69.9	78.0	65.6	74.1
8.3	14.6	18.2	10.5
21.1	4.9	14.9	15.4
.8	0	1.3	0
0	2.4	0	0
76.7	87.8	86.0	83.6
4.5	0	4.4	5.5
16.5	12.2	5.9	10.3
.8	0	2.9	.6
1.5	0	.7	0
37.6	21.4	27.7	49.6
29.4	78.6	69.0	48.9
33.0	0	3.2	1.5
34.7	80.0	12.5	50.5
37.3	10.0	8.3	25.2
20.0	0	35.4	13.6
1.3	10.0	43.8	8.7
6.6	0	0	1.0
56.3	100	24.0	65.8
14.6	0	8.0	12.7
6.3	0	40.0	12.7
6.3	0	20.0	3.8
16.7	0	8.0	5.1

14.C.If they do not function well, why don't they?

- 1 No answer
- 2 Does not know - Individual knows that other organizations function poorly but does not know why
- 3 Poor organizational structure or leadership
- 4 Lack of water or physical failure of infrastructure
- 5 Other miscellaneous responses

15. Are all the users in your organization content or happy to be farmers?

- 1 Yes
- 2 No
- 3 Does not know

16.A.Do you know if some are planning to leave farming?

- 1 Yes
- 2 No
- 3 Does not know

16.B.If yes, why?

- 1 No answer
- 2 Farming is unprofitable or insecure
- 3 Insufficient land
- 4 Insufficient water
- 5 Insufficient capital
- 6 Other miscellaneous responses

16.C.If yes, what will they do?

- 1 No answer
- 2 Does not know
- 3 Go into other than crop agriculture
- 4 Go to the city or seek other employment
- 5 Seek unoccupied land elsewhere

17. How much total land do you own, operate, or manage and how much is cultivated and irrigated?

BOL 135	COL 42	CHI 161	ECU 171
74.3	84.2	25.0	74.6
14.3	0	0	12.7
2.9	0	25.0	5.6
5.8	0	32.0	0
2.9	15.8	18.0	7.0
79.4	71.8	87.3	85.0
15.3	28.2	12.0	11.8
5.3	0	.6	3.3
27.5	12.8	7.2	7.9
61.8	87.2	87.6	86.8
10.7	0	5.2	5.3
10.0	37.5	31.6	75.9
17.5	50.0	0	13.7
37.5	0	0	0
22.5	0	0	6.9
0	0	36.9	0
12.5	12.5	31.7	3.4
10.0	37.5	33.3	76.7
2.5	0	0	6.7
2.5	62.5	22.2	6.6
65.0	0	44.5	6.7
20.0	0	0	3.3
Separate comparative table on page 16.			

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18. Are you:

- 1 Owner of land
- 2 Renter of land
- 3 Part owner, part renter
- 4 Sharecropper
- 5 Part owner, part sharecropper
- 6 Future land owner
- 7 Member of cooperative arrangement - land owned by cooperative
- 8 Miscellaneous other classifications

19. Is your land:

- 1 In one single place
- 2 Divided in various plots

20.A. Do you always have enough irrigation water?

- 1 Yes
- 2 No

20.B. If not, why not?

- 01 No answer
- 02 Insufficient water in general area year round
- 03 Insufficient water in general during growing season
- 04 Insufficient water due to natural causes or occasional drought
- 05 Physical deficiencies of water delivery infrastructure
- 06 Organization inefficiencies
- 07 Water theft
- 08 Water source insufficient
- 09 Various combinations of two or more of preceding responses
- 10 Other miscellaneous responses

21.A. Under the present circumstances, if you needed more water do you believe you would be able to obtain it?

- 1 Yes
- 2 No
- 3 Does not know

BOL 135	COL 42	CHI 161	ECU 171
%	%	%	%
91.0	81.0	84.7	77.1
.7	2.4	0	.6
1.5	7.1	1.3	2.9
.7	7.1	1.3	.6
2.2	0	0	4.1
3.7	0	.6	.6
0	0	0	13.0
0	2.4	12.1	1.2
14.8	71.4	93.2	42.9
85.2	28.6	6.8	57.1
28.6	60.0	50.9	36.8
71.4	40.0	49.1	63.2
5.2	22.2	8.9	11.9
22.7	0	2.5	16.5
4.2	11.1	2.6	19.3
0	0	5.1	6.4
5.1	22.2	3.8	14.7
3.1	16.7	6.3	8.3
0	11.1	1.3	4.6
44.3	16.7	57.0	3.7
12.3	0	6.4	9.2
3.1	0	6.5	5.4
39.3	44.0	30.7	35.8
41.0	52.0	52.3	57.5
19.7	4.0	17.0	6.7

21.B.If yes, how or from where would you obtain it?

- 1 No answer
- 2 From respondent's organization itself
- 3 Rent water from some else
- 4 From private well, spring, or other source
- 5 From a public irrigation system
- 6 From improvement of delivery infrastructure
- 7 Other miscellaneous responses

22. Is your agricultural production for your own household consumption only or do you also produce some for the market?

- 1 Only for household use
- 2 Some for the market
- 3 Other responses

23. Do you also work off your farm to support yourself?

- 1 Yes
- 2 No

24.A.What distance is your land from the:

- A. Main Diversion Works
- B. Main Canal, or
- C. Nearest secondary diversion work

(answers in kilometers)

- 01 No answer
- 02 0 - 1
- 03 1 - 1.9
- 04 2 - 4.9
- 05 5 - 9.9
- 06 10 - 19.9
- 07 20 - 49.9
- 08 50 and over
- 09 Adjacent to canal or well
- 10 Distant from main diversion work, canal or secondary diversion work
- 11 Close to main diversion work, canal or secondary diversion work
- 12 Does not know

BOL 135	COL 42	CHI 161	ECU 171
%	%	%	%
33.3	58.3	13.1	55.3
20.8	23.3	78.6	40.0
8.3	0	3.3	4.7
13.9	0	1.6	0
2.8	0	0	0
15.3	8.3	1.6	0
5.6	0	1.6	0
26.9	0	9.5	34.3
73.1	97.6	89.9	65.7
0	2.4	.6	0
19.3	38.1	25.0	48.8
80.7	61.9	75.0	51.2
1.5	85.7	3.1	77.1
35.5	0	1.2	1.2
7.4	0	.6	1.2
17.0	2.4	6.2	4.8
12.6	2.4	14.3	7.7
12.6	7.2	12.4	2.4
5.9	2.4	21.1	2.4
0	0	6.2	0
3.7	0	.6	.6
3.7	0	13.7	1.2
0	0	0	.6
0	0	20.5	1.2

- 24.B.01 No answer
- 02 0 - 1
- 03 1 - 1.9
- 04 2 - 4.9
- 05 5 - 9.9
- 06 10 - 19.9
- 07 20 - 49.9
- 08 50 and over
- 09 Adjacent to canal or well
- 10 Distant from main diversion work, canal or secondary diversion work
- 11 Close to main diversion work, canal or secondary diversion work
- 12 Does not know
- 24.C.01 No answer
- 02 0 - 1
- 03 1 - 1.9
- 04 2 - 4.9
- 05 5 - 9.9
- 06 10 - 19.9
- 07 20 - 49.9
- 08 50 and over
- 09 Adjacent to canal or well
- 10 Distant from main diversion work, canal or secondary diversion work
- 11 Close to main diversion work, canal or secondary diversion work
- 12 Does not know
25. How many of the last five years have you lost harvests? (Whole or partial loss)
- 1 One year
- 2 Two years
- 3 Three years
- 4 Four years
- 5 Five years
- 6 None
- 7 Does not know

BOL 135	COL 42	CHI 161	ECU 171
%	%	%	%
6.7	100	99.4	100
46.2	0	0	0
7.4	0	0	0
9.0	0	0	0
3.0	0	0	0
0	0	0	0
0	0	0	0
.7	0	0	0
17.9	0	.6	0
2.2	0	0	0
3.7	0	0	0
3.0	0	0	0
80.0	66.7	7.5	89.8
0	16.6	34.4	4.8
0	0	4.4	.6
0	4.8	13.7	.6
20.0	0	8.7	0
0	0	3.7	0
0	0	0	0
0	0	0	0
0	11.9	19.4	3.6
0	0	1.3	.6
0	0	.6	0
0	0	6.3	0
14.4	48.7	37.1	20.4
31.1	5.1	9.4	21.0
23.5	2.6	.6	8.0
8.3	0	0	4.9
17.4	0	0	4.9
4.5	43.6	52.8	40.1
.8	0	0	.6

100

26. Why did you lose them? (More than one answer possible - total frequency of response indicated)

- 1 Lack of water
- 2 Excess water (during rainy season)
- 3 Insects and/or disease
- 4 Weeds
- 5 Adverse weather conditions (hail, frost, etc.)
- 6 Other miscellaneous responses
- 7 No losses recorded
- 8 Does not know

27. If you had more money, which of the following would you do? (More than one answer possible - total frequency of response indicated)

- 01 Purchase more land
- 02 Religious fiesta or charity to church
- 03 Home improvement
- 04 Family education
- 05 Food, clothing, medical, and other family expenses
- 06 Invest in agriculture in general
- 07 Invest in crop agriculture specifically
- 08 Invest in livestock agriculture specifically
- 09 Invest in non-agriculture activity or business
- 10 Improve irrigation infrastructure
- 11 Other miscellaneous responses

28. In which of the following groups do you participate regularly? (more than one answer possible - total frequency of response indicated)

- 1 Agricultural society, cooperative, or water user group
- 2 Local community organization (community action group, etc.)
- 3 Local church activities
- 4 Sports activities
- 5 Other miscellaneous responses (professional associations, political organizations, etc.)
- 6 Does not participate in any group or organization
- 7 Does not know

BOL	COL	CHI	ECU
135	42	161	171
%	%	%	%
65.7	15.8	11.2	26.1
1.5	18.4	6.3	11.8
6.3	0	17.9	5.6
3.8	15.8	.6	1.8
60.5	0	9.4	16.8
5.4	5.2	9.4	6.8
4.6	44.7	52.5	40.4
.8	0	0	1.2
34.4	19.5	20.3	22.6
.8	0	.6	7.8
43.5	53.7	10.2	49.4
25.2	34.1	0	45.9
2.4	9.7	.6	11.9
73.3	29.3	76.3	35.2
8.5	0	1.2	4.8
34.6	12.2	15.8	9.0
6.1	12.1	15.3	13.8
7.0	7.2	4.3	3.6
4.8	9.6	4.9	12.0
65.9	78.6	50.6	83.4
46.2	52.3	14.4	52.4
6.1	47.6	1.2	48.9
21.2	2.4	9.4	2.4
1.6	0	5.5	10.2
24.2	2.4	41.3	1.8
0	0	1.6	0

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29. Indicate whether or not you have changed the following items with regard to your operation and describe the change. (Unless otherwise stated, a positive response indicates a progressive change)

A1. Irrigation methods

- 1 Yes
- 2 No
- 3 Does not know

A2. Description of change:

- 1 No specific description of change given
- 2 Has improved irrigation in general
- 3 Has improved irrigation infrastructure or equipment specifically
- 4 Did not irrigate in past but is now irrigating
- 5 Uses water from well now
- 6 Has regressed in irrigation methods or use

B1. Farm mechanization

- 1 Yes
- 2 No
- 3 Does not know

B2. Description of change:

- 1 No specific description given
- 2 General mechanization improvement
- 3 Uses and/or rents tractor, implements, and other mechanized equipment now and previously did not
- 4 Owns tractor and other mechanized equipment
- 5 Uses both oxen teams and tractor at present
- 6 Uses less machinery now than previously used

C1. Use of fertilizer

- 1 Yes
- 2 No
- 3 Does not know

	BOL 135	COL 42	CHI 161	ECU 171
	%	%	%	%
	48.1	66.7	26.6	10.0
	51.9	31.0	72.8	90.0
	0	2.4	.6	0
	0	0	18.3	0
	1.5	31.0	65.2	26.3
	40.0	0	8.1	5.3
	35.4	69.0	2.0	63.2
	21.5	0	2.0	5.3
	1.5	0	4.1	0
	45.2	97.6	38.0	55.9
	54.8	2.4	61.4	44.1
	0	0	.6	0
	0	0	12.0	0
	1.6	14.3	46.3	5.3
	60.6	85.7	26.9	61.0
	4.9	0	10.5	2.1
	31.1	0	0	31.6
	1.6	0	4.5	0
	84.4	92.9	51.3	51.8
	15.6	7.1	48.1	48.2
	0	0	.6	0

C2. Description of change

- 1 No specific description given
- 2 Uses natural fertilizer
- 3 Uses chemical fertilizer
- 4 Uses both chemical and natural fertilizer
- 5 Uses more fertilizer than used to use
- 6 Uses less fertilizer than previously

D1. Type of crops

- 1 Yes
- 2 No
- 3 Does not know

D2. Description of change:

- 1 No specific description given
- 2 Partial or complete change to permanent crops (fruit, etc.)
- 3 Changed to or expanded annual crops and vegetables
- 4 Changed to livestock agriculture and alfalfa
- 5 Improved varieties of traditional crops
- 6 Unspecified change in crops

E1. Use of chemical sprays

- 1 Yes
- 2 No
- 3 Does not know

E2. Description of change:

- 1 No specific description given
- 2 Currently uses chemical sprays and did not previously use
- 3 Has improved upon previous use of chemical sprays
- 4 Has abandoned use of chemical sprays

F1. Use of credit

- 1 Yes
- 2 No
- 3 Does not know

BOL 135	COL 42	CHI 161	ECU 171
1.7	0	9.2	0
34.8	2.6	0	2.3
46.1	74.4	7.9	69.3
16.5	23.1	27.5	26.1
0	0	46.0	0
.9	0	9.2	2.2
20.7	9.5	15.2	2.9
79.3	90.5	84.2	97.1
0	0	.6	0
0	37.5	23.3	0
3.6	0	13.3	20.0
60.8	25.0	33.4	0
28.5	0	0	60.0
3.6	37.5	6.7	0
3.6	0	23.3	20.0
52.6	100	2.5	60.6
47.4	0	96.8	39.4
0	0	.6	0
1.4	0	66.6	0
97.2	83.4	16.7	94.2
0	16.7	8.3	5.9
1.4	0	8.3	0
22.2	92.9	36.1	25.9
77.8	7.1	63.3	74.1
0	0	.6	0

F2. Description of change:

- 1 No specific description given of credit use
- 2 Uses more credit than previously used
- 3 Specified use of credit from government bank or program
- 4 Uses credit from private bank, family, or other source
- 5 Uses credit from a cooperative arrangement
- 6 Uses less credit than previously used

30.A. Does a water law exist for _____?
(country)

- 1 Yes
- 2 No
- 3 Does not know

30.B. If yes, how did you learn of the water law? (More than one answer possible - total frequency of response indicated)

- 1 No answer
- 2 Government agency or official publication
- 3 Press (radio and newspaper)
- 4 Traditional knowledge or from friends or neighbors
- 5 Other miscellaneous responses
- 6 Does not know

31. Do you know of some recent change in the water law for _____?
(country)

- 1 Yes
- 2 No
- 3 Does not know

32.A. Have you at some time paid a water tax to the state?

- 1 Yes
- 2 No
- 3 Does not know

32.B. If yes, since when?

- 1 1973
- 2 1974
- 3 1975
- 4 Not applicable ("No" answer on item 32.A)
- 5 Does not know

BOL 135	COL 42	CHI 161	ECU 171
%	%	%	%
6.7	15.4	28.6	13.6
0	15.4	36.5	9.1
53.3	64.1	4.8	61.4
6.6	0	0	6.8
23.2	0	0	4.6
10.0	5.1	30.2	4.5
10.3	56.1	53.2	72.8
9.5	0	6.3	11.8
80.2	43.9	40.5	15.4
63.3	8.0	35.6	6.8
26.4	60.0	30.7	45.4
13.2	23.4	9.9	39.2
6.5	15.7	23.8	10.8
0	4.0	1.0	1.5
3.3	0	0	3.0
0	40.0	24.6	40.8
83.7	40.0	25.4	47.1
16.3	20.0	50.0	12.1
0	0	1.3	7.8
98.5	100	96.2	92.2
1.5	0	2.5	0
0	0	.6	2.4
0	0	.6	1.2
0	0	0	3.6
100	100	98.7	92.3
0	0	0	.6

32.C.If yes, did you pay:

- 1 According to a measured consumed amount
- 2 According to a fixed amount established in the water rights document
- 3 The organization pays the water tax
- 4 Not applicable ("No" answer on item 32.A)

33. What is a water use right?

- 1 Does not know
- 2 The right to use water (in general)
- 3 The right to use according to amount of land
- 4 The right to use according to shares
- 5 The right to use based on membership in organization or in exchange for labor on canal
- 6 The purchased right to use water
- 7 The right to use based on law
- 8 Responses related to acquisition of use right from government
- 9 Other miscellaneous responses

34. Do you have a right to use irrigation water?

- 1 Yes
- 2 No
- 3 Does not know

35. Have you had to fill out a document having to do with a water right?

- 1 Yes
- 2 No
- 3 Does not know

36. Have you through your own efforts become informed about the right to use water?

- 1 Yes
- 2 No
- 3 Does not know

BOL 135	COL 42	CHI 161	ECU 171
%	%	%	%
0	0	0	0
.8	0	1.3	3.0
0	0	0	4.8
99.2	100	98.7	92.3
26.8	21.9	24.0	11.8
19.7	37.5	30.6	56.9
11.1	9.4	14.9	2.0
8.7	0	4.1	.7
22.8	3.1	.8	8.0
4.0	15.7	19.8	10.5
3.1	9.4	3.3	3.3
2.4	3.1	.8	5.4
1.6	0	1.6	2.0
94.0	92.1	96.9	93.8
1.5	5.3	1.9	3.7
4.5	2.6	1.3	2.5
7.6	14.3	19.0	7.7
84.0	85.7	76.2	91.7
8.4	0	4.8	.6
15.9	21.4	29.1	13.3
44.9	78.6	68.8	86.1
39.3	0	2.1	.6

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37. Do you have documents which give you a water right?

- 1 Yes
- 2 No
- 3 Does not know

38. How did you obtain the use of the water?

- 1 Inheritance or future inheritance
- 2 Purchased it with the land
- 3 Purchased part and inherited part
- 4 Purchased it separately from the land
- 5 From government concession of private use right
- 6 From a public irrigation district or program
- 7 By labor or membership in an irrigation organization, community, etc.
- 8 Miscellaneous responses and various combinations of above categories

39. How long have you had such use?

- 1 One year
- 2 Two years
- 3 Three - ten years
- 4 Ten years or more
- 5 Not applicable
- 6 Mitas for 10 years or more and other source 2 years or less (Bolivia only)

40.A. Do you currently rent irrigation water?

- 1 Yes
- 2 No
- 3 Does not know

40.B. If yes, on what basis do you pay rental?

- 1 No answer
- 2 According to the size or amount of land
- 3 Fixed yearly charge
- 4 By the hectare or by the harvest

BOL 135	COL 42	CHI 161	ECU 171
%	%	%	%
38.9	16.7	57.3	36.7
53.4	83.3	38.0	62.7
7.6	0	4.7	.6
25.4	0	19.0	12.9
10.4	22.0	41.1	24.7
14.9	0	1.3	16.5
1.5	2.4	1.9	.6
0	0	10.8	20.0
20.9	70.7	23.5	1.2
17.0	0	.6	19.4
9.3	4.9	1.9	4.7
4.5	4.9	15.8	3.6
4.5	4.9	3.8	10.8
16.5	70.7	34.2	42.5
71.4	19.5	44.9	43.1
0	0	.6	0
3.1	0	0	0
.7	81.0	.6	20.6
99.3	19.0	98.7	79.4
0	0	.6	0
100	66.7	66.7	90.9
0	3.0	0	0
0	12.1	33.3	9.1
0	18.2	0	0

40.C.If yes, how much does it cost? (In dollars)

- 1 No answer
- 2 \$9 - 22/hectare/harvest
- 3 \$3 - 25/year
- 4 Other miscellaneous responses

41.A.Did you use to rent or lease irrigation water?

- 1 Yes
- 2 No
- 3 Does not know

41.B.If yes, how long ago did you stop renting or leasing water?

- 1 One year
- 2 Two years
- 3 Three years or more
- 4 Not applicable ("No" or "does not know" on question 41)

42. Where would you go in case of a dispute over water, for example, in case of someone stealing water? (More than one answer possible - total frequency of response indicated)

- 1 Local community authority
- 2 The respondent's organization itself
- 3 Police
- 4 Government authority or public agency (Ministry of Agriculture, INCORA, INERHI, etc.)
- 5 Directly to person involved in conflict to resolve
- 6 Would do nothing
- 7 Other miscellaneous responses
- 8 Does not know

BOL	COL	CHI	ECU
135	42	161	171
%	%	%	%
100	56.7	66.7	88.2
0	12.0	0	0
0	9.0	33.3	11.6
0	12.0	0	0
.7	0	2.5	16.1
99.3	100	96.9	83.9
0	0	.6	0
.7	0	.6	.6
99.3	0	0	1.2
0	0	1.9	13.7
0	100	97.5	84.5
33.3	0	5.6	4.7
74.8	7.1	51.9	40.8
3.0	0	10.7	0
3.6	66.6	37.6	24.9
0	26.2	4.3	24.3
0	0	1.9	3.6
2.1	0	22.1	2.4
0	0	4.7	0

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43. Before what authority would you make a formal complaint? (More than one answer possible - total frequency of response indicated)

- 1 Local community authority
- 2 The respondent's organization itself
- 3 Police
- 4 Government authority or public agency (Ministry of Agriculture, INCORA, INERPI, etc.)
- 5 Directly to person involved in conflict to resolve
- 6 Would do nothing
- 7 Other miscellaneous responses
- 8 Does not know

BOL 135 %	COL 42 %	CHI 161 %	ECU 171 %
50.0	2.4	1.9	7.9
50.0	2.4	27.8	26.2
3.7	4.8	5.7	0
6.6	88.1	29.0	53.0
0	0	3.2	0
0	0	3.8	6.1
8.1	2.4	23.4	3.0
0	2.4	5.7	3.7

Item 17. Total land owned, operated, or managed by individual*

			BOLIVIA			COLOMBIA			CHILE			ECUADOR		
			Total land	Cultivated	Irrigated	Total land	Cultivated	Irrigated	Total land	Cultivated	Irrigated	Total land	Cultivated	Irrigated
00	No answer		0	0	0	0	2.4	0	1.2	1.8	1.2	0	0	0
01	0 -	.49	3.0	3.0	3.1	2.4	2.4	2.4	0	0	0	12.9	14.7	15.9
02	.5 -	.9	6.7	6.7	14.8	0	0	0	1.9	1.9	1.9	10.6	11.8	14.1
03	1 -	1.9	17.0	17.8	22.2	9.5	9.5	9.5	5.0	5.6	7.5	11.8	11.2	11.8
04	2 -	4.9	42.2	45.2	37.8	11.9	19.0	19.0	8.1	8.1	11.2	28.2	27.6	27.1
05	5 -	9.9	22.2	19.3	10.4	28.6	23.8	26.2	6.2	8.7	8.1	19.4	18.8	15.9
06	10 -	19.9	3.7	3.7	5.2	19.0	19.0	19.0	19.9	19.3	19.3	5.9	5.9	7.1
07	20 -	29.9	2.2	2.2	0	2.4	2.4	0	10.6	11.2	11.2	2.9	1.8	1.8
08	30 -	39.9	.7	.7	.7	2.4	0	0	3.7	2.5	3.7	1.2	1.2	0
09	40 -	49.9	.7	.7	0	0	0	0	5.6	5.0	5.6	0	.6	0
10	50 -	99.9	1.5	.7	.7	11.9	14.3	14.3	16.8	16.8	14.3	2.4	4.7	4.7
11	100 -	499.9	0	0	0	4.8	4.8	7.1	13.7	14.9	13.7	4.7	1.8	1.8
12	500 -	999.9	0	0	0	2.4	0	2.4	2.5	2.5	1.9	0	0	0
13	1,000 -	4,999.9	0	0	0	2.4	2.4	0	3.7	.6	0	0	0	0
14	5,000 -	9,999.9	0	0	0	2.4	0	0	0	0	0	0	0	0
15	10,000 -	and over	0	0	0	0	0	0	.6	.6	0	0	0	0

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* There were 19 in Ecuador who were members of some cooperative arrangement in which all land was owned by the cooperative. Consequently, they are not included in the table percentages.

INSTITUTIONAL DATA QUESTIONNAIRE AND CATEGORIZED RESPONSES

INSTITUTIONAL DATA QUESTIONNAIRE AND CATEGORIZED RESPONSES

Total Responses

1. Types of Organizations

A. Government Controlled Water Organizations

- 1 Direct central government control or through a dependent regional sub-agency
- 2 Direct central government control or thorough its dependency with user organization in an advisory position
- 3 Controlled by a government entity at the regional, municipal or local level

B. Private or User Controlled Organizations

1. Formal (statutes, written document approved by the government, constitution and bvlaws, etc.)

- 1 With governmental supervision
2 Without governmental supervision

2. Informal (without statutes or written rules, etc.)

- 1 With government supervision
2 Without government supervision

2. Types of Private Organizations and their Functions

A. User Association

- ```
1 Water distribution only
2 Performs other functions in addition to administering water
```

### B. Cooperative

- ```
1 Water distribution only
2 Performs other functions in addition to administering water
```

BOLIVIA	COLOMBIA	CHILE	ECUADOR
27 %	8 %	32 %	35 %
7.4	0	3.2	17.2
0	75.0	0	0
0	12.5	0	0
22.2 37.0	12.5 0	58.1 0	11.4 34.3
11.1 22.2	0 0	38.7 0	5.7 34.3
32.0 4.0	100 0	100 0	79.3 0
4.0 28.0	0 0	0 0	0 17.2

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2. C. Native Comuna

- 1 Water distribution only
- 2 Performs other functions in addition to water distribution

D. Other (Farmers' Federation, etc.)

- 1 Water distribution
- 2 Performs other functions in addition to water distribution

3. Structure of the Organizations

A. Number of members or users

- 1 1 - 19
- 2 20 - 49
- 3 50 - 99
- 4 100 - 299
- 5 300 - 499
- 6 500 - 999
- 7 1,000 - 1,999
- 8 2,000 - over

B. 1. Board of Directors

- 1 Yes
- 2 No

B. 2. Members of Board of Directors appointed or elected and by whom

- 0 No answer (Officer exists but no additional information given)
- 1 Appointed by central government or other public agency
- 2 Elected by members
- 3 Appointed by president and/or other elected officials

C. 1. President or equivalent

- 1 Yes
- 2 No

	BOL 27 <u>7</u>	COL 8 <u>7</u>	CHI 32 <u>7</u>	ECU 35 <u>7</u>
	4.0	0	0	0
	8.0	0	0	3.5
	0	0	0	0
	20.0	0	0	0
	3.7	0	22.6	14.3
	33.3	0	22.6	17.1
	3.7	12.5	25.8	20.0
	18.5	12.5	22.6	17.1
	11.1	12.5	3.2	11.4
	14.8	37.5	3.2	2.9
	3.7	25.0	0	5.7
	11.1	0	0	11.4
	59.3	100	71.0	74.3
	40.7	0	29.0	25.7
	0	0	0	0
	0	0	0	0
	100	100	100	100
	0	0	0	0
	81.5	100	74.2	80.0
	18.5	0	25.8	20.0

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3. C. 2. President appointed or elected and by whom

- 0 No answer (Officer exists but no additional information given)
- 1 Appointed by central government or other public agency
- 2 Elected by members
- 3 Appointed by president and/or other elected officials

D. 1. Vice-President

- 1 Yes
- 2 No

D. 2. Vice-President appointed or elected and by whom

- 0 No answer (Officer exists but no additional information given)
- 1 Appointed by central government or other public agency
- 2 Elected by members
- 3 Appointed by president and/or other elected officials

E. 1. Secretary

- 1 Yes
- 2 No

E. 2. Secretary appointed or elected and by whom

- 0 No answer (Officer exists but no additional information given)
- 1 Appointed by central government or other public agency
- 2 Elected by members
- 3 Appointed by president and/or other elected officials

F. 1. Treasurer

- 1 Yes
- 2 No

F. 2. Treasurer appointed or elected and by whom

- 0 No answer (Officer exists but no additional information given)
- 1 Appointed by central government or other public agency
- 2 Elected by members
- 3 Appointed by president and/or other elected officials

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
0	0	4.3	0
4.8	0	4.3	0
95.2	100	30.4	100
0	0	60.9	0
66.7	100	9.7	60.0
33.3	0	90.3	40.0
0	0	0	0
0	0	0	0
100	100	66.6	100
0	0	33.4	0
51.9	100	58.1	74.3
48.1	0	41.9	25.7
0	0	5.6	0
0	0	0	0
100	100	27.8	100
0	0	66.7	0
51.9	50.0	48.4	65.7
48.1	50.0	51.6	34.2
0	0	6.7	0
0	0	0	4.3
100	100	40.0	87.0
0	0	53.3	8.7

3. G. 1. Manager/Administrator or equivalent

- 1 Yes
- 2 No

G. 2. Manager/Administrator appointed or elected and by whom

- 0 No answer (officer exists but no additional information given)
- 1 Appointed by central government or other public agency
- 2 Elected by members
- 3 Appointed by president and/or other elected officials

H. 1. Watermaster/Inspector or equivalent

- 1 Yes
- 2 No

H. 2. Watermaster/Inspector appointed or elected and by whom

- 0 No answer (officer exists but no additional information given)
- 1 Appointed by central government or other public agency
- 2 Elected by members
- 3 Appointed by president and/or other elected officials

4. How often do the members of the organization have general membership meetings?

- 1 Annually
- 2 Semi-Annually
- 3 Monthly
- 4 According to need
- 5 Miscellaneous other times (weekly, semi-weekly, every quarter, etc.)
- 6 Do not have meetings

5. Percentage of members who attend general membership meetings

- 1 0 - 49%
- 2 50 - 79%
- 3 80 - 100%
- 4 Do not meet or have not met yet
- 5 Do not know

BOL 27	COL 8	CHI 32	ECU 35
<u>27</u>	<u>8</u>	<u>32</u>	<u>35</u>
3.7	37.5	16.1	37.1
96.3	62.5	83.9	62.8
0	0	0	0
0	0	0	0
100	33.3	0	61.5
0	66.7	100	38.5
37.0	0	41.9	42.9
63	100	58.1	57.1
0	0	8.3	0
0	0	0	0
100	0	25.0	80.0
0	0	66.7	20.0
3.7	12.5	54.9	25.8
7.4	75.0	12.9	17.1
22.2	0	6.5	14.3
44.4	0	6.5	20.0
22.2	12.5	12.9	5.7
0	0	6.5	17.1
14.8	12.5	50.0	8.8
25.9	37.5	26.6	35.3
55.6	25.0	10.0	38.3
0	12.5	6.7	17.6
3.7	12.5	6.7	0

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6. How frequently should the organization officers meet?

- 1 Monthly
- 2 Weekly or semi-weekly
- 3 Do not have regular meetings, only meet when necessary
- 4 There are no officers or meetings
- 5 Miscellaneous

7. How often do they meet in reality?

- 1 Monthly
- 2 Weekly or semi-weekly
- 3 Do not have regular meetings, only meet when necessary
- 4 There are no officers or meetings
- 5 Miscellaneous

8. Is the organization:

A. 1. A suborganization of a larger one?

- 1 Yes
- 2 No

A. 2. If yes, describe this larger organization

- 0 No answer
- 1 A public irrigation district or government entity
- 2 A private irrigation entity

B. Does the organization have suborganizations in it?

- 1 Yes
- 2 No

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
14.8	87.5	48.4	38.2
14.8	0	9.7	20.6
40.7	0	16.1	20.6
22.2	0	6.5	20.5
7.4	12.5	19.3	0
7.4	75.0	25.8	28.1
11.1	0	3.2	22.0
51.9	25.0	12.9	25.0
22.2	0	12.9	21.9
7.4	0	45.3	3.0
40.7	87.5	80.6	17.1
59.3	12.5	19.4	82.9
0	0	0	83.3
18.2	100	20.0	16.7
81.8	0	80.0	0
37.0	0	6.5	5.7
63.0	100	93.5	94.3

9. Who makes the decisions with respect to:

A. The Budget

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

B. Expenditures

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

BOL 27 %	COL 8 %	CHI 32 %	ECU 35 %
7.4	87.5	3.2	17.2
3.7	0	35.5	42.9
48.1	0	12.9	11.4
7.4	0	0	2.9
0	0	0	0
0	0	0	0
0	0	0	0
3.7	12.5	3.2	5.8
0	0	45.1	5.8
29.6	0	0	14.3
0	0	0	0
7.4	87.5	3.2	17.1
3.7	0	35.5	25.7
48.1	0	12.9	22.9
3.7	0	0	5.7
0	0	0	0
0	0	0	2.9
0	0	0	2.9
0	0	0	0
7.4	12.5	3.2	2.9
0	0	45.1	14.4
29.6	0	0	2.9
0	0	0	2.9

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9. C. Irrigation Scheduling

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

D. Maintenance

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
3.7	75.0	3.2	17.1
0	0	12.9	17.1
11.1	0	12.9	17.2
3.7	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
3.7	0	0	2.9
7.4	0	3.2	0
11.1	0	25.8	0
55.6	25.0	41.9	42.9
3.7	0	0	2.9
3.7	87.5	3.2	17.1
3.7	0	32.3	20.0
14.8	0	16.1	31.5
3.7	0	0	2.9
0	0	0	0
0	0	0	0
0	0	0	5.7
0	0	0	2.9
14.8	12.5	3.2	0
7.4	0	45.1	8.7
48.1	0	0	2.9
3.7	0	0	8.6

9. E. Capital Improvements

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

F. Disputes

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

BOL	COL	CHI	ECU
27	8	32	35
%	%	%	%
7.4	75.0	3.2	17.1
3.7	0	29.0	37.1
40.7	12.5	16.1	22.9
0	0	0	2.9
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
3.7	0	3.2	0
0	12.5	41.5	11.5
44.4	0	6.4	8.6
0	0	0	0
7.4	62.5	3.2	17.1
0	0	9.7	8.6
14.8	0	54.8	28.6
14.8	0	6.5	14.3
0	0	0	0
0	0	0	0
0	12.5	0	0
18.8	0	0	0
11.1	0	6.4	2.9
0	12.5	0	5.8
0	0	19.4	20.0
33.3	0	0	2.9

10. Who carries out the following functions:

A. Payment of Expenditures

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

B. Investment of Funds

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
7.4	87.5	19.3	17.1
0	0	0	0
18.5	0	0	0
3.7	0	12.9	5.7
0	0	0	0
25.9	0	16.1	51.4
0	0	6.5	17.1
0	0	0	0
0	12.5	16.2	2.9
0	0	0	2.9
29.6	0	25.8	0
14.8	0	3.2	2.9
7.4	62.5	19.3	17.1
0	0	0	0
33.3	0	0	0
3.7	0	16.1	0
0	0	0	0
11.1	0	16.1	22.9
0	0	6.5	14.3
0	0	0	0
0	12.5	16.1	2.9
0	0	0	0
44.4	12.5	22.6	40.0
0	0	3.2	2.9

10. C. Accounting or Bookkeeping

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

D. Maintenance and Operation

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

BOL	COL	CHI	ECU
27	8	32	35
%	%	%	%
7.4	75.0	19.3	17.1
0	0	0	0
0	0	0	0
0	0	3.2	2.9
48.1	0	3.2	0
0	12.5	29.0	0
0	0	3.2	0
0	0	0	0
3.7	0	6.4	71.4
0	0	0	5.7
29.6	12.5	25.8	0
11.1	0	9.7	2.9
3.7	87.5	19.3	17.1
33.3	0	3.2	62.9
3.7	0	0	2.9
0	0	0	0
0	0	0	0
0	0	3.2	0
0	0	6.5	8.6
0	0	16.1	0
3.7	0	6.4	0
48.1	12.5	0	5.8
3.7	0	29.1	2.9
3.7	0	16.1	0

10. E. Oversees the Distribution of the Water

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

F. Relations with Other Organizations

- 01 Government authority or other public official or office
- 02 Members or water users
- 03 Board of Directors
- 04 President
- 05 Secretary
- 06 Treasurer
- 07 Manager/Administrator or equivalent
- 08 Watermaster/Inspector or equivalent
- 09 Combinations of various officers
- 10 Combinations of officers and users
- 11 No such activity or decision made by group
- 12 Miscellaneous other responses

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
3.7	75.0	19.3	17.1
0	0	0	2.9
18.5	0	0	14.4
11.1	0	0	0
0	0	0	0
0	0	0	0
0	0	0	8.6
22.2	0	48.4	34.3
22.2	0	6.4	2.9
3.7	25.0	0	0
0	0	25.8	11.4
18.5	0	0	8.7
3.7	87.5	19.3	17.2
0	0	0	0
25.9	0	0	2.9
33.3	0	22.6	48.6
0	0	0	0
0	0	3.2	0
0	12.5	3.2	2.9
3.7	0	0	0
7.4	0	3.2	17.2
3.7	0	0	0
18.5	0	48.4	2.9
3.7	0	0	8.6

11. Which other organizations or agencies have a relationship with your organization and its members in regard to the use of irrigation water?

(More than one answer possible - total frequency of response indicated)

- 01 Ministry of Agriculture
- 02 National Agricultural Bank (or equivalent agency)
- 03 Agricultural extension service (ICA, INIAP, SEAB, etc.)
- 04 Other national public agencies (INCORA, INERHI, SNDC, CORFO, etc.)
- 05 Regional or local government agencies
- 06 Private irrigation organizations
- 07 Private sector farmer/producer related organizations
- 08 Private local banks
- 09 Private industry or consultant
- 10 Local church
- 11 Does not have a relationship with any other organization or agency

12. What following kinds of assistance does your organization or its members receive and from whom?

(More than one answer possible - total frequency of response indicated)

- A. 1. Methods of irrigation and construction

- 1 Yes
- 2 No

- A. 2. If yes, indicate the organization or entity

- 01 Ministry of Agriculture
- 02 National Agricultural Bank (or equivalent agency)
- 03 Agricultural extension service (ICA, INIAP, SEAB, etc.)
- 04 Other national public agencies (INCORA, INERHI, SNDC, CORFO, etc.)
- 05 Regional or local government agencies
- 06 Private irrigation organizations
- 07 Private sector farmer/producer related organizations
- 08 Private local banks
- 09 Private industry or consultant
- 10 Local church
- 11 Does not have a relationship with any other organization or agency

BOL 27	COL 8	CHI 32	ECU 35
<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
18.5	0	35.5	29.4
0	100	35.5	49.0
18.5	37.5	32.3	8.8
70.4	100	93.5	94.1
18.5	25.0	22.3	20.6
0	0	12.9	0
0	100	42.0	11.7
0	87.5	32.3	26.4
0	50.0	0	2.9
0	12.5	29.0	14.7
14.8	0	6.5	2.9
63.0	100	22.6	22.9
37.0	0	77.4	77.1
5.9	0	0	55.6
0	0	0	0
17.6	0	0	0
94.1	75.0	100	33.3
0	12.5	0	11.1
0	0	0	0
0	0	0	0
0	0	0	0
5.9	25.0	0	0
0	0	0	0
0	0	0	0

12. B. 1. Agricultural assistance in general

- 1 Yes
- 2 No

B. 2. If yes, indicate the organization or entity

- 01 Ministry of Agriculture
- 02 National Agricultural Bank (or equivalent agency)
- 03 Agricultural Extension Service (ICA, INIAP, SEAB, etc.)
- 04 Other national public agencies (INCORA, INERHI, SNDC, CORFO, etc.)
- 05 Regional or local government agencies
- 06 Private irrigation organizations
- 07 Private sector farmer/producer related organizations
- 08 Private local banks
- 09 Private industry or consultant
- 10 Local church
- 11 Does not have a relationship with any other organization or agency

C. 1. Administration of your organization

- 1 Yes
- 2 No

C. 2. If yes, indicate the organization or entity

- 01 Ministry of Agriculture
- 02 National Agricultural Bank (or equivalent agency)
- 03 Agricultural Extension Service (ICA, INIAP, SEAB, etc.)
- 04 Other national public agencies (INCORA, INERHI, SNDC, CORFO, etc.)
- 05 Regional or local government agencies
- 06 Private irrigation organizations
- 07 Private sector farmer/producer related organizations
- 08 Private local banks
- 09 Private industry or consultant
- 10 Local church
- 11 Does not have a relationship with any other organization or agency

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
81.5	100	19.4	31.4
18.5	0	8.6	68.6
13.6	0	33.3	63.6
0	0	0	9.1
90.9	50.0	0	0
13.6	37.5	50.0	54.5
0	0	0	0
0	0	0	0
0	0	33.3	0
0	12.5	0	0
0	50.0	16.7	9.1
0	0	0	0
0	0	0	0
7.4	50.0	9.7	11.4
92.6	50.0	90.3	88.6
0	0	0	75.0
0	0	0	25.0
0	0	0	0
100	100	100	50.0
0	0	0	0
0	0	0	0
0	0	0	25.0
0	0	0	25.0
0	0	0	0
0	0	0	0
0	0	0	0

12. D. 1. Conflicts over the use of water

- 1 Yes
2 No

D. 2. If yes, indicate the organization or entity

- 01 Ministry of Agriculture
02 National Agricultural Bank (or equivalent agency)
03 Agricultural Extension Service (JCA, INIAP, SEAB, etc.)
04 Other national public agencies (INCORA, INERHI, SNDC, CORFO, etc.)
05 Regional or local government agencies
06 Private irrigation organizations
07 Private sector farmer/producer related organizations
08 Private local banks
09 Private industry or consultant
10 Local church
11 Does not have a relationship with any other organization or agency

E. 1. Credit

- 1 Yes
2 No

E. 2. If yes, indicate the organization or entity

- 01 Ministry of Agriculture
02 National Agricultural Bank (or equivalent agency)
03 Agricultural Extension Service (JCA, INIAP, SEAB, etc.)
04 Other national public agencies (INCORA, INERHI, SNDC, CORFO, etc.)
05 Regional or local government agencies
06 Private irrigation organizations
07 Private sector farmer/producer related organizations
08 Private local banks
09 Private industry or consultant
10 Local church
11 Does not have a relationship with any other organization or agency

BOL 27 %	COL 8 %	CHI 32 %	ECU 35 %
3.7	75.0	6.5	34.3
96.3	25.0	93.5	65.7
0	0	0	0
0	0	0	0
0	0	0	0
100	100	100	91.7
0	0	0	8.3
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
37.0	100	9.7	40.0
63.0	0	90.3	60.0
10.0	0	66.7	0
70.0	100	100	100
10.0	0	0	0
10.0	12.5	0	0
0	0	0	0
0	0	0	0
0	0	0	0
10.0	100	0	42.8
0	0	0	7.1
10.0	0	0	0
0	0	0	0

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12. F. 1. Legal counsel

- 1 Yes
- 2 No

F. 2 If yes, indicate the organization or entity

- 01 Ministry of Agriculture
- 02 National Agricultural Bank (or equivalent agency)
- 03 Agricultural Extension Service (ICA, INIAP, SEAB, etc.)
- 04 Other national public agencies (INCORA, INERHI, SNDC, CORFO, etc.)
- 05 Regional or local government agencies
- 06 Private irrigation organizations
- 07 Private sector farmer/producer related organizations
- 08 Private local banks
- 09 Private industry or consultant
- 10 Local church
- 11 Does not have a relationship with any other organization or agency

13. Has the organization as a whole a water right that is recorded with the government?

- 0 No answer
- 1 Yes
- 2 No
- 3 Does not know

14. A. Has the organization paid a tax for the water to the government?

- 0 No answer
- 1 Yes
- 2 No

B. If yes, on what basis was the tax paid

- 1 Amount of water consumed or used

BOL 27 %	COL 8 %	CHI 32 %	ECU 35 %
11.1	62.5	0	65.7
88.9	37.5	100	34.3
0	0	0	4.3
0	0	0	0
0	0	0	0
66.7	60.0	0	91.3
0	0	0	0
0	0	0	0
33.3	0	0	4.3
0	0	0	0
0	60.0	0	8.7
0	0	0	0
0	0	0	0
0	0	0	0
0	0	3.2	0
33.3	12.5	96.8	20.0
59.3	87.5	0	80.0
7.4	0	0	0
0	0	3.2	0
0	12.5	0	8.6
100	87.5	96.8	91.4
0	100	0	100

15. The land of this organization is:

- 1 Privately operated (i.e. private ownership, sharecropper, renters, etc.)
- 2 Owned and operated in common (cooperative) with no individual operation of any land
- 3 Owned in common but with individuals allocated individual parcels to operate
- 4 Privately owned, but with some private land placed into common operation

16. How many members of your organization have farms in the following categories?

(Individual country responses found at end of comparative table)

17. Total amount of land of the members of your organization and what percent is cultivated (farmed) and irrigated.

(Individual country response information found at end of comparative table)

18. What percentage of farmers in the area related to this irrigation system are members of an organization that administers irrigation water?

- 0 No answer
- 1 0 - 29%
- 2 30 - 59%
- 3 60 - 100%

19. A. Do the farmers in the area that are not members of an irrigation organization have larger farms than those that are?

- 0 No answer
- 1 There are none that are not members
- 2 Yes
- 3 No
- 4 Does not know

B. If yes, what is the average size of their farms?

- 1 0 - 5 (has)
- 2 6 - 15 (has)
- 3 16 - 50 (has)
- 4 51 - 100 (has)
- 5 100 - more (has)

BOL	COL	CHI	ECU
27	8	32	35
%	%	%	%
92.6	100	100	85.7
0	0	0	2.9
0	0	0	11.4
7.4	0	0	0
3.7	0	3.2	0
0	0	3.2	28.6
3.7	0	3.2	20.0
92.6	100	90.3	51.4
0	0	6.5	0
74.1	50.0	71.0	17.1
0	0	3.2	40.0
22.2	50.0	16.1	42.9
3.7	0	3.2	0
0	0	100	7.1
0	0	0	21.4
0	0	0	14.3
0	0	0	42.9
0	0	0	14.3

20. A. Do some of the users of the organization have water from other sources independent of that provided by the organization?

- 0 No answer
- 1 Yes
- 2 No

B. If yes, what is the source of this water?

- 1 Private ditch or canal
- 2 Private well or spring
- 3 River or stream
- 4 Other sources (residual waters, another users association, etc.)

21. What is the main source of water for those farmers in the area that you know that are not members of the irrigation organization?

- 0 No answer
- 1 Private canal
- 2 Private spring or well
- 3 Other miscellaneous sources (streams, etc.)
- 4 They do not have irrigation water
- 5 There are none that are not members

22. A. In order of importance, identify the five most common crops of the members or water users, along with the number of harvests per year for each one.

1. First order of crops

- 0 No answer
- 1 Grains (corn, barley, rice, wheat, etc.)
- 2 Tubers and roots (potatoes, melloco, yuca, etc.)
- 3 Grain legumes (peas, green beans, lima beans, etc.)
- 4 Vegetables (tomatoes, onions, peppers, etc.)
- 5 Fruits (apples, table grapes, wine grapes, etc.)
- 6 Short cycle oil crops (peanuts, soybeans, sesame, etc.)
- 7 Industrial crops and flowers (sugar cane, coconut, tobacco)
- 8 Pasture, cattle, and dairy products
- 9 No other crops listed

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
0	0	3.2	0
40.7	62.5	54.8	65.7
59.3	37.5	41.9	34.3
90.9	20.0	41.2	34.8
27.3	60.0	0	47.8
9.1	20.0	41.2	4.3
0	0	17.6	13.0
0	0	9.7	0
37.0	12.5	12.9	38.3
3.7	0	0	2.9
7.4	0	12.9	8.8
3.7	62.5	3.2	32.4
48.2	25.0	61.3	17.6
0	0	6.5	0
40.7	62.5	45.2	51.4
40.7	0	6.4	11.4
0	0	3.2	0
11.1	12.5	12.9	8.6
0	0	6.4	2.9
0	0	0	0
0	25.0	0	8.6
7.4	0	19.4	17.1

22. A. 2. Second order of crops

- 0 No answer
- 1 Grains (corn, barley, rice, wheat, etc.)
- 2 Tubers and roots (potatoes, melloco, yuca, etc.)
- 3 Grain legumes (peas, green beans, lima beans, etc.)
- 4 Vegetables (tomatoes, onions, peppers, etc.)
- 5 Fruits (apples, table grapes, wine grapes, etc.)
- 6 Short cycle oil crops (peanuts, soybeans, sesame, etc.)
- 7 Industrial crops and flowers (sugar cane, coconut, tobacco)
- 8 Pasture, cattle, and dairy products
- 9 No other crops listed

3. Third Order of crops

- 0 No answer
- 1 Grains (corn, barley, rice, wheat, etc.)
- 2 Tubers and roots (potatoes, melloco, yuca, etc.)
- 3 Grain legumes (peas, green beans, lima beans, etc.)
- 4 Vegetables (tomatoes, onions, peppers, etc.)
- 5 Fruits (apples, table grapes, wine grapes, etc.)
- 6 Short cycle oil crops (peanuts, soybeans, sesame, etc.)
- 7 Industrial crops and flowers (sugar cane, coconut, tobacco)
- 8 Pasture, cattle, and dairy products
- 9 No other crops listed

4. Fourth order of crops

- 0 No answer
- 1 Grains (corn, barley, rice, wheat, etc.)
- 2 Tubers and roots (potatoes, melloco, yuca, etc.)
- 3 Grain legumes (peas, green beans, lima beans, etc.)
- 4 Vegetables (tomatoes, onions, peppers, etc.)
- 5 Fruits (apples, table grapes, wine grapes, etc.)
- 6 Short cycle oil crops (peanuts, soybeans, sesame, etc.)
- 7 Industrial crops and flowers (sugar cane, coconut, tobacco)
- 8 Pasture, cattle, and dairy products
- 9 No other crops listed

BOL 27	COL 8	CHI 32	ECU 35
<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
0	0	6.5	00
51.8	50.0	45.2	45.8
22.2	0	6.4	22.9
11.1	0	6.4	14.4
11.1	12.5	19.3	0
0	0	0	2.9
0	0	6.4	0
0	37.2	0	2.9
3.7	0	9.7	8.6
0	0	0	2.9
0	0	6.5	0
33.3	25.0	38.7	20.1
18.5	0	0	17.1
11.1	0	16.1	11.5
29.6	0	22.6	22.9
0	12.5	6.5	0
0	25.0	3.2	2.9
0	27.5	3.2	2.9
7.4	0	3.2	14.3
0	0	0	8.6
3.7	0	6.5	0
18.5	50.0	19.4	20.1
7.4	12.5	0	11.4
11.1	0	6.5	20.0
22.2	0	29.0	17.2
7.4	0	9.7	5.8
3.7	0	3.2	2.9
0	12.5	3.2	2.9
3.7	0	19.3	8.6
22.2	25.0	3.2	11.4

22. A. 5. Fifth order of crops

- 0 No answer
- 1 Grains (Corn, barley, rice, wheat, etc.)
- 2 Tubers and roots (potatoes, melloco, yuca, etc.)
- 3 Grain legumes (peas, green beans, lima beans, etc.)
- 4 Vegetables (tomatoes, onions, peppers, etc.)
- 5 Fruits (apples, table grapes, wine grapes, etc.)
- 6 Short cycle oil crops (peanuts, soybeans, sesame, etc.)
- 7 Industrial crops and flowers (sugar cane, coconut, tobacco)
- 8 Pasture, cattle, and dairy products
- 9 No other crops listed

B. Average number of harvests per year for each order of crops from item 22.A. (Number indicated is actual average number of harvests, not a percentage.)

- 1 First order of crops
- 2 Second order of crops
- 3 Third order of crops
- 4 Fourth order of crops
- 5 Fifth order of crops

23. Percentage of members of the organization which fit the following categories of economic indicators.

A. Primitive life style (no electricity, culinary water, sewerage, etc.)

- 0 No answer
- 1 0 - 9%
- 2 10- 19%
- 3 20- 29%
- 4 30- 49%
- 5 50- 69%
- 6 70- 89%
- 7 90-99 %
- 8 100%

BOL 27 %	COL 8 %	CHI 32 %	ECU 35 %
0	0	6.5	0
14.8	12.5	19.4	17.3
0	12.5	3.2	8.6
0	12.5	3.2	17.3
14.8	0	6.5	11.5
7.4	12.5	16.1	5.8
0	0	9.7	0
0	0	0	2.9
14.8	0	9.7	2.9
48.1	50.0	25.8	34.3
1.1	1.5	1.0	1.2
1.2	1.6	1.0	1.0
1.2	2.0	1.1	1.2
1.1	1.5	1.0	1.1
1.7	2.2	1.1	1.1
0	0	6.5	0
11.1	25.0	16.1	11.4
7.4	0	9.7	5.7
3.7	37.5	16.1	5.7
3.7	0	19.4	8.6
7.4	12.5	3.2	2.9
3.7	25.0	19.4	22.9
11.1	0	9.7	20.9
51.9	0	0	22.9

23. B. Improved life style (electricity, culinary water, etc.)

- 0 No answer
- 1 0 - 9%
- 2 10 - 19%
- 3 20 - 29%
- 4 30 - 49%
- 5 50 - 69%
- 6 70 - 89%
- 7 90 - 99%
- 8 100%

C. Electricity in homes

- 0 No answer
- 1 0 - 9%
- 2 10 - 19%
- 3 20 - 29%
- 4 30 - 49%
- 5 50 - 69%
- 6 70 - 89%
- 7 90 - 99%
- 8 100%

D. Culinary water

- 0 No answer
- 1 0 - 9%
- 2 10 - 19%
- 3 20 - 29%
- 4 30 - 49%
- 5 50 - 69%
- 6 70 - 89%
- 7 90 - 99%
- 8 100%

BOL 27	COL 8	CHI 32	ECU 35
0	0	6.5	0
63.0	0	3.2	37.1
3.7	0	9.7	20.0
0	0	12.9	8.6
0	25.0	6.5	5.7
11.1	12.5	9.7	5.7
3.7	37.5	29.0	11.4
7.4	12.5	12.9	5.7
11.1	12.5	9.7	5.7
0	0	6.5	0
70.4	0	6.5	40.0
3.7	0	0	14.3
0	0	9.7	8.6
0	25.0	6.5	2.9
7.4	12.5	6.5	11.4
3.7	37.5	9.7	14.3
7.4	12.5	19.4	5.7
7.4	12.5	35.5	2.9
0	0	6.5	0
96.3	12.5	41.9	58.8
0	0	9.7	5.9
0	0	3.2	11.8
0	37.5	6.5	2.9
3.7	0	9.7	2.9
0	37.5	0	11.8
0	0	3.2	0
0	12.5	19.4	5.9

23. E. Sanitary facilities (sewer, etc.)

- 0 No answer
- 1 0 - 9%
- 2 10 - 19%
- 3 20 - 29%
- 4 30 - 49%
- 5 50 - 69%
- 6 70 - 89%
- 7 90 - 99%
- 8 100%

F. Radios (any kind)

- 0 No answer
- 1 0 - 9%
- 2 10 - 19%
- 3 20 - 29%
- 4 30 - 49%
- 5 50 - 69%
- 6 70 - 89%
- 7 90 - 99%
- 8 100%

G. Subsistence farmers (basically consume what produce)

- 0 No answer
- 1 0 - 9%
- 2 10 - 19%
- 3 20 - 29%
- 4 30 - 49%
- 5 50 - 69%
- 6 70 - 89%
- 7 90 - 99%
- 8 100%

	BOL 27	COL 8	CHI 32	ECU 35
	%	%	%	%
0	0	0	6.5	0
100	25.0	45.2	79.4	
0	12.5	22.6	2.9	
0	0	12.9	0	
0	12.5	0	5.9	
0	0	9.7	5.9	
0	37.5	0	5.9	
0	0	0	0	
0	12.5	3.2	0	
0	0	0	6.5	0
3.7	0	6.5	0	
0	0	0	0	
0	0	3.2	0	
3.7	0	0	0	
7.4	0	0	0	
11.1	0	3.2	5.7	
29.6	25.0	0	20.0	
44.4	75.0	80.7	74.3	
0	0	6.5	0	
40.7	87.5	48.4	25.7	
0	12.5	6.5	5.7	
7.4	0	6.5	2.9	
3.7	0	6.5	5.7	
14.8	0	19.4	5.7	
7.4	0	6.5	22.9	
18.5	0	0	22.9	
7.4	0	0	8.6	

13. H. Privately owned motor vehicles (automobiles, trucks, etc.)

0 No answer
 1 0 - 9%
 2 10 - 19%
 3 20 - 29%
 4 30 - 49%
 5 50 - 69%
 6 70 - 89%
 7 90 - 99%
 8 100%

I. Income other than from farm

0 No answer
 1 0 - 9%
 2 10 - 19%
 3 20 - 29%
 4 30 - 49%
 5 50 - 69%
 6 70 - 89%
 7 90 - 99%
 8 100%

J. Mechanized machinery

0 No answer
 1 0 - 9%
 2 10 - 19%
 3 20 - 29%
 4 30 - 49%
 5 50 - 69%
 6 70 - 89%
 7 90 - 99%
 8 100%

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
0	0	9.7	2.9
96.3	50.0	35.5	65.7
0	0	19.4	20.0
3.7	12.5	9.7	2.9
0	12.5	6.5	0
0	0	6.5	5.7
0	12.5	6.5	0
0	0	3.2	0
0	12.5	3.2	2.9
0	0	6.5	0
51.9	25.0	54.8	11.8
25.9	12.5	16.1	20.6
7.4	0	9.7	0
7.4	0	6.5	0
0	12.5	6.5	14.7
7.4	25.0	0	20.6
0	12.5	0	29.4
0	12.5	0	2.9
0	0	9.7	0
44.4	37.5	16.1	79.4
14.8	0	32.3	8.8
0	25.0	9.7	2.9
0	0	3.2	5.9
7.4	12.5	16.1	0
18.5	12.5	6.5	0
7.4	0	0	0
7.4	12.5	6.5	2.9

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24. Of all the members in the organization what percentage have changed in regard to: (Unless otherwise stated, response indicates a progressive change)

A. Method of Irrigation

- 0 No change
- 1 1 - 30%
- 2 31 - 60%
- 3 61 - 99%
- 4 100%
- 5 Negative Indicator (individuals have retrogressed in this item)
- 6 No answer

B. Use of credit

- 0 No change
- 1 1 - 30%
- 2 31 - 60%
- 3 61 - 99%
- 4 100%
- 5 Negative Indicator (individuals have retrogressed in this item)
- 6 No answer

C. Types of crops

- 0 No change
- 1 1 - 30%
- 2 31 - 60%
- 3 61 - 99%
- 4 100%
- 5 Negative Indicator (individuals have retrogressed in this item)
- 6 No answer

D. Use of fertilizers

- 0 No change
- 1 1 - 30%
- 2 31 - 60%
- 3 61 - 99%
- 4 100%
- 5 Negative Indicator (individuals have retrogressed in this item)
- 6 No answer

BOL 27 %	COL 8 %	CHI 32 %	ECU 35 %
51.8	0	80.6	65.7
3.7	0	6.5	14.3
0	0	6.5	5.7
3.7	62.5	0	0
22.2	37.5	0	14.3
0	0	6.5	0
18.5	0	0	0
51.8	0	32.3	25.7
33.3	0	16.1	42.8
3.7	12.5	9.7	8.6
0	75.0	6.5	5.7
7.4	12.5	9.7	17.1
0	0	25.8	0
3.7	0	0	0
51.8	12.5	48.4	77.1
18.5	0	22.6	11.4
0	37.5	16.1	5.7
7.4	12.5	9.7	2.9
14.8	37.5	3.2	2.9
0	0	0	0
7.4	0	0	0
7.4	0	29.0	14.3
29.6	0	6.5	31.4
3.7	0	25.8	8.6
25.9	75.0	12.9	20.0
22.2	25.0	3.2	25.7
0	0	22.6	0
11.1	0	0	0

24. E. Machinery

- 0 No change
- 1 1 - 30%
- 2 31 - 60%
- 3 61 - 99%
- 4 100%
- 5 Negative indicator (individuals have retrogressed in this item)
- 6 No answer

25. A. On what basis do you pay for the use of the water in this organization?

- 0 No answer
- 1 By the hour
- 2 Amount consumed or used
- 3 According to the size or amount of land
- 4 According to number of water shares
- 5 Both a fixed charge according to amount of land and according to volume of water used
- 6 Other miscellaneous basis for affixing charge
- 7 Do not pay for water usage

B. Amount charged per user

(These amounts discussed in written portion of analysis)

26. Is this a fixed price regardless of the type of crop?

- 0 No answer
- 1 Yes
- 2 No
- 3 Do not pay fees

27. On what basis do you pay for operation and administration?

- 0 No answer
- 1 By the hour
- 2 Amount consumed or used
- 3 According to the size or amount of land
- 4 According to number of water shares
- 5 According to amount of land and volume of water used
- 6 Other miscellaneous basis for affixing charge
- 7 Do not pay for water usage

BOL 27	COL 8	CHI 32	ECU 35
<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
33.3	0	41.9	22.9
25.9	0	25.8	28.6
7.4	0	9.7	5.7
22.2	75.0	9.7	17.1
7.4	25.0	9.7	22.9
0	0	3.2	0
3.7	0	0	2.9
0	0	6.5	0
0	0	0	25.7
3.7	12.5	3.2	17.1
11.1	12.5	35.5	17.1
0	0	29.0	0
0	75.0	0	0
3.7	0	25.8	2.9
81.5	0	0	37.1
0	0	6.5	0
14.8	100	77.4	62.9
0	0	16.1	2.9
85.2	0	0	34.3
0	25.0	32.3	0
0	0	3.2	2.9
0	0	0	5.7
0	0	9.7	0
0	0	6.5	0
0	25.0	0	0
18.5	50.0	38.7	65.7
81.5	0	9.7	25.7

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28. A. Do the users in your organization also help with maintenance and cleaning of the canal?

- 0 No answer
- 1 Yes
- 2 No

B. If yes, in what form?

- 1 The quota or charge is separate from the water charges
- 2 The quota is included in the water charge
- 3 Labor
- 4 Miscellaneous other responses

29. On what basis do members pay for maintenance?

- 0 No answer
- 1 By the hour
- 2 Amount consumed or used
- 3 According to the size or amount of land
- 4 According to number of water shares
- 5 Both a fixed charge according to amount of land and according to volume of water used
- 6 Other miscellaneous basis for affixing charge
- 7 Do not pay for water usage

30. How much or in what form is the payment?

- 0 No answer
- 1 Not applicable - no payment for maintenance
- 2 Maintenance charges included in general water charge
- 3 All users work equally on canal
- 4 Miscellaneous other forms of payment

31. A. Are there difficulties in collecting fees or charges from the users?

- 0 No answer
- 1 Yes
- 2 No
- 3 No charges or fees required

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
0	0	12.9	0
100	62.5	38.7	85.7
0	37.5	48.4	14.3
0	0	0	3.3
0	100	50.0	10.0
100	0	50.0	83.3
0	0	0	3.3
0	0	12.9	0
3.7	0	0	2.9
0	12.5	0	0
11.1	12.5	12.9	5.7
0	0	25.8	0
0	37.5	0	0
85.2	37.5	48.4	71.5
0	0	0	20.0
3.7	12.5	6.5	0
0	0	0	17.1
0	87.5	41.9	20.0
48.1	0	0	28.6
48.2	0	51.6	34.3
0	0	9.7	0
7.4	50.0	58.1	54.3
59.3	50.0	29.0	40.0
33.3	0	3.2	5.7

31. B. If yes, how many users do not pay their assessments

- 0 No answer
- 1 0 - 9.9%
- 2 10 - 49%
- 3 50 - more than 90%
- 4 Do not know

32. Do all fees and charges levied upon users cover the annual costs of operation and maintenance?

- 0 No answer
- 1 Yes
- 2 No
- 3 Does not know
- 4 Pay no fees - not applicable

33. The total annual operation and maintenance costs of the organization is:

(This information is discussed in the written portion of the analysis)

34. How is the value of construction and canal improvements paid for?

- 0 No answer
- 1 Totally by the users
- 2 Partially by the users and partly by the government
- 3 Totally by the government

35. Identify the predominant race of the members of the organization

- 1 Indian
- 2 Mestizo
- 3 European
- 4 Mestizo and European combination
- 5 Negro

36. Identify the predominant language of the majority of the members of the organization.

- 1 Quechua
- 2 Aymara
- 3 Spanish

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
0	0	21.7	23.8
0	25.0	65.2	42.8
100	50.0	13.0	19.0
0	0	0	9.5
0	25.0	0	4.8
7.4	0	9.7	0
33.3	37.5	83.9	80.0
14.8	62.5	6.5	20.0
11.1	0	0	0
33.3	0	0	0
0	0	12.9	2.9
59.3	37.5	71.0	77.1
29.6	12.5	0	2.9
11.1	50.0	16.1	17.1
29.6	0	0	8.6
70.4	75.0	9.7	91.4
0	0	35.5	0
0	0	54.8	0
0	25.0	0	0
70.4	0	0	8.6
18.5	0	0	0
11.1	100	100	91.4

37. Describe the average educational level of the users

- 0 None
- 1 1 - 4 grade or years
- 2 5 - 8
- 3 9 - 12 and over

38. Are the officers of the organization from:

A. The same race as the members in general?

- 0 No answer
- 1 Yes
- 2 No

B. The same educational level as the members in general?

- 0 No answer
- 1 Yes
- 2 No (generally indicates more education)

39. A. Indicate the number of months of the irrigation season of the zone

- 1 3 - 5 months
- 2 6 - 7 months
- 3 8 - 10 months
- 4 11- 12 months

B. Indicate the months

- 01 January
- 02 February
- 03 March
- 04 April
- 05 May
- 06 June
- 07 July
- 08 August
- 09 September
- 10 October
- 11 November
- 12 December

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
0	0	6.5	0
85.2	87.5	19.4	71.4
14.8	0	67.8	28.7
0	12.5	6.5	0
0	0	6.5	0
92.6	87.5	90.3	97.1
7.4	12.5	3.2	2.9
0	0	6.5	0
92.6	62.5	29.0	62.9
7.4	37.5	64.5	37.1
11.1	12.5	0	23.5
25.9	0	54.8	17.7
51.8	25.0	45.1	14.7
11.1	62.5	0	44.1
33.3	87.5	100	55.8
18.5	100	100	55.8
14.8	100	100	55.9
25.9	87.5	73.3	52.9
59.3	87.5	16.7	61.8
70.4	87.5	3.3	76.4
77.8	87.5	0	88.3
77.8	87.5	0	88.2
92.6	75.0	13.3	94.1
92.6	62.5	66.7	85.3
81.5	62.5	100	79.4
66.7	87.5	100	69.7

40. A. Is there always sufficient water in your canals for irrigation?

- 0 No answer
- 1 Yes
- 2 No

B. If no, how many of the last ten years have you lacked water?

- 1 1 - 3 years
- 2 4 - 6 years
- 3 7 - 8 years
- 4 9 - 10 years

C. Why have you lacked water during those years?

(More than one answer possible - total frequency of response indicated)

- 1 General water shortage in area
- 2 Landslides or defective infrastructure
- 3 Miscellaneous other responses (organizational neglect, theft, etc.)

41. Climate (specify according to the Hargreaves classification)

- 1 Very arid (no months above item.33 Moisture Availability Index; or not suited for rain-fed agriculture)
- 2 Arid (one or two months above .34 MAI)
- 3 Semiarid (three or four consecutive months above .34 MAI)
- 4 Humid-dry (five or more consecutive months above .34 MAI)

42. Altitude in meters

- 1 0 - 1,000
- 2 1,001 - 2,000
- 3 2,001 - 3,000
- 4 3,001 meters and above

BOL 27	COL 8	CHI 32	ECU 35
0	0	3.2	0
14.8	75.0	51.6	40.0
85.2	25.0	45.2	60.0
13.0	0	62.5	4.7
34.8	0	6.3	4.7
0	0	6.3	14.3
52.2	100	25.0	80.1
91.3	100	100	76.2
4.4	0	7.1	33.3
8.7	0	0	19.1
22.2	0	0	2.9
59.3	0	0	22.9
18.5	100	71.0	54.3
0	0	29.0	20.0
0	87.5	100	20.0
3.7	0	0	2.9
63.0	12.5	0	69.2
33.3	0	0	8.7

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43. What type of main diversion works does the irrigation system have?

- 1 None or rudimentary
- 2 Temporary (reconstructed each year)
- 3 Permanent
- 4 Miscellaneous combinations of the above

44. How long have the canals existed? (In years)

- 0 No answer
- 1 1 - 10 years
- 2 11 - 30 years
- 3 31 - 50 years
- 4 51 - 97 years
- 5 Over 98 years
- 6 Does not know

45. How many main and secondary canals and how many total kilometers of each belong to this organization?

A. Main Canal - Number of Kilometers

- 0 No answer
- 1 0 - 3.9 Km.
- 2 4 - 9.9
- 3 10 - 24.9
- 4 25 - 49.9
- 5 50 - 99.9
- 6 More than 100
- 7 Does not know
- 8 Canals do not exist

B. Secondary canals - Number of kilometers

- 0 No answer
- 1 0 - 3.9 Km.
- 2 4 - 9.9
- 3 10 - 24.9
- 4 25 - 49.9
- 5 50 - 99.9
- 6 More than 100
- 7 Does not know
- 8 Canals do not exist

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
3.7	12.5	0	25.7
40.7	0	32.3	17.1
55.6	87.5	67.7	48.6
0	0	0	8.6
14.8	0	22.6	0
7.4	50.0	9.7	17.6
14.8	25.0	9.7	20.3
18.5	25.0	12.9	11.7
3.7	0	6.5	14.5
40.7	0	22.6	35.3
0	0	16.1	0
0	0	3.2	0
37.0	0	12.9	25.7
29.6	0	16.1	17.2
22.2	12.5	29.0	25.8
3.7	25.0	22.6	22.9
3.7	62.5	9.7	8.6
3.7	0	0	0
0	0	6.5	0
7.4	12.5	6.5	0
22.2	0	9.7	35.2
14.8	0	12.9	26.5
3.7	0	29.0	11.7
3.7	25.0	16.1	8.7
3.7	12.5	6.5	11.7
3.7	50.0	6.5	5.8
40.7	0	9.7	0
0	0	3.2	0

45. C. Number of primary canals that belong to the organization

- 1 1
- 2 2 or more
- 3 Does not know

D. Number of secondary canals that belong to the organization

- 0 No answer
- 1 1 - 5
- 2 7 - 12
- 3 15 - 37
- 4 59 - 71
- 5 More than 100
- 6 No secondary canals in the system
- 7 Does not know

46. The primary canal(s) is (are):

- 1 Without lining (entirely)
- 2 Lined with concrete or rock
- 3 Combination: Partially unlined, partially lined
- 4 Do not know

47. The secondary canals are:

- 1 Without lining
- 2 Lined with concrete or in pipe
- 3 Partially unlined, partially lined
- 4 There are no secondary canals

48. What part of the total of the irrigation canal is maintained by the organization in general?

- 1 Only the main canal
- 2 The main canal and secondary canals
- 3 The main canals, secondary canals, and tertiary canals
- 4 Only the tertiary canals

BOL 27	COL 8	CHI 32	ECU 35
63.0	0	77.4	80.0
37.0	100	9.7	20.0
0	0	12.9	0
7.4	0	6.5	0
44.4	0	48.4	42.4
0	0	16.1	12.0
14.8	75.0	12.9	6.0
0	12.5	3.2	3.0
0	12.5	0	3.0
0	0	3.2	27.3
33.3	0	9.7	6.1
88.9	37.5	80.6	77.2
0	0	6.5	2.9
11.1	62.5	6.5	20.0
0	0	6.5	0
100	87.5	100	68.6
0	12.5	0	2.9
0	0	0	2.9
0	0	0	25.7
29.6	12.5	61.3	40.0
51.9	87.5	19.4	57.1
18.5	0	3.2	2.9
0	0	16.1	0

49. What water control apparatus are found in the system? (Describe)

A. Rudimentary - no constructed development

- 1 There are no rudimentary water control apparatus in the system
- 2 There are no water control apparatus at all in the system
- 3 Combination use of sod, dirt, branches and rocks

B. Developed but without a measuring apparatus:

- 0 No answer
- 1 There are no developed control apparatus in the system
- 2 There are no control apparatus of any type in the system
- 3 Gates (simple) and divider boxes
- 4 Radial and circular gates, etc.
- 5 Miscellaneous other responses

C. Highly developed (with gauge measurement capacity)

- 0 No answer
- 1 No highly developed apparatus in the system
- 2 Headgates (various kinds), divider boxes, or combination
- 3 Miscellaneous other responses

50. Is there some water volume measurement device for each user?

- 1 Yes
- 2 No

51. Are technical criteria used to determine the necessary amount of water for crops?

- 0 No response
- 1 Yes
- 2 No

BOL 27 %	COL 8 %	CHI 32 %	ECU 35 %
11.1	100	93.6	8.6
0	0	0	0
88.9	0	6.5	91.5
3.7	0	6.5	0
81.5	0	9.7	25.7
0	0	0	8.6
14.8	50.0	83.9	54.3
0	37.5	0	5.7
0	12.5	0	5.8
0	0	9.7	0
92.6	87.5	90.3	91.4
3.7	12.5	0	5.8
3.7	0	0	2.9
0	62.5	0	2.9
100	37.5	100	97.1
3.7	0	3.2	0
3.7	75.0	3.2	2.9
92.6	25.0	93.6	97.1

52. A. Are there other waters feeding the canals outside of the primary water source?

- 1 Yes
- 2 No

B. If yes, describe

- 0 No description given
- 1 Small river(s)
- 2 Miscellaneous other sources (residual waters, etc.)

53. Are there facilities for storing water?

- 0 No response
- 1 Yes
- 2 No

54. Do you irrigate at night?

- 0 No response
- 1 Yes
- 2 No

55. To what extent should the government be involved

A. In financing irrigation works?

- 0 No answer
- 1 More
- 2 Less
- 3 Same
- 4 Not applicable - already a government-operated organization or system

B. Providing technical assistance?

- 0 No answer
- 1 More
- 2 Less
- 3 Same
- 4 Not applicable - already a government-operated organization or system

BOL 27	COL 8	CHI 32	ECU 35
25.9	12.5	35.5	22.9
74.1	87.5	64.5	77.1
25.0	0	18.2	40.0
75.0	100	36.4	40.0
0	0	45.5	20.0
0	0	9.7	0
37.0	62.5	48.4	8.6
63.0	37.5	41.9	91.4
0	12.5	6.5	0
92.6	37.5	12.9	88.2
7.4	50.0	80.6	11.8
0	0	3.2	0
85.2	12.5	74.2	57.1
3.7	0	6.5	0
0	12.5	16.1	25.7
11.1	75.0	0	17.1
0	0	3.2	0
85.2	12.5	58.1	62.9
3.7	0	6.5	0
0	12.5	32.3	20.0
11.1	75.0	0	17.1

55. C. Controlling your administration?

- 0 No answer
- 1 More
- 2 Less
- 3 Same
- 4 Not applicable - already a government-operated organization or system

D. Policing water use?

- 0 No answer
- 1 More
- 2 Less
- 3 Same
- 4 Not applicable - already a government-operated organization or system

E. Paying operation and maintenance costs?

- 0 No answer
- 1 More
- 2 Less
- 3 Same
- 4 Not applicable - already a government-operated organization or system

F. Providing legal assistance?

- 0 No answer
- 1 More
- 2 Less
- 3 Same
- 4 Not applicable - already a government-operated organization or system

G. Deciding water disputes?

- 0 No answer
- 1 More
- 2 Less
- 3 Same
- 4 Not applicable - already a government-operated organization or system

BOL 27	COL 8	CHI 32	ECU 35
%	%	%	%
3.7	0	3.2	0
40.7	0	9.7	34.3
7.4	0	38.7	5.7
40.7	25.0	48.4	42.9
7.4	75.0	0	17.1
3.7	0	3.2	0
33.3	0	16.1	37.1
3.7	0	25.8	0
48.2	25.0	54.8	45.7
11.1	75.0	0	17.1
7.4	0	3.2	0
59.3	0	19.4	45.7
3.7	0	12.9	0
18.5	25.0	64.5	37.1
11.1	75.0	0	17.1
11.1	0	3.2	0
70.4	0	41.9	51.4
3.7	0	6.5	0
3.7	25.0	48.4	31.4
11.1	75.0	0	17.1
3.7	0	3.2	0
33.3	0	19.1	25.7
7.4	0	25.8	0
44.4	25.0	51.6	57.1
11.1	75.0	0	17.1

56. Would you prefer government participation in the management of your water supply to be:

- 0 No answer
- 1 More
- 2 Less
- 3 About the same
- 4 Not applicable - already a government-operated organization or system

BOL	COL	CHI	ECU
27	8	32	35
3.7	0	3.2	0
66.7	25.0	32.3	54.3
3.7	0	9.7	0
14.8	0	54.8	28.6
11.1	75.0	0	17.1

B O L I V I A

Item 16. The number of organizations (27 total) with the corresponding percent of members in each of the following land-size categories:

Has.	0%	1 - 30%	31 - 60%	61 - 99%
0 - .4	9	11	6	1
.5 - 1	6	12	9	0
1 - 2	3	15	8	1
3 - 10	5	14	3	5
10 - 15	15	12	0	0
16 - 50	21	5	1	0
51 y más	25	1	1	0

C O L O M B I A

Item 16. The number of organizations (8 total) with the corresponding percent or members
in each of the following land-size categories:

Has.	0%	1 - 30%	31 - 60%	61 - 99%	Not applicable No answer
0 - 5	0	2	4	1	1
5 - 10	0	6	0	0	2
10 - 30	0	6	1	0	1
30 - 50	0	7	0	0	1
51 - over	0	6	1	0	1

C H I L E

Item 16. The number of organizations (31 total) with the corresponding percent of members in each of the following land-size categories:

Has.	0%	1 - 30%	31 - 60%	61 - 99%	Not applicable No answer
0 - .4	26	3	2	0	0
.5 - 1	21	8	1	0	1
1 - 2	19	9	1	0	2
2 - 5	15	13	1	0	2
5 - 15	10	16	5	0	0
16 - 50	6	14	9	2	0
51 - over	5	12	6	6	2

E C U A D O R

Item 16. Number of organizations (35 total) with the corresponding percent of members in the following land-size categories:

Has.	0%	1 - 30%	31 - 60%	61 - 99%	Not applicable*
0 - .4	10	4	6	11	4
.5 - 1	5	21	4	1	4
1 - 2.9	5	25	0	1	4
3 - 15.9	11	11	4	5	4
16 - 50	22	6	3	0	4
51 - over	21	9	1	0	4

*Cooperatives with all land owned by the cooperative.

Item 17. Number of organizations in each country with the corresponding percentage of their total land cultivated and irrigated

Percentage	<u>BOLIVIA</u>		<u>COLOMBIA</u>		<u>CHILE</u>		<u>ECUADOR</u>	
	(27 total)		(8 total)		(31 total)		(35 total)	
	Cultivated	Irrigated	Cultivated	Irrigated	Cultivated	Irrigated	Cultivated	Irrigated
No answer	0	0	0	0	6	3	3	3
1 - 20 %	0	3	0	0	1	4	0	1
21 - 40 %	1	5	2	4	4	7	1	6
41 - 60%	5	11	4	2	0	3	3	4
61 - 80%	5	1	1	2	5	7	10	6
81 - 98%	2	2	0	0	2	3	2	3
99 - 100 %	14	5	1	0	13	4	16	12