

IRRIGATION WATER MANAGEMENT

IN ECUADOR

by

D. Craig Anderson

A thesis submitted in partial fulfillment
of the requirements for the degree

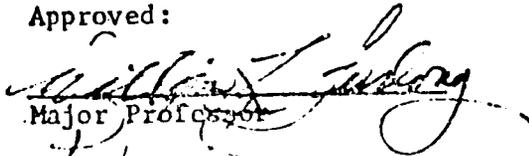
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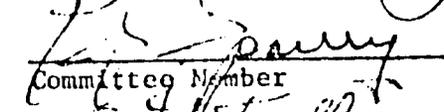
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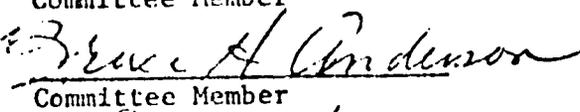
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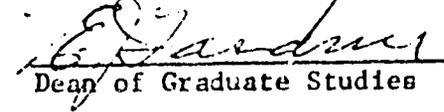
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D. Craig Anderson

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ABSTRACT

Irrigation Water Management in Ecuador

by

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The following thesis describes and analyzes irrigation water management in Ecuador.

One of the primary thesis objectives is to discuss the different private and public administered entities which have irrigation water delivery programs and describe the function and role of each as water management institutions.

Secondly, the thesis investigates and analyzes non-technical variables which influence the actual distribution of irrigation water by those institutions, and the use of water on the farm unit.

The thesis concludes that there are definite recognizable social, political, economic and natural physical factors in Ecuador which are directly associated with programs of irrigation water delivery and use. These non-technical factors play significant roles in determining the success or failure of such programs. They are therefore important variables for development in general.

This thesis is also designed to introduce technical assistance people to these non-technical factors in Ecuador which are so highly relevant to development programs, specifically to irrigation water management and use.

Finally, the author hopes the conclusions reached in this study of Ecuadorian organizations and water management can provide useful guidelines for similar research which may be conducted in other countries in the future.

(135 pages)

CHAPTER I
INTRODUCTION

The following thesis deals with irrigation water administration in Ecuador and focus on the various organizations, both public and private, which distribute irrigation water. It attempts to indicate the factors or variables which influence the administrative processes of these organizations and which are associated with irrigation water distribution and delivery to the water user.

Objectives

The thesis objectives are two-fold. The first is to describe the goals, functions, structure, and other administrative characteristics of the various institutions which distribute irrigation water. The second objective is to explore and analyze some of the social, political, economic, and natural physical factors which directly or indirectly influence the administrative process of these institutions, and which are thus associated with the actual distribution of irrigation water in Ecuador. In short, we want to know what organizations administer water and what variables or conditions relate to the actual delivery of the water to the point of use.

The Ecuadorian institutions which distribute irrigation water are of two general types, governmental and private. The public group principally consists of the Ecuadorian Institute of Water Resources, hereafter referred to as INERHI, the Spanish acronym of Instituto Ecuatoriano de Recursos Hidráulicos. INERHI is a national agency with

administrative charge over all waters in the nation. In addition, there are several other regional and provincial institutions of a public nature involved with irrigation distribution.

Various kinds of private organizations also distribute irrigation water. The most predominant in number are the water users associations (Directorios de Agua) which are similar to canal companies in the western United States. Agricultural cooperatives and other similarly constituted bodies as well as private individuals also administer water for irrigation purposes. Each of these kinds of institutions will be discussed in more detail in following chapters.

Since INERHI is a national government agency responsible for controlling the use of all Ecuadorian waters it is involved in several activities other than irrigation and not necessarily related to it. The entire organization of INERHI will be described in general, but this study will be primarily concerned with those functions which deal directly with irrigation.

For irrigation distribution purposes INERHI operates six irrigation districts within which networks of canals have been constructed with national government funds. We will closely examine each of these districts. A study of all collectively, will help in the analysis to determine what conditions influence the actual administration of irrigation water in Ecuador.

A detailed exploration of those administrative processes of the central office of INERHI which have to do with irrigation and irrigation policy is another important step in reaching the objectives of this paper. These processes are very important because of the direct relationship they have to the actual delivery of the resource.

We will complete the study of the public sector by briefly examining the other institutions of a public nature which to a limited degree have irrigation programs to carry out.

The private sector plays a vital role in the total picture of irrigation water use in Ecuador. One important thesis objective is to become aware of the extent and magnitude of that role, its importance, and the organizations that are involved. We are concerned with knowing where such institutions are located, what functions they perform, and how well they accomplish their goals. Since little has been written about these organizations we need to identify them, their structure, and characteristics in order to gain a basic understanding of how each fits into the Ecuadorian irrigation picture. This is our objective with the private sector, to describe and analyze the behavior of its irrigation organizations.

Speaking of organizational behavior Thompson has written, "organizational rationality therefore is some result of (1) constraints which the organization must face, (2) contingencies which the organization must meet, and (3) variables which the organization can control." (1, p. 24)

The above variables described by Thompson will be used to examine the Ecuadorian water institutions. We want to discover what circumstances in the surrounding social environment place constraints on their behavior and modify their ability to accomplish the efficient distribution of water. We hope to discover which variables they can and cannot control and why, as well as their effects on administration.

One final objective is to compare the private and public sectors for additional conclusions on irrigation and its administration in Ecuador.

Research

Easton's systems model provided good general guidelines which were used in the research for this study.

The model suggests that any management system, large or small, has certain demands placed on it. There are tangible and non-tangible supports for the system which we could label as resources. Together these form inputs into the system. Management takes these demands and supports and through a decision-making and management process produces outputs. These are called decisions and programs of action. The outputs, in turn, in the form of feedback, become new demands or supports for the system. This basic approach was utilized to study all the various irrigation organizations in Ecuador.

The research itself was conducted by the author during a four month stay in Ecuador. It consisted mainly of daily personal contact with individuals both in INERHI's central office and farming communities throughout the country.

Field work involved interviewing INERHI district personnel as well as numerous water users within each of the six irrigation districts. Because many district personnel were available for extensive periods of contact they proved to be invaluable sources of information.

During this same period the author was able to interview approximately 250 farmers, land owners, and water users throughout the country. The bulk of the material in this thesis is the result of an accumulation of such data.

A good deal of field time was spent researching the independently operated distribution organizations and gaining first-hand knowledge

of their operation. Again, both INERHI personnel and individual members of these institutions freely provided much time, patience, and valuable information.

When not in the field, research was conducted in the central office of INERHI located in Quito, where the author worked closely with administrators there. Because of such daily contact with employees and the administrative operations in general, the author was able to gain considerable knowledge of the agency and establish an excellent working relationship with these people. This proved to be invaluable and extremely necessary in obtaining much needed material for the thesis. Again, interviews and personal contact were the basic sources of information.

Interviews were generally informal and structured for the specific groups of persons with which the respondents were associated, such as for INERHI employees or water users on the farm. They varied with time, person, situation, and the type of information the author was seeking. Interview procedure was left entirely to the discretion of the interviewer, and was structured to solicit specific kinds of information. The types of questions used were refined through time and use. No written questionnaire or formal interview schedule was ever used for research purposes.

All the thesis material cannot be attributed to this form of research. Data and other materials were gathered from books, articles, publications, records, and reports from both INERHI and private groups and individuals.

Gordon Tullock suggested in his book, The Politics of Bureaucracy, that two methods of knowing are:

1. Observation of the social environment through investigation and experiment.
2. Understanding through experience. (2, p. 14)

The research relied heavily on these two methods of knowing for the contents of the thesis.

Methodology

One essential element of any scholarly work is the establishment of an orderly procedure which the paper will follow as it progresses toward its objectives. The methodology employed in this thesis is basically the structural-functional analysis* approach utilizing description and analysis as fundamental tools. This is the most appropriate method for the nature of the work to be covered, in spite of its limitations. It does not attempt to do more than identify and analyze the specific function each structure performs in the distribution of irrigation water.

Describing the purpose of structural-functional analysis Scarrow says the following:

Another label for the functional-systems approach is structural-functional analysis, a label that makes clear that the approach asks what specific function (i.e., contribution to the whole) each structure (i.e., pattern) performs in the system. Since by definition all parts of the system are making some kind of contribution, the question of the specific function served may be asked of any of them. (4, p. 63)

*Structural-functional analysis, in the definition used for this paper, can also be termed empirical-functional analysis.

We will look at each irrigation institution, see what part it plays in the whole system of irrigation distribution in Ecuador, and analyze that role. When possible, each organization will be studied following these general steps.

1. Identification of the organization.
2. Description of the function.
3. Analysis of the functioning process.

Step one is to identify the specific structure or institution performing the function of irrigation water administration. This includes information such as general characteristics, informal structures, the financial structure, and the organizations legal power or authority.

The second step involved a description of how, or how well, the structure operates; how it performs the function of distributing irrigation water. For our purposes, distribution of water means who gets the water, when (timely) and where (point of use) and in what amounts. Objectives and programs to carry out distribution goals are important to look at.

The third step is the analysis of why the structure operates as it does and why it may or may not be reaching its goals. This is one of the most important objectives of the thesis. The purpose of this step is to single out and identify those factors which in some way influence function and thus, which can be related to distribution success or failure. Here, we hope to point out how conditions such as education, financial structure, physical security of the resource, and other factors can affect both the distribution of the water and distribution organizations.

Justification

One might be lead to question the importance of this topic. What is the purpose and the timeliness of the subject? How can it be justified as necessary and purposeful?

First, during the last few years there has been increasing interest in agricultural development in Latin America. Scholars, technical assistance programs, and politicians of all sorts have focused attention on agrarian reform, increased farm productivity and other agrarian related activities. Two things have stimulated this interest, (1) increased requirements in agricultural production due to a sharp rise in population, and (2) a majority of the population currently dependent on agriculture for existence. These people, however, live in poverty conditions at a subsistence level. We need to understand the social problems associated with these circumstances.

For example, approximately 54 percent of the 6.5 million people in Ecuador are directly engaged in agriculture. Of these people, 87 percent are "small producers on minifundios and rural hired workers of various types." (3, p. 9) This is an acute social problem worthy of serious study and research in all of its aspects. This brings us to a second point.

In conjunction with the above, irrigation and efficient distribution of water resources takes on added importance. When we consider the implications of irrigation for increased productivity we see the need to study irrigation in Ecuador and become aware of how it is distributed and used. Certainly, knowing about the institutions involved and the role of each in irrigation is essential and justifiable.

The third point is that only during the last few years has the need for social science research in natural resources been recognized. Even technical assistance programs have often failed to include vital social inputs in their programs. Social factors have long been ignored in these areas. Now, we need to become aware of the influence these factors can have in decision making which may effect the success of technical projects or resource administration. For example, a well designed and engineered irrigation system will not necessarily function efficiently in and of itself. Understanding the social mechanisms and other factors associated with its operation may enhance the possibilities of success. Only recently has this fact been recognized.

Hopefully, the social information of this thesis will be of direct benefit to technical assistance personnel who may work in Ecuador in the future. Perhaps it can help sensitize them to the social conditions which are highly relevant to technical programs.

A fifth point is that this work can add to the general body of knowledge in the social sciences in general and to the study of public administration particularly by analyzing the administrative processes of decision-making. Perhaps the information can also be useful in the study of administration of public agencies in Latin America specifically. Although the study is restricted to irrigation institutions, it can help delineate social and other related factors which influence organizational behavior.

To the knowledge of the author research of this type has never been conducted previously on irrigation distribution institutions of Ecuador. Hopefully, then, this work can be regarded as an original

contribution to the study of water resources management in Latin America, a relatively recent field of interest. Perhaps the thesis can help indicate some factors in water management which can serve as guidelines for future research or similar studies in other countries. The research and thesis were undertaken as a project of study because of the above basic reasons. They briefly explain and justify the importance and necessity of such work at the present time.

CHAPTER II

ECUADOR AND IRRIGATION

The purposes of this chapter are primarily two-fold. The first is to discuss information about Ecuador which gives necessary background material and serves as a logical beginning for the remainder of this paper. It should make the reader aware of certain conditions which exist in Ecuador and acquaint him with some of the social realities surrounding irrigation organizations and within which they must operate.

The second is to begin to explain how and where irrigation and irrigation distribution entities fit into this general picture. This chapter should provide a point from which to explore more deeply into the irrigation administration in Ecuador.

Geography

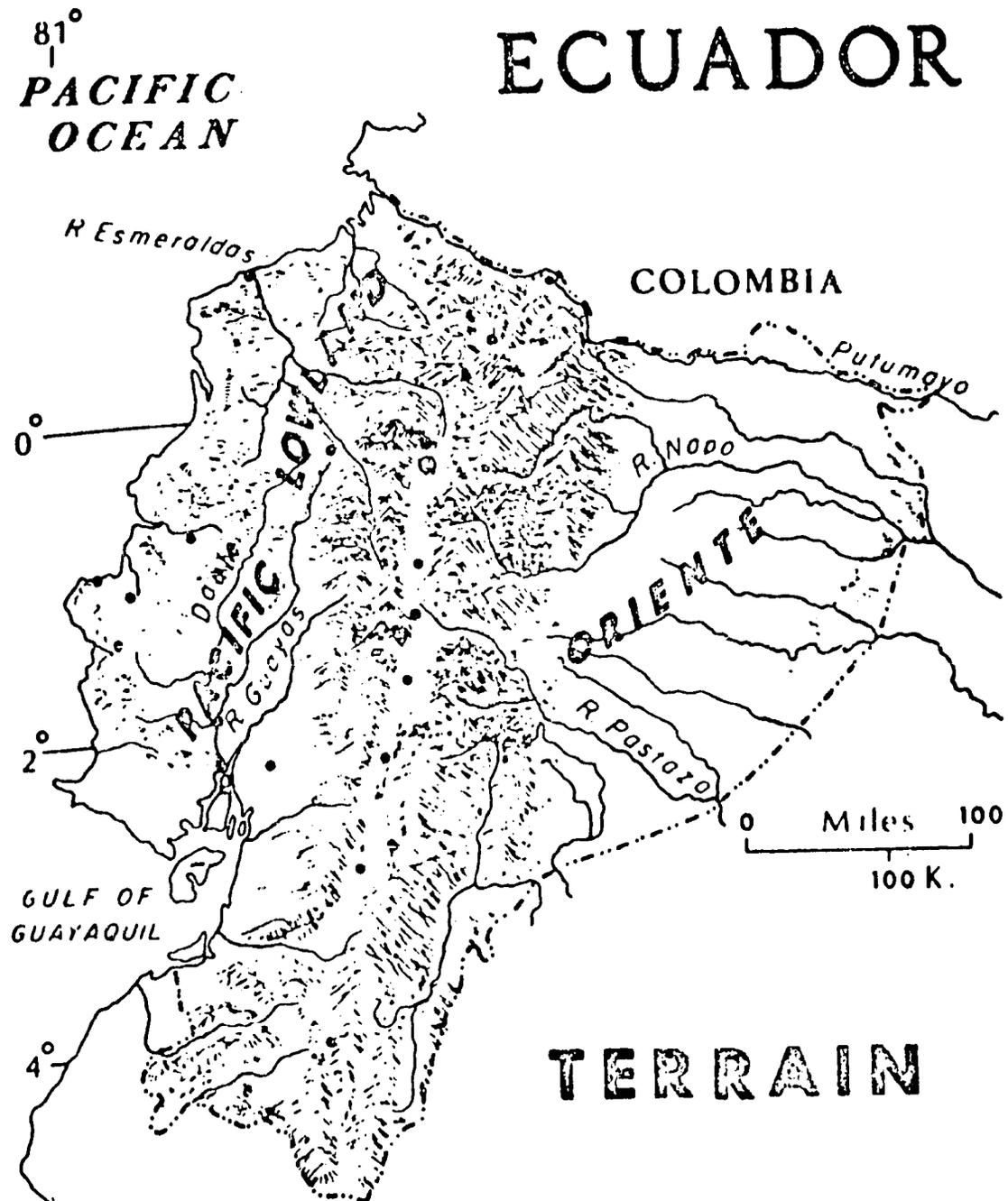
Ecuador is one of the smallest South American countries, with a total land area of 109,483 square miles (5, p. 428). Despite its small size, it is a country of extreme geographic and climatic diversity. Ecuador can be divided into three distinct geographic regions; the coast, the Andes mountains or Sierra, and the eastern lowlands or Oriente.

Forming the backbone of Ecuador are the high ranges of the Andes which divide the country in two. These mountains consist of two parallel chains, running the length of the country, between which are located the intermountain valleys and population centers. These valleys

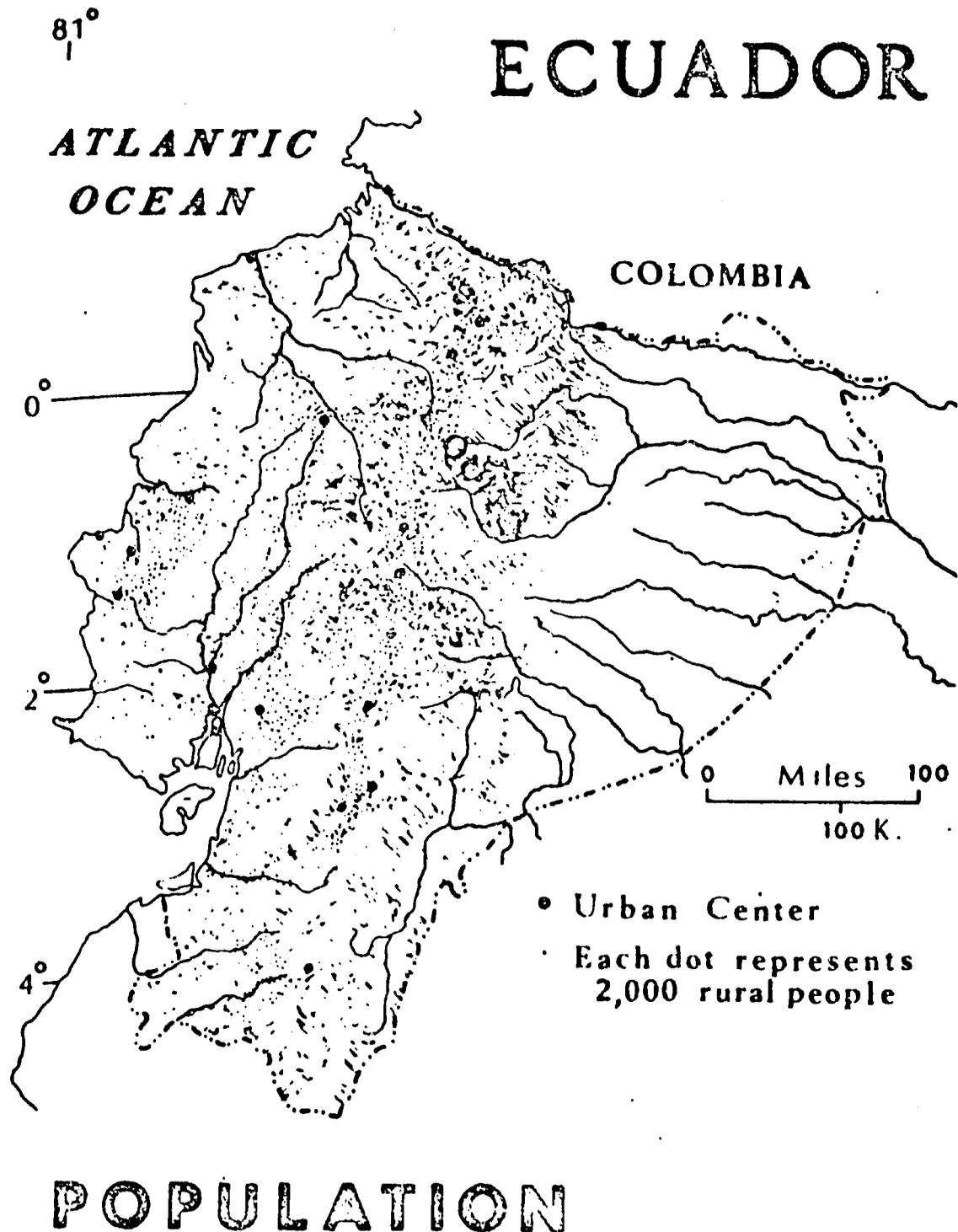


Map 1. Political Map of Ecuador.

Source: Martz, John D. Ecuador: Conflicting Political Culture and the Quest for Progress. Allyn and Bacon, Inc., Boston, Mass. 1972.



Map 2. Geographic Regions of Ecuador.
Source: James, Preston E. Latin America. The Odyssey Press, New York, 1969.



Map 3. Population Distribution of Ecuador.
Source: James, Preston E. Latin America. The Odyssey Press, New York, 1969.

or basins average approximately 9,000 feet in altitude and are surrounded by beautiful snow covered volcanos of which the highest is Chimborazo, at 20,577 feet.

West of the sierra is the coastal plain, called Costa, of Ecuador. It consists primarily of swampy lowlands and low rolling hills. The northern coastal area is dense rainforest but to the south is a dry desert-like area of little rainfall. The Costa supports a large percentage of the population most of whom are involved in crop export and trade activities in the Guayas River Basin.

The third region of Ecuador is the Oriente, the densely forested lowlands east of the Andes. A sparsely populated area, it is inhabited by a few scattered primitive Indian tribes and some military troops. This region is rich in petroleum reserves which have recently begun to be exploited.

The Galápagos Islands could be considered the fourth region of Ecuador. They are of volcanic origin and lie 650 miles off the Pacific Ocean. Few people inhabit the island chain composed of twelve larger islands and numerous smaller ones. These islands are most famous for their unique animal life which has long been the object of scientific research.

The bulk of Ecuador's population live in either the coast or sierra, each supporting nearly half the total. The pattern, however, has been one of slow yet constant migration from the sierra to the coast. This slow migration is continuing to occur at the present time.

Because of the wide diversification in geographical regions, climate and corresponding crops are also highly diversified. Ecuador is in

a unique geographic position. Situated on the equator, its coastal plain is in an area of high temperatures and humidity. The Guayas River Basin is flooded most of the spring and early summer months due to the heavy winter rainfall of the region.

The principal products of the coast are bananas, rice, sugarcane, coffee, and cacao. Most of these crops are grown for export and Ecuador is the world's largest producer and exporter of bananas.

The sierra, stretching across the earth's equator, is so high in altitude that the weather is generally described as one of eternal spring. A wide variety of crops are grown in the sierra, but maize (corn) and potatoes are the most important. Other products are wheat, barley, alfalfa, dairy products, citrus fruits, and deciduous fruits. The Salinas Valley, near the city of Ibarra, is a large producer of sugarcane.

Diverse mini-climates within the highland region help account for this vast variety of crops which can be grown in such close physical proximity. Varied altitudes, the equatorial location, and the climatic effects of the El Niño ocean current of the coast are prime factors in such diversity. This rare combination of natural circumstances creates an extremely unusual farming condition. For example, one farm near Quito produces corn, peas, potatoes, avocados, citrus fruits, grapes, and roses. This is by no means a rare exception for that area. The Ecuadorian sierra can, and does, support crop activities of this nature and has good potential for more agricultural development.

Such geographic and climatic diversity has endowed Ecuador with many natural resources and regions with potential development capabilities. They have given Ecuador all the necessary natural ingredients

for successful agricultural development. The country is plentiful in rivers and other water supplies and resources for use in irrigation and other water needs. The coastal climate is perfect for the production of many cash export crops and great varieties of staple crops for domestic markets can be successfully cultivated in the sierra. Even the recent exploitation of petroleum in the oriente could aid Ecuadorian agriculture by strengthening the national economy and government funded development programs. Ecuador, of course, must learn to use these resources wisely.

Population and People

The population of Ecuador is 6.5 million with an annual growth rate of 3.4 percent (6). Most of these people are located in rural areas. In 1968, of the total population, 62.4 percent were classified as rural and 37.6 percent as urban (7, p. 8). The GNP per capita is \$240 U. S. dollars (6). Quito, the capital, and Guayaquil, the largest city, are the two principal urban and commercial centers of the country.

One of the most significant social factors to be recognized is the population diversity. Paralleling the geography and climate are vast differences in Ecuador's people. In the northern coastal province of Esmeraldas is a high concentration of Negroid people of African descent, while in the Oriente are various tribes of premodern Indians. Even within the sierra, we find great social and tribal differences among Indian and mestizo communities.

One of the most noticeable internal social cleavages found in any Latin American country is that between the Costeños and Serranos in Ecuador; the intra-national split between the coast and sierra.

This division is very real and a significant social feature. Great differences in customs, living patterns, speech, and even value systems divide people from the coast and the sierra. These differences are quite highly related to working habits and agrarian disposition of the people.

Agriculture

Ecuador is an agricultural nation. Its economy is heavily based directly on agriculture or related activities. Some 53.7 percent of the total population is actively employed in agriculture at the present time (8, p. 4).

Since agriculture plays such a predominant role in Ecuadorian life, perhaps we should take a closer look at it. According to Ernest Feder there are some 344,000 farms, including all types, encompassing 6,000,000 hectares* of farmland (3, p. 104). Not all of this farmland is worked or occupied by its legal owner and there are various types of land tenure in use. The fundamental types are legal ownership, renting, and sharecropping. The most important thing to realize is that the best land is owned by the smallest percentage of the population, the landed elite. This same pattern predominates throughout Latin America.

To give us some idea of land size distribution, of the 344,000 farm units in Ecuador only 3.5 percent are classified as medium and large multi-family farms yet these same units comprise 68 percent of the total farmland. In contrast, 84 percent of all farms are

*1 hectare = 2.5 acres (or 2-1/2 acres).

minifundia* but include only 12 percent of all farmland (3, p. 104). In other words, the greatest agricultural population occupies the least amount of land.

We will not discuss all the problems associated with land tenure but these figures indicate the type of system in which Ecuadorian agriculture operates. The average or most common farm size in Ecuador is the small or medium small class farm. These are by far the most numerous of any and are the ones with which most irrigation organizations deal.

Perhaps it would be beneficial to include a brief description of the farm life or conditions under which the majority of Ecuador's agrarian society lives. These rural peasants are generally poor, have high expenses and receive little from their crops. The government provides little or no market price controls or lines of credit, and the people are largely left to struggle for themselves in many cases. Let us take a look at a specific example, a small agrarian community of 100 families in the highland province of Imbabura.

This community of San Juan is located adjoining the hacienda of a large landholder. Many people in the village own no land of their own and must hire-out as wage earners or rent land on which to grow crops. There are no culinary water or sewer disposal systems in the community. Even education facilities are limited and the provincial government provides only one teacher for 80 students in six grades.

*Minifundia are farms which have insufficient land to satisfy the needs of a family.

Most of the men earn around 15 sucres a day on which to maintain a family (25 sucres = \$1 U.S.). At this level of subsistence it is difficult to meet family needs and expenses.

Though the people of San Juan lead a humble life, most of them will never know any other. Migration to the city results in added expenses and more problems, though some are searching for a way to break out from their present way of life.

The villagers receive little attention from anyone, government and private enterprise alike. What crops they do produce may not bring in any income due to lack of adequate marketing practices. The people have formed no permanent or formal organization through which they could even represent themselves fairly before others. These people have few means by which they can remedy this situation.

Now, this may present a dim picture, but such circumstances are all too real and common. Yet, anyone who wants to improve social conditions, agriculture, irrigation, or any related area must recognize these social facts and take them into consideration.

This problem of rural poverty and economic inequality is stated most adequately by Feder, who says:

But inequalities are not so easily condoned when the differences are great and persistent, where the mass of the population lives without even food and shelter necessary to life, and where the disparities are perpetuated by systematic exclusion of most of the population from the means of livelihood, education, and political power needed to improve their status. In most of rural Latin America, the income distribution is a problem precisely because of the unequal access of the population to the opportunities for progress and personal achievement. (3, p. 8)

This is the situation we have described above through example.

Government

Ecuador is governed by a strong central government. To aid in the governing process smaller political subdivisions have also been established. These include, in descending order of size and jurisdiction, Provinces, Cantons, and Parroquias, each with corresponding political duties. The central government, however, has control over each of them.

At the present time, the government is a military dictatorship. It is not a repressive regime but rather is conservative in orientation and extremely nationalistic minded. Although progressive in its reforms and policies at first, the traditional elements of society have greatly diminished that zeal and life has generally proceeded as usual.

The military, in the short time since the coup d'etat of March, 1972, has entrenched itself strongly in power and placed military people in all important government posts at nearly every level.

Petroleum

The most recent development in Ecuadorian politics is the exploitation of the huge petroleum reserves in the oriente. In September 1972, the first barrel of oil arrived through pipeline to the port of Esmeraldas. This event added fuel to a "get rich quick" fire. Every government agency and private business as well wants a share of the profits which will soon flow into the country. This has had its effects on INERHI and irrigation too, as will be pointed out later in Chapter III. Indeed, petroleum-politics is a popular game at the present time in Ecuador.

Irrigation History

The use of irrigation is not a new thing for Ecuador. Due to rainfall irregularity, irrigation of some form has been practiced among inhabitants of the sierra since the pre-colonial period. The Inca empire established and administered a rather extensive irrigation network. Parts of that system were later destroyed yet others were utilized by the Spanish during the colonial era, during which time additional irrigation works were built for use in the highland areas. Nearly all of these old ditches and canals were later destroyed and most of the irrigation works which exist today have been constructed in the post-colonial period. In contrast to the long history of irrigation in the sierra, it has only been during the last three or four decades that systems of irrigation have even been constructed and utilized on the coast.

The size and extent of post-colonial irrigation works has depended upon the economic situation of he who constructed and owned them.

Relatively few people were wealthy enough to construct canals. Since there were few canals and many people who needed water for irrigation, the situation quickly became one of selling and renting water at a price imposed by the canal owner. One result has been a tradition of economic exploitation in irrigation use of the campesino in some regions, by the larger and more influential landholders. This situation still persists today.

Government and Irrigation

Although private irrigation works continued to be constructed, with the growth in population came an urgent need for more irrigation for land and crops; more than the private sector was providing. The national state then became involved in the construction of irrigation systems.

In July, 1944, an Irrigation and Hydrology section was created as a dependency of the Ministry of Public Works. A similar department had previously been associated with the Ministry of Agriculture. This section existed until 1959 at which time it was disbanded. It was unable to implement any concrete programs of irrigation development.

On August 9, 1944, another arm of government, an autonomous institution called the National Bureau of Irrigation was created. Its purposes were to study, construct, and administer various nationwide irrigation projects. This step was primarily taken as a result of the Water Law of 1936 and the Irrigation and Drainage Law of 1944, which established for the state certain responsibilities toward irrigation. Slowly the government was becoming more aware of irrigation needs and the role it must play in attempting to deal with the problem.

The NBI, however, was never able to implement nationwide irrigation programs, that is, to plan, regulate and control all irrigation throughout Ecuador. It did not establish regulation policies but rather was something like a state-owned construction company for irrigation works purposes. Although it was involved to some degree in many projects, the NBI was primarily responsible for the construction of six major

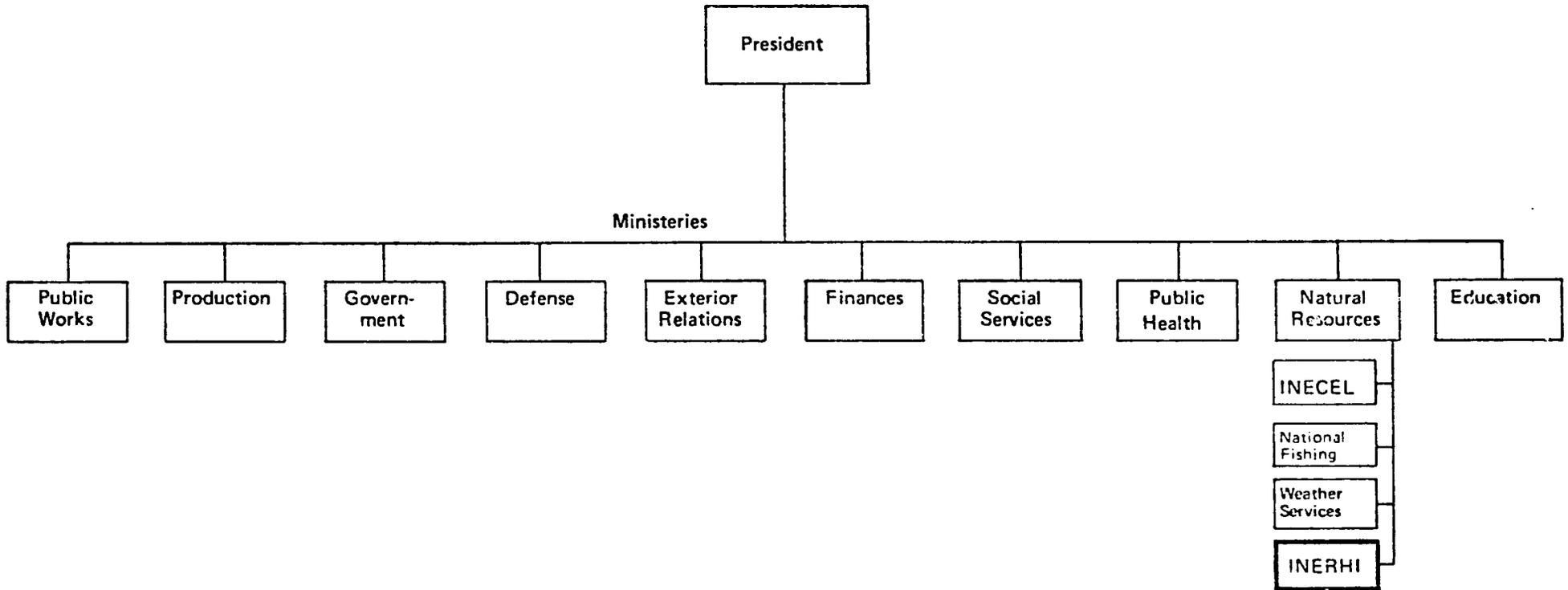
irrigation projects. These projects were Salinas, Pisque, Tumbaco, and Chimborazo in the sierra, and Milagro and Manuel J. Calle on the coast.

The NBI survived until November 10, 1966, at which time the Ecuadorian Institute of Water Resources, INERHI, was created. This new entity combined the duties of the NBI and the Water Resources Division of the Ministry of Agriculture which had been organized some years previous. INERHI was given responsibility to direct the improved use and protection of the nation's water resources. It has national jurisdiction to establish, guide and control irrigation and drainage policies. All government and private entities were to subscribe to that control. The creation of INERHI and a description of its duties, structure, and functional processes is the subject matter of the following chapter.

The Ecuadorian government has become increasingly aware of the irrigation needs of the country although at times good intentions have been stifled and irrigation programs have suffered. The restrictive combination of insufficient financial resources and numerous financial demands on government is largely responsible for irrigation having received low priority in actual economic terms.

While INERHI began to solidify itself, irrigation distribution practices continued ~~on~~ as they had previously done. The six major projects of the NBI became irrigation districts of INERHI, which began to administer and operate them as such. Irrigation networks in the private sector continued to be constructed and no control was ever being exercised over them by the new government agency.

Figure I
Basic Structural Diagram of National Government and INERHI



INECHI began to conduct pre-feasibility and feasibility studies for many new projects, but nearly all of them have never gone past that stage. Actual construction of new canals with state funds has been severely curtailed since 1966, principally due to a lack of adequate funding. We will look at this particular problem more closely in Chapter III.

Private Irrigation

Independently funded organizations and individuals have continued to construct and operate irrigation works of a private nature which have significantly contributed to the total irrigation output of Ecuador. In reality the private sector is extremely important and is responsible for 77 percent of the total irrigation delivery and use in the country (8, p. 88).

Table 1. Irrigated cropland by sector and region.*

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

*in hectares: 1 hectare = 2-1/2 acres.

This is rather a large percentage but points out to what extent each sector is involved in actual irrigation delivery. In Chapter IV, we will look much closer at the private sector and the means through which irrigation water is administered and delivered.

The New Water Law

One more important event needs to be described at this point, the enactment of the New Water Law by Executive Decree on May 18, 1972. The whole concept of the new law revolves around three basic principles.

First, the law declared all waters to be national property for public use. This eliminated private ownership of water and water use rights.

Second, all water use rights of any nature must be granted and authorized by INERHI. This meant that all irrigation use rights must be applied for, granted and registered by this agency. Riparian use rights heretofore recognized were now abolished.*

The third concept of the law was the centralization of authority in INERHI for the administration and adjudication of all waters of the state. The law gives INERHI the authority to control, administer, use and adjudicate all national waters, and gives the Institute wide powers and responsibilities.

The net effect of the new law cannot be determined at present. Regulations regarding the application of the law to actuality have not been approved and implemented. These regulations, to an extremely large degree, have direct implications on just how the law will be received and carried out, therefore we cannot determine as yet what the final result will be.

Some water users have had misgivings concerning certain aspects of the law among water users but for the most part it has been received

*Riparian rights are preferred water use rights to landowners bordering streams or other water sources.

well. Of course, those who favor it most are the rural labor class while the principal opposition has come from the more influential land-holding class.

One important thing to recognize is that a new water law embodying rather vast reforms was enacted by the government. To a large extent the law is directed at irrigation in many of its aspects, and is an indicator of the continual increasing interest the Ecuadorian government has placed on irrigation and its development, control, and administration.

Summary

In this chapter we have covered some basic background material on Ecuador, essential to acquiring an understanding of the country, its people, and the history of irrigation development.

To restate the main points, Ecuador is a country of extreme diversity in geography, climate, and people. The three principal geographic regions are the coast, the sierra and the lowlands of the oriente, each with its peculiar climate and population characteristics. The majority of the population are Indian and Mestizo, with the Indian cultures more concentrated in the Sierra, the homeland of their ancestors.

Agriculture has traditionally been the principal economic activity of Ecuador. The majority of the population is involved in agricultural activities of some kind, yet most of these people are extremely poor and live at a subsistence level. Rural poverty is prevalent throughout the country.

Associated with rural poverty is the extremely irrequitable farm land size and distribution. Some 68 percent of the total farmland in

Ecuador is occupied by only 3.5 percent of the total farm units. This means that the greatest agricultural population occupies the least amount of land. We need to be aware that Ecuadorian agriculture operates within this system of inequities in wealth and farm size.

Irrigation has enjoyed a long history in the Ecuadorian sierra. Since the pre-colonial period people have been irrigating in some highland areas. On the coast, irrigation was virtually non-existent until the modern era. Until fairly recently, the private sector was entirely responsible for all irrigation in Ecuador. Today, it can still account for over 70 percent.

During the last forty years the central government has become increasingly aware of the rising irrigation necessities of the country and has become involved in irrigation development. Today, the principal public funded and operated irrigation organization in the Ecuadorian Institute of Water Resources, INERHI. This organization operates six irrigative districts in the country, which distribute nearly 30 percent of the nation's irrigation water. The new Water Law of 1972 is also a manifestation of the government's efforts to develop and control irrigation and water use, and gives extensive administrative power to INERHI to control all inland waters.

Briefly, this is a summation of the main points of this chapter, which are important items to consider as the thesis progresses.

In the following chapters we will discuss in more detail both the public and private sectors involved with irrigation in Ecuador. Consistent with the thesis objectives we will be concentrating on those aspects which best describe the general functioning process of the

distribution organizations, and those factors which we observe that most significantly relate to irrigation distribution.

CHAPTER III

ECUADORIAN INSTITUTE OF WATER RESOURCES

Structure and Budget

The Ecuadorian Institute of Hydraulic Resources (INERHI) is the principal public agency responsible for irrigation administration and distribution in Ecuador. INERHI has been charged with other duties as well, but irrigation is one key responsibility. Nearly all INERHI activities eventually relate to some phase of irrigation, whether it be in administration, construction, maintenance, or studies for future projects. Each part of the organization plays a role which in some way assists the institution in carrying out its assigned tasks.

Although this thesis is restricted to those functions most directly related to the irrigation process, we need to also get a broad general picture of INERHI and how it is structured. This will give us a frame of reference which may be helpful as we proceed through the chapter.

Creation and objectives

The Ecuadorian Institute of Water Resources was created by Executive decree on November 11, 1966. The law dictated INERHI to be an executive institution of the state established to execute the Law of Irrigation and Drainage. Its fundamental responsibility is to look after the best possible use and protection of the nation's water resources. As established by law and in order to accomplish this task the principal duties and responsibilities of INERHI are:

1. Conduct an evaluation study of the water resources of the nation.
2. Study and determine water needs for irrigation and other uses.
3. Review and transact applications for water use right concessions and issue technical reports necessary for water adjudications.
4. Make an inventory of use rights and maintain a registry of water use right concessions.
5. Execute the National Plan of Irrigation and Drainage.
6. Establish through regulation, norms and requirements for irrigation and drainage works.
7. Collect water use tariffs from users.

These objectives have not been altered. Under the new Water Law of 1972, INERHI has been given increased duties in conformity with the ones above.

INERHI is now the single administrator of the law itself with legal jurisdiction over state waters and authority to adjudicate water controversies of any nature, power which it did not previously have. If the Institute could assume and freely carry out all its responsibilities it would become one of the most powerful arms of the government.

INERHI is a semi-autonomous government institution attached to the Ministry of Natural Resources and Tourism. More precisely, it is classified as an institute, a special kind of entity with the capabilities to implement its own programs and manage its own funds. This is its semi-autonomous nature, for a bureau or a dirección does not have

the capability to conduct its own affairs. Financially, however, INERHI, or the Institute, is directly dependent on the national government for revenue.

Board of Directors

The Institute is governed by a five-man Board of Directors the President of which is the Minister of Natural Resources and Tourism. The other four members consist of (1) the Director of the Technical Office of the General Secretariat of Economic Planning or his representative, (2) the Executive Director of the Institute of Agrarian Reform and Colonization or his technical director, (3) an elected representative of the agricultural interests, (4) the manager of the National Development Bank or his credit manager. These five members are permanent members of the Board.

The President of the Board selects the Executive Director of INERHI who serves for a four year term during which time he is also the General Secretary of the Board of Directors. In the capacity of Secretary he can voice his opinions but has no actual voting power on the Board in spite of the fact he is a very important member.

Duties of the Board are (1) establish and approve the general policies and programs of INERHI, (2) approve programs involving government funds of over \$200,000 sucres or contracts of major importance, (3) review and approve the budget of INERHI, (4) approve permanent personnel recommendations made by the Executive Director. The Board can designate general policies but does not decide how they will be implemented. This is left to the discretion of the Executive Director.

The Board should meet on a regular bi-monthly basis, but it is often not able to do so and the periods between sessions are extended.

The New Water Law specifies that a special committee called the Consultive Council of INERHI is to be established within the Board. It consists of three people, two permanent members and the Executive Director. This committee will act as the judge of second and last instance in the adjudication of cases arising from the application of the law.

Executive Director

The formal head of INERHI in both theory and practice is the Executive Director. 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. Granted, much of his autocracy is a result of his own personality traits and capabilities but his office inherently has a good deal of discretionary power and authority.

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.* His decisions are final at INERHI. It is sufficient to say he is the 'boss' and is regarded as such.

*Ing. Jaime Bustamante, Executive Director of INERHI, personal interview.

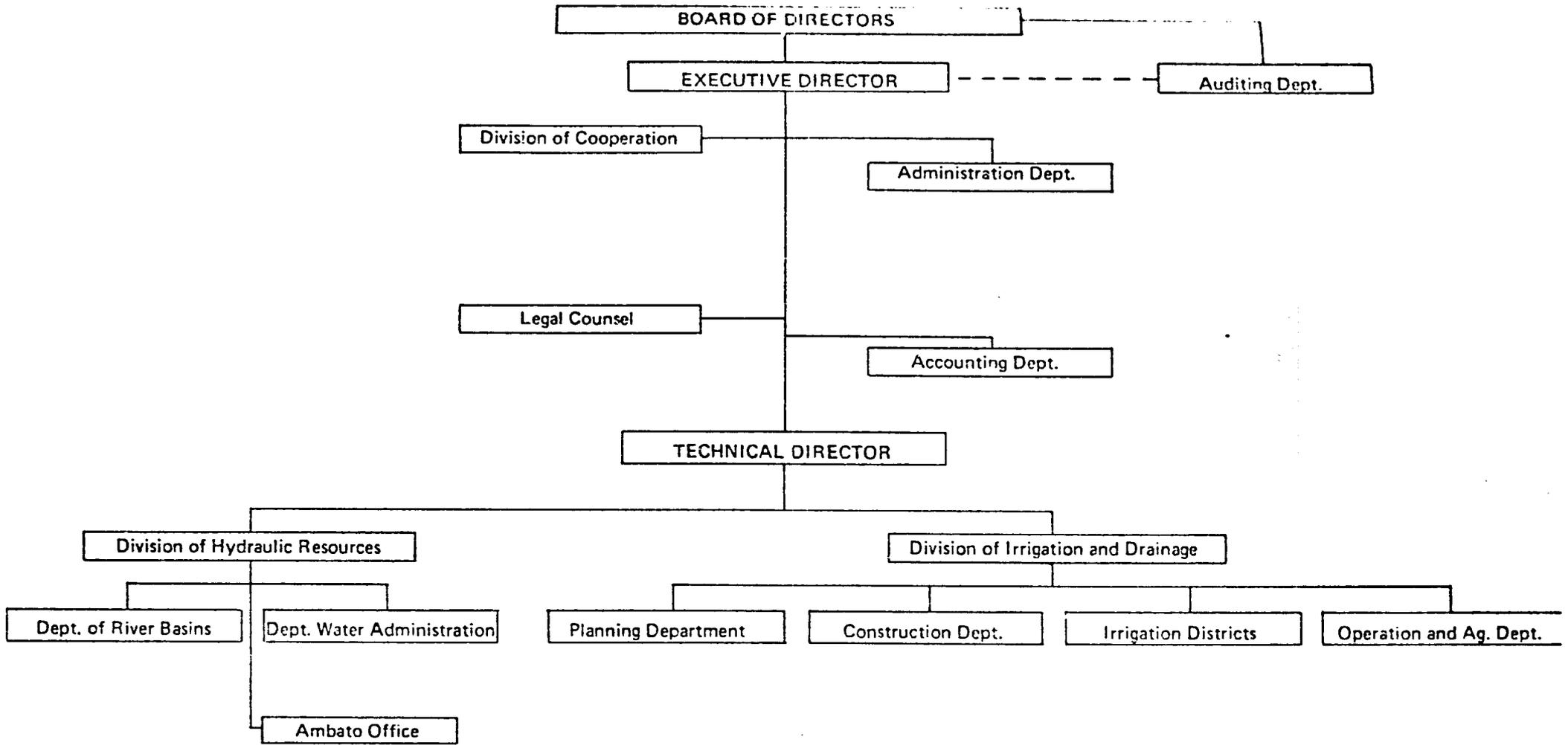


Figure 2
Administrative Structure of INERHI

Organizational structure

Beneath the Executive Director the organizational structure of INTERHI breaks down into three principal Divisions and several administrative departments which are independent from the Divisions (see Figure 2). These departments are a Department of Administration, Auditing and Accounting Departments, and a Legal Counsel Office, each with corresponding sub-sections. These departments handle the everyday administrative affairs of INERHI's central office.

The Cooperation Division, the first of the three main Divisions, is also administrative but directed toward cooperation and coordination at several levels. It is generally responsible for assessing INERHI programs and budgets, coordinating activities within the Institute, administering and obtaining international loans, cooperation with other government entities, and the general promotion of the Institute.

All the above may be termed as administrative or supportive units. There are two other 'operation' Divisions which actually perform the Institute's technical responsibilities and obligations. They are the Water Resources Division and the Irrigation and Drainage Division, supervised by a Technical Director who coordinates their activities. He is directly responsible to the Executive Director.

The Water Resources Division is responsible for the administration of national waters and has two departments. One is for river basin planning and the other basically executes the Water Law.

The functions of the Irrigation and Drainage Division are much the same as those of the old NBI, primarily planning and study, construction, and exploitation of irrigation projects. Its four departments are

Planning, Construction, Operation and Agricultural Development, and the fourth consists of the six irrigation districts which were constructed by the National Bureau of Irrigation before 1966. 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.

All the above divisions and departments, except the irrigation districts themselves, are located in Quito at INERHI's central offices.

We have now taken a brief look at the responsibilities of INERHI and the structure which has been created to perform its duties. This is, of course, only the structure or theory and says nothing for how it actually functions. INERHI formally operates along the general established lines of responsibility, though at times some functions are duplicated and conflicts arise.

The remainder of the chapter is devoted to the study of two aspects of INERHI that help shed light on what the realities of administration and water delivery are and why. One is the budgetary process in which the Institute is engaged. It is important to study this process because of its direct relationship to the functioning of INERHI in almost every respect, including the actual distribution of irrigation water. Insufficient revenue is the root of many problems associated with the success or failure of irrigation distribution to the user. Therefore we need to know more about the budgetary process and see what influence it has on the organization's operations.

The second part of this chapter deals with the six irrigation districts. These are the same districts that were constructed as

irrigation projects by the old NBI. We will look at each of them to see what characteristics or problems they have that relate to the management of water. By the time we review each of them separately they should indicate to us various kinds of factors which can most directly affect organizations actually distributing water, whether they be public or private.

The budgetary process

One of the biggest problems facing INERHI is the lack of sufficient revenues and the struggle to obtain more. Almost every administrative deficiency can at some point be attributed to this situation. The roots of the problem stem from the simple fact that there are multiple demands on the public pursestrings and that there are insufficient funds to satisfactorily meet all of those demands. There is just not enough money to go around.

Consequently, INERHI finds itself engaged in the business of competition with other public agencies and dependencies for money. This is a very unstable situation but one over which INERHI has little control. Its very survival as an institution, like all other public agencies, depends on how well it can acquire enough money to run its programs. The procedure for doing so is a vital one to the Institute and therefore, to the interests of this thesis.

The process through which INERHI must obtain government funds is a complex one. The first stage is that of securing a budgetary allotment from the total budget of the nation. It consists of several steps, first, the formation of a budget request by the Institute. To help simplify this task a special Programming and Administration

Department has been created. One of its primary duties is to work with each division and department in formulating a working budget.

This is quite a time consuming process in itself. Each unit head must determine what he considers are the realistic needs of his department and compile a budget for the following year based on that determination. During this period, department heads meet together with the Executive Director as a Coordinating Council in which they discuss various programs and needs against what they think the government may give. A good deal of budget alterations are generally made in these meetings. This process may take many months and is initiated long before the government's submittal date deadline.

The Programming Department, working with the department heads formulates a complete budget for the Institute accumulating the preliminary budgets for each department as have been agreed upon in the above mentioned sessions. The provisional budget is then given to the Board of Directors for study, review, and approval.

A special commission is named consisting of one or two Board members together with some INERHI heads to study the proposed budget. At this point it is also subject to modification based on their recommendations. With such financial matters the ability of the Executive Director to prevail over the Board is diminished.* To help expedite this process and enhance approval further down the line a representative of the Ministry of Finances has now been added to this commission. This will help eliminate the risk involved in guessing how much money will be available to work with.

*Ibid.

During the review of the preliminary budget by the Board and special commission consideration for allocations is given to the following list of priorities.

A. Irrigation

1. Operation and maintenance of existing works.
2. Termination of works now in construction.
3. Initiation of new works which have been studied and are feasible.
4. Termination of present studies.
5. Initiation of new studies.

B. Administration of waters

1. Attention to legal adjudications
2. River Basin studies when there are sufficient funds.

These are the same priorities which guided the decisions made by the Coordinating Council before the proposed budget was first formulated.

When the budget has finally received the approval of the Board of Directors it is handed to the Ministry of Finances by way of the Ministry of Natural Resources and Tourism. Again, it is reviewed. In the Finance Ministry it is most openly subject to modifications and this is the step which INERHI believes to be the most damaging in the entire process.* At the Ministry it is thrown into the hopper to be overhauled along with the budgets of all other state entities.

The Ministry of Finances has previously made an estimation of the national income for the fiscal year against which the necessities of

*Ibid.

government agencies are compared. Quotas for each are discussed and further studied by the Bureau of the Budget of the Ministry. A formal statement is then issued of what each agency can expect upon which they begin the formulation of their budgets, as has been explained for INERHI.

When these requests are finally handed in they are modified to fit the present existing financial circumstances. Usually such modifications are in the form of decreases. Rarely has an agency been known to get more than it asked for.

After being studied and modified by the Budget Bureau the individual agency recommendations are given to the Minister of Finances who usually accepts them as they are. Thus the total national budget and the budget of each entity is approved by him. It is the end of a long time consuming process from the formulation to the acceptance and approval of a budgetary allotment. No other formal government approval of the budget is required.

The second and most difficult part of the budget process now begins. It consists of the steps necessary to actually acquire the money which has been budgeted and approved by the Finance Ministry. This situation is a constant headache for INERHI.

The problem is that during the year reforms are made in the national budget based on the policies and politics of the government. Also, the amount of money estimated for one year is always larger than the amount actually received into the national treasury.

These two items pose a serious problem to any public institution. It is an unstable situation over which government agencies have very

little control. As a result INERHI always received less money than it is budgeted. When there is not enough money in the national coffers to receive the budgeted allotment INERHI programs suffer.

The situation is even more of a problem in reality. INERHI receives its budget in twelve equal monthly payments. To begin a new fiscal year it solicits two or three of these payments which have been approved by the Ministry of Finances. It must then go to the National Comptroller who gives the order for funds to be released from the Treasury. The Treasury in turn gives what portion of the amount it can, usually less than what is solicited.

If the treasury were full from month to month no one would get less than what was budgeted to them. Most of the time, however, everyone wants their money and the coffers are low. In this situation the agency with the most political leverage or the best personal contact gets its money first. This is the game in which INERHI is engaged monthly. There is a constant shuffling back and forth between the Institute and various Ministries just to actually obtain the money allotted to it by the government in the budget.

Because of the above situation INERHI has never, in one year, been given the amount of funds it was supposed to receive (Table 2). It is a difficult problem, one on which no realistic program for development can either be planned or implemented. It is the primary cause of multiple problems which plague INERHI at every level, including the irrigation districts.

When INERHI finally does get what money it can, this money is distributed to the various departments based on the following priorities.

Table 2. Budget of INERHI.*

Year	Total National Budget	INERHI's National Budget	INERHI** Total Budget	Amount Received from Gov't
1966	2,653,000,000	41,895,661	41,895,661	22,752,743
1967	2,866,000,000	30,673,000	30,673,000	25,934,045
1968	3,821,000,000	41,647,000	42,147,000	31,932,494
1969	4,178,000,000	43,097,000	45,297,000	37,035,316
1970	5,232,000,000	47,756,000	55,756,000	37,320,291
1971	5,946,000,000	125,497,000	156,440,000	44,560,259
1972	- - -	95,500,000	132,600,000***	27,755,306 (as of June)

*in sucres: 25 sucres = \$1 U.S.

**including international loans

***includes:

FAO	1,500,000
PMA	6,300,000
Germany	1,000,000
Peru	4,500,000
BID	20,800,000
World Committee Against Hunger	3,000,000

1. Programs involving international loans and contracts.
2. Salaries, wages, administration and office costs.
3. Operation and maintenance of irrigation districts.
4. Construction of new works.

Projects partially funded through contracts with international organizations or with other nations are given top priority as a matter of national prestige. The second priority includes all administrative expenses, personnel salaries, project feasibility studies and all other activities of the central office. Three and four are self-explanatory.

We may note that this list is different from the one determining priorities for the budget formation. Most of this difference is due to the administrative fact what money there is must be spent where it will do the most good or where it is most needed.

When expenditures are finally made, they are closely accounted for and checked by a vast network of authorizations and signatures. Even an employee must obtain three required signatures in order to draw his paycheck from the central office. Two complete INERHI departments account and audit the books and records, which are also closely scrutinized by national auditors to whom a complete accounting of expenditures must be made.

To avoid this systematic hassle, one of INERHI's aspirations is to be free from the national budget and have its own source of income. The Institute would like to see the government earmark certain taxes or revenues directly for its use instead of going into the general fund. For example, a tax on irrigated land or some other permanent tax source would give the agency a more reliable income.

The biggest push, however, is to gain a concession from the central government for a certain percentage of the petroleum income. As everyone else, INERHI would like a piece of the pie. Recently the Institute has become involved in a giant propaganda campaign to convince the government, and country in general, that irrigation is of vital future importance to Ecuador. It feels that irrigation and improved farmland use are essential to the nation's progress. Its motto has essentially been "canals over highways," meaning that irrigation is the more important of the two for economic development.

The campaign has apparently been quite successful and irrigation seems to be one of the top priorities for national development spending. If INERHI can in fact receive a fixed percentage of the petroleum income it would reduce a good deal of uncertainty which it now faces by

giving it a more reliable source of revenue that it could more easily count on.

We have seen that the budgetary process is complex, time consuming and a general administrative entanglement of huge proportions. Let us now look at a few examples of the kinds of problems for efficient administration such a situation can pose.

Consequences

We have previously mentioned the numerous administrative procedures for organizing, securing, and controlling the budget. Each of them is extremely time consuming, costly, requires myriads of paperwork and generally causes dissatisfaction within the organization. These problems place added administrative burdens on employees and the organization's structure.

Since the formation of INERHI in 1966 many well qualified technicians, engineers, and other employees have left to work where there is less internal tension and the pay is better. INERHI is plagued by low salaries and has a difficult time keeping people for a productive length of time. This loss in expertise is a detriment to the Institute and reduces the efficiency of its operations.

One of the most astonishing net results of an insufficient budget is that construction of irrigation canals has virtually ceased since the creation of the Institute. Perhaps five kilometers of new primary canals and some 50 kilometers of unlined secondary canals have been constructed. Some existing canals have been concrete lined, repaired or covered but construction of new canals with state funds has been

minimal. There has just not been enough money. Most is eaten up in administrative costs and operation and maintenance of existing works.

The only construction going on at present is the Montrúfar project consisting of 25 kilometers of canal, 20 of which have been completed. This project, however, is primarily funded by BID, the Inter-american Development Bank, with some Ecuadorian matching funds.

Besides the lack of sufficient money, construction has also been curtailed for another reason. In the words of one INERHI technician we discover what that reason is. "We spend most of our time in feasibility or other types of studies. This happens in all departments of the central office."*

This statement leads us into another interesting and paradoxical situation. INERHI does not have enough money to both operate itself internally and construct new projects, so the latter has suffered. But in an effort to construct new works, as it feels it must do as one of its primary obligations, the Institute has looked for other sources of revenue. The search for more money has led INERHI to go outside the country and make loans with international organizations (Table 2).

Most international bodies require extremely detailed and intricate studies as prerequisites for loans. If such studies are not conducted no contract is signed. Prefeasibility and feasibility studies are very complex and require a tremendous body of personnel to complete the burdensome specifications. The result has been a rapid extensive growth

*Ing. Marco Ayala, Chief of the Department of Construction, INERHI, by personal interview.

in the administrative personnel of the central office of INERHI, most of whom are directly involved in such studies.

The paradox is this, that the search for more money has led to a huge build-up in administrative costs which in turn take even a larger percentage of INERHI's budget. This means less money left over for actual construction of new works which led to the search for more money in the first place.

It is a vicious cycle that is hard to break under the present financial situation. "We can't reduce personnel here (central office) because even what we have is not enough to do the studies that by international contract we must do."*

As can be noted from Table 2, each year a larger portion of INERHI's total revenue is derived from international loans. One redeeming benefit of this predicament is that at least some construction of new works is being accomplished because of the loans. Construction would take a long time if INERHI were to rely solely on national funds.

Another consequence of insufficient funds directly related to irrigation is that little money is expended for the proper maintenance of existing irrigation works. Operation and maintenance are the third allocation priority for the expenditure of funds from the national government. This means that most of the money is spent in other activities of INERHI and little is left for the upkeep and operation of the irrigation systems which have already been constructed and are in service. As a result, irrigation service is often poor and the canals continually deteriorate.

*Ing. Jaime Bustamante.

The situation is even more critical for irrigation when we consider the fact that the irrigation districts cost more to operate in one year than the returns from the rental contracts, and are thus dependent on the central office for subsidization. They are definitely not repaying the original investment of national funds as they were supposed to do over time, an additional burden on the public treasury.

When the districts have to rely on the central office for revenue they suffer. Besides being on a low priority to begin with they generally have limited contact with Quito. Each district is deficient in operable equipment. Their employees receive low wages and in some cases may go for months at a time without a paycheck. Salaries and expenses in Quito are paid first and the districts take what is left. Many district personnel are extremely dissatisfied with this situation. Each of these conditions inhibits the ability of the districts to properly carry out their responsibilities in distributing irrigation water.

There just seems to be a general lack of attention by Quito toward the districts and in most every case, too numerous to mention here, it can be traced back to insufficient money somewhere along the line. With this sort of stumbling block no program can really work efficiently.

Summary

We have not tried to suggest how things ought to be but rather describe how they are and why. The financial situation in which INERHI must operate has a tremendous relationship to its behavior as an institution administering water. Originally designed to build, operate and maintain works of infrastructure for irrigation water delivery to the

user, it has now become a sizeable bureaucracy whose supportive functions have become more important than the operative functions.

Table 3. Costs for district maintenance,* 1971.

Name	Total Expenditures	Total Income From District	Cash Transfers from Quito
Tumbaco	396,651	319,330	121,572
Salinas	964,552	379,763	321,585
Pisque	1,153,289	864,047	312,854
Chimborazo	1,590,922	681,909	891,755
Manuel J. Calle	991,928	850,290	81,953
Milagro	--	--	--

*in sucres; from INERHI records

INERHI never receives the total revenues allotted to it by the central government. In an effort to maintain its irrigation programs the Institute has gone to international agencies for financial assistance, and received it. This action, however, has merely contributed to INERHI's revenue problems and administrative costs by increasing the work load necessary to carry out the studies these agencies require. The situation has become paradoxical.

Insufficient financial resources is not the only factor involved in irrigation management efficiency in INERHI, but it is the most significant one to consider because of its far reaching implications. Multiple problems relating to irrigation in the public sector can be attributed to the financial dilemma of not having sufficient enough money to properly meet responsibilities.

The Irrigation Districts

During the days of the old Bureau of Irrigation six major irrigation projects were constructed with national funds. Although most have not been fully completed as originally intended, large portions of the works have been in use for some time. When INERHI was created in 1966, it assumed the role of the NBI and was given charge of the six districts for their completion, operation and maintenance.

General characteristics

Operationally, each district distributes the water diverted by its diversionary works through a system of primary and secondary canals to the user, who through his own private ditches or tertiary canals conducts the water from that point to the point of use. Water is distributed to the user on a rental-type basis through individual contract with the district for a specified volume, price, and time.

This is how the system should function. Unfortunately it is much more complicated in reality than the theory indicates. We will examine several factors which interfere with the actual distribution procedure.

All the districts are structurally organized in similar fashion with slight variations according to the needs and circumstances of each. An example of such structure can be seen in Figure 3.

In none of these districts does INERHI supply all the irrigation water used by every farmer in the district. Neither do all potential users even irrigate. In other words, the districts themselves are not areas in which everyone employs irrigation practices. Not all property owners within the districts irrigate, and not all of those who do irrigate use water provided by INERHI.

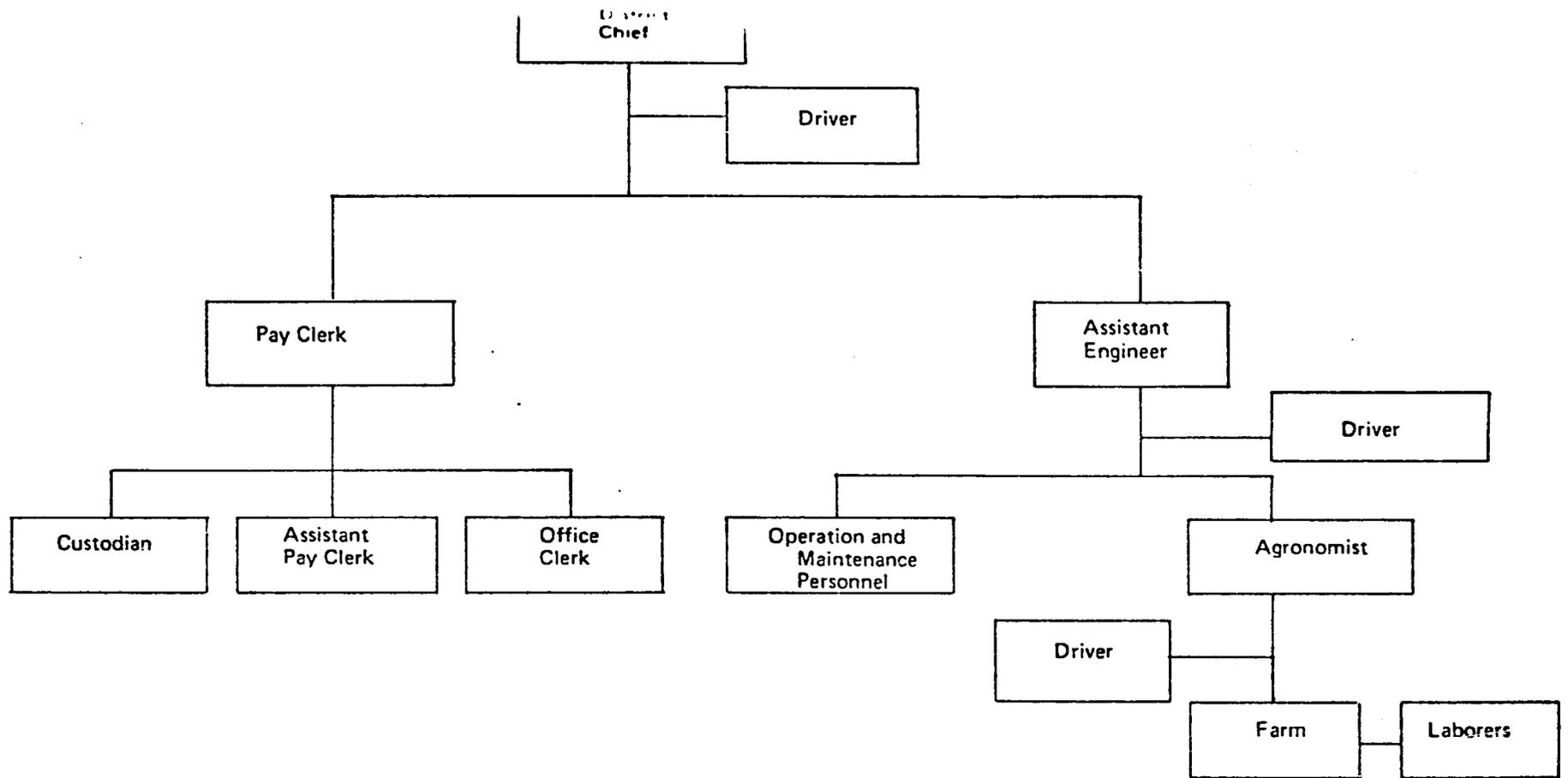


Figure 3
Structural Diagram of Salinas District

Under the new Water Law the Institute is trying to rectify this situation by requiring either mandatory use or tariff payment whether or not one uses water from the district's canal. Through this method they hope to contract out all the water they could potentially deliver through their systems. This would reduce the gap which presently exists between what they think they could deliver and what is actually being used (Table 4).

Table 4. Capacity flow efficiency in INERHI districts.

District	Canal Max. Capacity in liters	Liters/Second Rented 1970	Efficiency Percent
Salinas	2,500	1,292	52
Pisque	7,000	2,057	29
Tumbaco	2,000	1,123	56
Chimborazo	7,000	2,438	35
Milagro	9,000	4,811	53
Manuel J. Calle	10,000	6,168	62

Title XII, Art. 51 of the new Water Law reads,

"The utilization of waters for irrigation conducted through irrigation canals constructed with funds of the state is obligatory.

The properties under the influence of the above mentioned canals that have a slope of less than a twenty percent grade are subject to the obligation covered in the previous paragraph." (9)

Although this is INERHI's goal there is doubt that it can actually be implemented, for some reasons we will observe later. This is not of fundamental importance but is interesting to keep in mind.

Another common feature of all the districts, as before mentioned, is that they cost more to operate in one year than the income received from rental contracts. This has added to the financial burdens under which they must function.

This is a synopsis of the basic general characteristics six irrigation districts have in common. Each, however, is peculiar in some regards with respect to the distribution of water. By looking at each of them we can see examples of several factors which are associated with irrigation distribution and use.

Tumbaco district

The Tumbaco district is located just a few kilometers east of Quito. Its total area is some 3,000 hectares of which 1,470 are irrigated with district waters. Construction of this project began in 1945, and service was initiated twelve years later, making it the oldest of the six districts.

Water for irrigation is contracted out on a land size basis rather than on the basis of crops or soils, the standard being one liter/second/hectare/year. This is the standard universally used in all the districts. The cost of one liter varies from district to district and is computed in the central office.

Unlike any other district, one of the distinguishing characteristics of Tumbaco is its unique combination of water users, which are of two types. First, are the annual rental contract users and second, water use right owners.

Water renters do not own their water rights but pay a rental fee of 400 sucres/liter/year for the operation and maintenance of the system. On the other hand, water use right owners are people who once bought a water right concession under a special program of the government. This right, sold at a one-time fixed price, entitles them to the use of a specified volume of water for the rest of their lives. In addition, they also annually pay a maintenance fee. This program was never repeated and in every other district water is delivered only on a fixed-time rental basis.

Another feature of Tumbaco is that the irrigation infrastructure is old, outdated, and not extensive enough to provide irrigation opportunities to all potential users in the area. Even the present existing canals are becoming rundown and cannot work at full capacity. The meters at the diversion points on the secondary canals are called óvalos, an ancient structure which allows only a determined flow of water to pass. Closure is accomplished by covering the opening with rocks, dirt clods, and clumps of grass, creating a condition in which water is lost and wasted.

The combination of these conditions in the physical system itself places a limiting factor on how much water can actually be distributed and how many people can benefit from the presence of the district. This is one reason why so much land in every district is either not under irrigation or is irrigated from another source, simply because water is not available from INERHI. The infrastructure is inadequate to provide sufficient water for everyone.



Map 4. Irrigation Districts of INERHI.
1. Salinas 4. Chimborazo
2. Pisque 5. Manuel J. Calle
3. Tumbaco 6. Milagro

In Tumbaco the soil is in poor condition from agricultural over-use. Such a condition has a direct relationship to irrigation. Where land is unproductive from over-use, people either leave it unplanted, or if it is farmed, many will not irrigate it because irrigation alone does not help productivity and crop yield. The sad fact is that most of this land is worked by poor subsistence farmers, who have no other place to go and must continue to try and eke out an existence from this land year after year.

A joint program of FAO-INERHI was initiated in 1972 to teach people the benefits of fertilizers and make chemical fertilizers available to them. There are problems. Experimental sites have been set up for field demonstrations showing the advantages of chemical fertilizers. Accompanying night classes have also added to the program. Consequently, many farmers have been convinced that the use of fertilizers is beneficial. But when they go to INERHI to obtain fertilizers they find they are not available. Many have lost confidence in INERHI for that reason, and confidence in the Institute is what INERHI feels people should have. It almost seems like a self-defeating program and has had universal failure in all the districts. Some social characteristics of the people of Tumbaco are also associated with irrigation use. For example, most farmers in Tumbaco are very traditionalistic minded in the type of crops they plant, the growing season, and application of water to their crops. The majority rely entirely on the winter rainfall for water for their crops, and in so doing they follow the customary practices of their forefathers.

These people are so bound in tradition that they know of no other way, and yet they are convinced that there could be no other way.

Many know that the traditional crops grow with rain water and therefore see no need for irrigation. To others, irrigation would be an economic risk, far too costly for any benefits it could bring. Tradition, then, becomes an important factor in irrigation use and distribution, in this case, why some people prefer not to irrigate.

Helping such people understand that the use of modern agricultural methods may be to their advantage and not disadvantage is a big task and cannot happen overnight. Although irrigation may give them two growing seasons and increased productivity as well, there are too many other factors involved to make the answer that simple. Land size and tenure, education, and soil conditions are examples of other variables which must be considered in seeking a program which can be accepted and can in reality succeed. We can find an example of this type of situation in Tumbaco.

Recently a good highway was constructed through the region and land became more valuable. This resulted in an increase in the value of land, either to buy or rent, and an increase in the land taxes which one must pay to the government. Land productivity and crop yields have not increased proportionately to the increase in land value and taxes caused by the highway. Now, people must pay more for land without earning more from it. This is a serious problem in agricultural development because it has not increased the saleability of the land itself.

The value of irrigated land is also greater which again means increased land taxes. Traditional oriented people become reluctant to use anything which may increase the productivity of their land

for fear that the government will take that increase away from them in the form of taxes. A long history of such exploitation gives them good reason to believe this may happen.

Another problem is this. Many people who would like to irrigate are denied access to irrigation water because some influential people with large land holdings refuse to allow canals to pass through their properties. In this situation, those with the least degree of political power suffer. They either get involved in lengthy litigation or their land goes without water. Degree of political influence is another pervasive social problem related to irrigation use, of which Tumbaco is an example.

We also find that the district lacks a sufficient number of personnel to adequately watch over, control and maintain proper distribution. Financial restrictions are the prime reason because the district simply cannot afford to hire more people.

In addition to this problem many users go delinquent in the payment of their fee assessments, some for years at a time. This is a headache for the district, which is already operating in the red and must rely on cash transfers from Quito to keep in operation.

With a limited number of personnel it is difficult to maintain the canals in proper working condition and watch over the correct delivery of water according to schedule. Thus, efficiency and good management suffer.

This leads to an even more serious situation in which water theft abounds. Farmers, both INERHI contractors and others steal great volumes of water. Insufficient supervision just adds to the problem,

and it has come to be one of tremendous proportions for INERHI, who must keep constant vigil over the irrigation works. This is of course an impossibility without more employees.

Actually, theft of water for irrigation purposes is almost an accepted practice in Ecuador, especially in the sierra. It is all too common everywhere, inside and outside of INERHI's districts, and a great deal of land is irrigated in this fashion. The water is not secure physically, and certainly not legally, but it does get to the land and must therefore be recognized as a means of irrigation distribution.

This practice is even more simplified in Tumbaco because the delivery schedule is extremely confused and disorganized due to the two classes of users, each receiving water from the same canal yet on a different basis. Water is not delivered by sequence along a particular canal, which results in confusion, waste and mismanagement.

All of Tumbaco's characteristics are not unique but they do help us begin to see some factors associated with irrigation, its practice and distribution.

Salinas district

Salinas is located in the sierra near the city of Ibarra and encompasses the 4,000 hectare Salinas Valley, virtually all of which is irrigated cropland. Over 80 percent of this land is planted in sugarcane while alfalfa, tomatoes, and cotton are cultivated on the rest. The monoculture nature of this region is one of its most peculiar characteristics.

In 1971, of the 100 property owners in the valley, 51 signed rental contracts with INERHI. Of these, 47 also received water from a source other than INERHI. This means that most of the annual rental users in this valley have water from two sources. This situation will likely persist in the future. The Salinas infrastructure is designed for a capacity flow of 2,500 liters/second. Based on the standard of one liter/second/hectare and computing a conduction efficiency rate of 100 percent, INERHI could only service somewhat more than half the cropland in the valley. Even this amount of land is highly improbable.

This same general situation exists in all six INERHI districts and is an example of the fact that even within publically operated irrigation districts people must rely on private sources of water. The importance and necessity of irrigation by the private sector is thus sustained.

The gravest problem in the Salinas district is the high salt content of the irrigation water and the lack of sufficient natural drainage. As a consequence, the soil also has a high salt content. As its name in Spanish indicates, Salinas is an area noted for this characteristic. This creates a serious problem for irrigation because the continual application of this salty water to the soil increases salinity and the problem becomes even more severe.

Associated with this poor drainage situation is a problem of a social nature, as in the small village of San Luis de Cachiyacu located below the primary canal. The water table in that area has risen to the point that the soil is constantly wet and several open springs and pools have been created. Salinity has increased and agriculture has

become extremely difficult. In addition, the adobe-like walls and dirt floors of local buildings rapidly soak up water, ruining houses and making them damp and uninhabitable. Many residents have had to move to higher ground, leaving their homes behind.

We observe that this problem has both agricultural and social connotations. The presence of state and private operated irrigation works in the area, though they provide many benefits, has some very real negative results as well. At the present time no satisfactory program of action to help correct this situation is in progress and it grows worse daily.

Pisque district

Between Tumbaco and Salinas is the district of Pisque. It is the second largest of the six with a total area of 14,000 hectares, 2,617 of which are irrigated by the district.

Here, as in all other districts of the sierra, the source of water is continual, secure, and there has been no history of service suspension due to insufficient water. However, there has been suspension of service due to faulty infrastructure, a problem which plagues both Pisque and Chimborazo but this problem will be discussed at greater length in the following section. We need only note that it has caused dissatisfaction among users in Pisque. Distrust in the district's ability to deliver the water when, where, and in the right amounts needed leads many property owners to rent smaller water amounts or discontinue district service completely.

Soil in the district is sandy, a handicap to agricultural development and consequently, to irrigation in the area. It is difficult to

obtain a good yield from crops grown in the soil. Large quantities of water are required to keep it moist, and it is naturally deficient in many vital plant nutrients and requires a great deal of fertilizer.

Farmers, both large and small lose money due to high production costs and poor yield. Many of the larger farms are now being sold and are purchased by smaller farmers in the area. These smaller farmers always want more land. This in turn leads to the problem of land percellation and fragmentation which only increasingly inhibits efficient land use and agriculture.

Although Pisque is an agricultural region few people can subsist from agriculture only. Therefore many of the people who reside there now travel to Quito for jobs to support themselves and their families. This in turn creates a farm labor shortage in the area. As a result, potentially cultivable land goes unproductive due to lack of available labor to work it. Landowners are unwilling and unable to pay the high wages that people can earn in the city. They prefer not to plant crops because labor and production costs would rise higher than crop yield returns and they would lose money on the investment. It is more economical for them to leave their land idle. Those who are most affected by this labor shortage are the property owners who have larger landholdings and rely on rural labor to operate their farms. Because sufficient labor is not available they are only able to work a fraction of their land. They therefore rent from INERHI only enough water to fulfill their irrigation needs, which are fewer than if more land was under cultivation. This is an important variable in irrigation water use.

Again we see that the presence of an irrigation project does not mean either instant irrigation or prosperity for everyone. There are too many other factors which determine if and how the water will even be used.

Chimborazo district

This district is centered around the city of Riobamba in the province of Chimborazo. Some 1,200 hectares are irrigated by the district of the total 9,700 hectares it encompasses. With regard to operation of the district and delivery of water there are two principal items which are of most interest to this thesis.

The first is the extreme parcellation of land, or minifundia, which exists in the region. Since the pre-colonial period this area has been traditionally agricultural. The present minifundia condition has come about as land has been parceled and subdivided when handed down from father to sons, generation after generation. These people stay with the land and live on smaller and smaller plots. According to the 1962 census the population density of the region was one of the highest in Ecuador at 170 inhabitants per square kilometer (10).

The following are some statistics which can help us comprehend how extensive the minifundia problem is in Chimborazo. In this region, and the entire province as well, there is no property owner with more than 35 hectares. We can use the water rental users of the district as an example of this entire situation. For 1970, comparing size and number of farm units we find the following information:

Table 5. Minifundia in Chimborazo among INERHI contracts.*

Number	Size of farm unit in hectares
168	.050 or less
369	.050 - .10
1568	.10 - .50
514	.50 - 1.0
348	1 - 5
13	5 - 10
4	10 - 20
4	20 - 35

*INERHI records

These rather startling figures indicate that the average farm size is only .53 hectares per water user. We can also note that 2,105 farm units are of 1/2 hectares or less. Although these figures are for water rental users of the district only, they are representative of the entire region and demonstrate the critical extent of minifundia. As mentioned in Chapter II, 87 percent of the active agricultural population of Ecuador are rural peasants who live and work on minifundia lands.

We cannot go into all the problems which minifundia poses for agricultural development but we can look at some of its ramifications on the efficient delivery of irrigation water. Simply stated, minifundia makes technically administered distribution nearly impossible for the following reasons. Such a numerous amount of extremely small properties makes it very difficult to formulate, follow, and supervise a set distribution schedule. Without such a schedule efficient distribution is impaired and water is lost, stolen, and misused.

Water distribution among minifundia is carried out more by customs and tradition than anything else. When properties are sold, handed down

and divided, the situation becomes even more critical. People simply will not leave their land which creates an acute minifundia situation and a decrease in the economic prosperity and independency of the farmer.

Agricultural production and the level of economic stability decrease as minifundia increases. Minifundia indicates more than just farm land size. It means rural poverty, traditionalism and primitive methods of agricultural production.

The second problem in the district is the faulty condition of the distribution network. The canals are in extremely poor condition which often causes the suspension of service to the water users. Water is not delivered as scheduled because the canals become inoperable. The following table is a short history of days service has been suspended in Chimborazo.

Table 6. Service efficiency in Chimborazo.*

Year	Days service suspended	Efficiency %
1967	68	81
1968	87	76
1969	116	68
1970	153	58
1971	121	67

*INERHI records

This situation has some grave consequences. The real problem is the uncertainty on the part of the user that the resource will even be delivered to him. This in turn means a reduction in the number of contracts and results in less money in the district to repair and properly

maintain the canals and so the problem persists. The principal reason why they are not maintained well in the first place is lack of money.

In addition, people fall behind in the payment of their water assessments and refuse to pay for water they did not receive, which only adds to the problem. The farmers lose faith and confidence in the district and will not cooperate well with its programs. Inability to provide regular irrigation service certainly does not encourage the success of obligatory use as required in the New Water Law.

In conclusion, if an organization is to be successful in administering and delivering water, it must be able to guarantee service and satisfy its clientele by providing for their irrigation needs at the time and in the amounts it is needed. Inability or failure to do so breeds mistrust, financial doom for the organization, and loss of crops for the farmer. The organization cannot continue to function unless it receives funds other than from within itself. Such an organization must be willing and able to dedicate a good percentage of its budget to the proper maintenance of its distribution system if it is going to guarantee service. Chimborazo is a case in point.

Milagro district

The Milagro district of INERHI is near the city of Milagro in the Guayas Basin. It, and its companion district Manuel J. Calle, are the only two districts on the coast. The principal crops of the region are sugarcane, bananas, rice, coffee and cacao.

In total area the district embraces 10,000 hectares with an irrigated total of 6,957 hectares. Of this amount, 5,000 hectares belong

to one giant operation, the Valdez Sugar Plantation, and the remainder is distributed among other farmers in the district. Another large industry, the San Carlos Sugar Company, is also located in the area but its lands are irrigated through private irrigation systems.

Of the 160 users in Milagro other than Valdez Sugar, land size distribution is as follows:

Table 7. Land distribution of Milagro users.*

Farm size in hectares	Number
5 or less	100
10 or more	44
50 or more	6

*INERHI records

This land distribution pattern of extremely large extensions of land under single ownership, such as Valdez and San Carlos, adjoining a number of small or medium-sized farms, is a general characteristic of the entire coastal region. These large units are very influential. For example, the initial and primary purpose for construction of the Milagro project was to furnish irrigation for the Valdez plantation. Later it was enlarged to become a general irrigation project benefiting other users in the area as well.

The district director for Milagro is also in charge of Manuel J. Calle and INERHI's regional office in Guayaquil. This demonstrates the fact that both of these districts lack sufficient numbers of technically qualified personnel. This deficiency can be attributed to low salaries, difficult working conditions and insufficient revenue to hire new

people. Such a condition is certainly related to the efficient operation of the district as a supplier of irrigation water.

The primary peculiar problem in Milagro is the physical insecurity of the water source itself. It is the first time we have come across such a situation. Uncertainty results not from insufficient water but from too much water. With the coming of the heavy winter rains and spring runoff the rivers in this region rise so high they often change course. This creates a problem in constructing a permanent diversion work because there is no certainty there will be any water to divert; the source is insecure. This problem has a direct relationship to irrigation in that there is no guarantee of a constant supply of water.

Milagro has been plagued by this problem. A great deal of time and money are spent in trying to keep the river in the same channel so water can be diverted from it. This is not always successful and service is suspended at times. We have previously seen the effects service suspension can have on the water user and the distribution organization.

Manuel J. Calle district

This district is identical to Milagro in almost every respect and is also located in the southern floodplain of the Guayas Basin. It is the largest in total area, covering 27,000 hectares of which 6,292 hectares are under irrigation, principally in sugarcane and bananas. The Aztra Sugar Company is the biggest consumer and irrigates 3,500 hectares with district water.

This district, like Milagro, has not been completed as originally designed and the canals are almost entirely unlined. The hot humid climate of the coast causes vegetation to grow at a rapid rate. This is a damaging situation for unlined canals and they require almost constant cleaning. If not properly kept free of plant growth and debris the water flow is impaired and the volume of flow is reduced.

This is but an indication of yet another physical or natural factor, of which there may be many, that must be taken into consideration when an irrigation project is planned and constructed. Such conditions may place added burdens on the organization after construction is completed and service has been initiated. If they are not properly solved in time and with sufficient personnel and money, they will cause the infrastructure to degenerate and eventually become useless, thereby not meeting the goals for which it was created. If a system is going to remain in good working order it must receive constant attention after it is put into use.

Summary

The six irrigation districts of INERHI demonstrate a wide range of factors and conditions related to irrigation water distribution. They point out some specific examples yet also indicate general kinds of variables which can and do influence irrigation delivery and use. We will now review some of the most important of these variables as discussed in the chapter.

One significant social consideration in irrigation distribution and use is the education of the water user, as associated with customs

and tradition. They can determine when, how, and even if, irrigation water will be applied to the soil by the user. Another vital factor is farm size, which can create multiple problems for irrigation if the farm plots are too small and too numerous.

The inability of an organization to properly operate and maintain its irrigation infrastructure due to financial restrictions placed upon it is an economic factor directly related to efficient water management. Consequently, uncertainty on the part of the water user that the resource will be delivered and distrust in the organization can result.

If the organization fails to gain the confidence of its clientele in any of its programs, the social legitimacy of that organization drops, as has happened in several INERHI districts.

We have also seen that there are natural conditions in the physical environment with which a water management organization must be willing and able to deal, usually with sufficient time, money and personnel, or they can undermine the organization in the performance of its duties. These are the principal types of factors which are associated with water use and distribution in INERHI's six irrigation districts.

Realization that such factors can be associated with irrigation is vital, for if we are to understand the organization which administer water we must become aware of the reality in which they exist and know the types of conditions with which they must cope in order to reach their goals. We can also observe how these social, political, economic, or natural factors assist or hinder the organization in performing its functions.

CHAPTER IV

THE PRIVATE SECTOR

This chapter will describe and analyze the organizations other than INERHI which distribute irrigation water. It will concentrate on the private sector but will also include a small section on the other public institutions which are involved in irrigation administration to a limited degree. All these entities are similar as they are not national organizations implementing nationwide programs as is INERHI. The scope of their influence is much less.

Of course, any study of irrigation water distribution in Ecuador would be incomplete without discussing the private sector, for it includes multiple institutions which deliver water. The private sector is responsible for over 70 percent of the total irrigation in Ecuador, a significant percentage. One purpose of this chapter is to investigate the various means and organizations through which irrigation is administered in the private sector.

We have previously reviewed a brief history of irrigation development in Ecuador. Traditionally, it was practiced only in the sierra among some indigenous groups and was later further developed during the post-colonial period. Irrigation was unknown on the coast until the modern era. It came into use as people began to migrate to the open coastal lands. Lack of available farmland and excessive population growth in the sierra prompted many highland people to move to the coast where these pressures were less intense.

It is interesting to note that today the majority of farmers comprising the agricultural community of the coast are highland people by origin, who carry with them the traditional values of owning and working their own land. The original costeños on the other hand, are not nearly so land oriented and are traditionally non agricultural by nature.

The history of irrigation in these two regions, a long one in the sierra and a comparatively short one on the coast, is primarily responsible for the development of distinct trends in irrigation distribution methods and organizations. This point will become more clear as we proceed through the chapter.

Although irrigation methods have always been employed in numerous mountain valleys throughout the Ecuadorian sierra, they have been most well known and practiced over a long period of development in the territory near Ambato. This is an area of traditionally less rainfall than others of the sierra and the need for irrigation has been greater. A brief description of the water history of this region will aid in more clearly understanding the development of private irrigation practices and organizations in Ecuador.

Beginning several hundred years ago, nearly all the productive land in the Ambato area was divided among very large haciendas. This type of landholding is termed latifundia,* the extreme opposite of minifundia. These haciendas were originally awarded to various people as a concession from the colonial government and was later passed on through inheritance.

*Latifundia are large farms with sufficient land to employ a group of workers much larger than the owner or the family of the owner.

Between 150 to 200 years ago the large land owners began to build irrigation canals to service their huge estates, utilizing the Indian labor from those people who lived and worked on the hacienda. Upon the completion of such canals the hacienda owners would rent or sell the water to the Indians who had built the canals or other users who would pay for it.

Two significant things have occurred during the last century. One, is that the haciendas no longer exist today because they have been subdivided and fragmented into many small units. Second, in many cases the water rights and land titles were sold separately and therefore do not necessarily correspond to one another. The relationship between land titles and water use rights has been destroyed.

This chaotic history of water rights and land sale has led to several conditions still evident today. The first has been a good deal of confusion and controversy over legal water rights and land titles. The second, an even greater issue, is that the cost of obtaining a water right has risen tremendously. Consequently, when a person buys a water use right, he makes a considerable investment upon which he hopes to realize a return. He has often done so by renting his water at extremely high prices to subsistence farmers who absolutely need the water to survive. This exploitation of the rural poor is a social injustice which has risen to alarming proportions in Ecuador. Far too many people have made enormous profits from such a business.

In an effort to bring this situation to a halt, the Water Law of 1972 absolutely prohibits the sale, purchase, or rental of water by private individuals. Although of noble intent, this is not the most

satisfactory solution because if people cease to rent water, those who have been wholly dependent on that water are left without any and cannot obtain it. This spells economic disaster for water renters. Some method must be established to insure that those users who have rented waters can have the continued use of the water until it can be procured from another source.

Water rental by such private systems has been one common means of irrigation distribution in the past, and to a limited degree will probably continue to be in the future, despite the new law.

This history of water and land transactions has also left another lasting impression on irrigation development in the sierra. Fundamentally, this condition prompted many farmers, especially small landowners or minifundistas, to come together into groups for the common purpose of jointly acquiring water for irrigation and then administering that water among themselves. Clusters of users along a canal or section of canal began to organize in order to secure an independent source of water which they would purchase and use as a group. This custom of banding together into private water distribution organizations is common throughout the sierra but has been most predominant in the Ambato area (See Table 7, Tungurahua and Cotopaxi).

The oldest of these water user associations date back to the 1930's, but they continue to be created even at the present time. They are known as Directorios de Agua, what we shall term water user associations, and serve much the same purpose as canal companies in the Western United States. These user associations have become very important as distribution organizations in Ecuador, and they are by far the most numerous

of any formal irrigation institution, public or private. For the most part, these associations function well and are responsible for the delivery of a great deal of irrigation water.

Water user associations

It would be impossible to cover in this paper the circumstances under which every water user association functions, for there are over 250 such organizations throughout Ecuador. We want, however, to get a general picture of what these associations are, how they operate, and where they are located.

The appendix contains a translated copy of the Statutes and Regulations of one typical user association. Since these organizations legally exist under the provisions of Article XII, of the Water Law of October 6, 1939, each one is structured and formed in much the same fashion as the example. Though they may vary in size from just a few shareholders to several thousand, each follow the same general pattern.

Water user associations are governed by a Board of Directors, which manages everyday administrative affairs, and a General Assembly composed of all shareholders in the association. The duties of each of these bodies and respective Board members are set forth in statute, as can be seen in the example in the appendix. In other words, the structure, offices, duties and procedures of user associations are universal with modifications to fit diverse existing circumstances.

The statutes and regulations set forth the procedures by which these associations ought to function. Generally, most of them actually

function in the manner prescribed by their statutes. That is, these organizations operate in reality much as they should in theory. The difference between reality and theory in their management is small in most cases.

The steps in organizing and legally establishing a water user association are the following:

1. Establish a general assembly of all interested users and elect a provisional Board of Directors.
2. Elect or assign a commission, generally three persons, to write statutes for the association.
3. Present them, upon completion, to the general assembly on two different occasions for discussion and approval.
4. Upon approval, send the statutes to INERHI along with certified minutes of all previous sessions, and a petition to approve the enclosed statutes.
5. They are studied and approved by INERHI, which has the right to make any changes, with or without the consent of the provisional association. (Previously, INERHI could only study the statutes, make recommendations, and send them to the Minister for approval.)
6. The statutes are approved and published in the Official Register of the government.
7. A permanent Board of Directors is elected and the association begins to function legally.

Under Title XVI, of the Water Law of 1972, all formerly constituted user associations continue to exist and new ones may be formed upon approval of INERHI (9).

Water user associations are financed privately through assessments levied upon each shareholder according to a set rate on the volume of water he uses. The amount of this fee varies with each organization and is usually fixed by the Board of Directors.

One important point is that this individual assessment, is very low. These organizations generally operate on low budgets with relatively few expenses. The cost per shareholder per year is considerably lower than the corresponding rate in any of INERHI's irrigation districts.

We must also take into consideration the economic effect of the supplemental labor provided by each associate, for the maintenance of the infrastructure. The labor assessment is also minimal in most cases, and is also calculated on volume of water consumption.

User association members only pay in cash the amount necessary for administrative matters, provide voluntary labor for the cleaning and maintenance of the distribution works, and most association officers serve without monetary remuneration. These are all factors which help drive the cost of operation down yet it is accomplished without sacrificing the means to adequately accomplish goals. These organizations were originally created to acquire and deliver water and to do it at a reasonable price. They do this quite effectively.

The following table shows the income versus costs per year in sucres, of one association consisting of some 2,000 shareholders in the Tungurahua region.

Shareholders in this association annually pay 36 sucres and two man days of labor for each water hour used.

Table 8. Income and expenditures in sucres of a water user association.*

Year	Income	Expenditures	Balance
1966	-	-	1,862
1967	14,960	15,002	1,820
1968	15,489	16,485	785
1969	13,008	11,404	1,604
1970	18,578	14,288	5,893
1971	18,112	19,851	4,153

*from records of the Toallo Water User Association.
25 sucres = \$1 U.S.

The principal characteristic of the irrigation networks utilized by these associations is their simplicity. They are not too large or extensive, are unlined, and distribution is non-technical. Water is usually distributed by hours, which is the total volume of water in the ditch for one hour every so many days. The number of hours needed is calculated by the size of the plot to be irrigated and what customary practice has been.

One local criticism of these organizations is that their infrastructure is not well engineered, and distribution and use are not carried out on a technical basis. Even in INERHI's districts, however, distribution is not technically calculated or administered, and delivery of the water resource often cannot even be guaranteed. As for the efficient and beneficial use of the water by the user, it is probably as favorable in user associations as anywhere else in the nation. The people employ the same irrigation methods, whether the water source be public or private.

It is therefore difficult to assume that user associations are either more or less efficient in water use than the districts of INERHI

or any other distribution organization, as some technicians have suggested. Just the opposite may be the case. Though not technically directed or administered, they deliver water to the satisfaction of the user, and at a more reasonable price than INERUHI's districts.

To emphasize the significance of this point we can examine the results of a recent economic study conducted in Ecuador. One conclusion of this study indicates that at every farm size level the farmer is better off to go all the way with both irrigation and modern agricultural technology. The most value, however, is obtained just by going to irrigation. In fact, for a small farm of under five hectares there is a negative return by trying to technically modernize. The most valuable asset to the farm is irrigation.

Again, though user associations are not technically oriented organizations, they are efficient in providing water for farmland irrigation. In economic terms, they are very significant irrigation organizations (11, p. 90).

The distribution by province, region, and number of all known water user associations in Ecuador is shown in Table 9. Several interesting observations should be noted. The most noticeable is the overwhelming number of associations located in the sierra with virtually no such organizations elsewhere in the country. This is an interesting pattern of development. Even within the sierra the vast majority are located in certain key provinces, all of which are between Riobamba and Ibarra. This is the area of historically more intense agriculture and irrigation; the area such as Ambato, where people have had to band together for irrigation purposes.

Table 9. Water user associations by province.*

Region	Province	Number
<u>Sierra</u>	Azuay	10
	Bolívar	0
	Cañar	1
	Carchi	4
	Cotopaxi	50
	Chimborazo	23
	Imbabura	37
	Loja	3
	Pichincha	24
	Tungurahua	<u>98</u>
	250	
<u>Coasta</u>	El Oro	0
	Esmeraldas	0
	Guayas	1
	Los Ríos	0
	Manabí	<u>1</u>
		1
<u>Oriente</u>	Morona Santiago	0
	Napo	0
	Pastaza	0
	Zamora Chinchipe	<u>0</u>
		0
	Total	<u>251</u>

*compiled by author

The pattern on the coast has been quite different, principally because the agricultural population is less dense and much larger tracts of farmland are prominent there. Larger plantations owned by few people are much more common. These extensive companies irrigate thousands of hectares through private means, but on an individual basis. Each of these companies usually owns and operates its own private irrigation system. User associations are therefore unnecessary.

Farm sizes and land distribution patterns are basically different in the two regions. Large extensive farms with individual source of water are more characteristic of the coastal region. In the sierra, we find greater numbers of people on extremely small land plots who do not have a private water source each and must depend on each other to obtain water for irrigation. Agricultural land patterns and population have not become so intense on the coast that people have had to, of necessity, form such organizations.

This, of course, is not the only explanation of why water user associations do not exist on the coast. Expressing his ideas as to why, one engineer said, "In my concept this is due to various factors; (1) the individualistic spirit of people in the area, (2) the lack of sufficient knowledge of the benefits of irrigation and the predominant custom of relying on natural precipitation, (3) lack of confidence in such organizations, and (4) the majority of small farmers in the area are land renters and not land owners."* Each of these reasons is important in explaining the odd distribution pattern of water user associations in Ecuador. In summary, we will discuss a few factors which seem to influence the internal management and operation of these organizations most directly.

Custom and tradition in irrigation practices are prime factors which determine how water will actually be distributed and used by the people. Allocation of water by hours, distribution and use, and the organization of a delivery schedule can all be attributed to custom. Even the very existence of user associations is part of a long history

*Ing. Gustavo Salazar, Chief of Milagro District of INERHI, personal interview.

of tradition in water use as we have seen. These factors therefore exert a high degree of influence on organizational behavior.

The law itself, primarily that of October 1936, sets forth the basic organization and procedure to be followed in the internal structure and management of these institutions. Since they must conform to these standards in order to be legally approved and rightfully function, the law also has a direct relationship to how these organizations operate.

Another primary factor in the operation of user associations is the quality of available leadership. These entities usually consist of indigenous people with little education who are not prepared to accept and carry out the responsibilities of managing such an organization. This can cause many problems. If the association seeks a more capable person, for example, it may also get one who will take advantage of his position and exploit the organization in one fashion or another. But, if leadership positions are always filled from within the association itself, and unqualified people placed in charge, management inefficiency may result. Either condition would be a detriment to the institution in performing its main tasks.

Leadership problems, however, do not always plague user associations. Usually, the responsibilities of association officers are so fairly well divided that inefficiency on the part of one of them does not damage the entire organizational operation. Leadership is, however, a key factor directly associated with the management of user associations and can account for some differences between theory and practice in their operation.

The formal judicial system of Ecuador is at times directly responsible for the ability of these organizations to accomplish their tasks. In cases of water theft or the refusal by a shareholder to pay his assessments, associations must rely on the sanctioning power of the courts for legal recourse. This relationship is often important to the proper management of these institutions, and is another major factor associated with their operation.

Other distribution organizations in the private sector

Besides water user associations, there are other private institutions which distribute irrigation water. Those that can be classified as having formal structures are much like user associations in that they are established, authorized, and regulated by law and must function accordingly. They are also given authority to tax in the sense that they may assess their members for services rendered. In addition, they rely on the power of the court system as ultimate legal authority to enforce their rules.

One common characteristic of all the following organizations is that they were not originally structured for irrigation distribution and they do not all distribute irrigation water. Some of them do, but irrigation is only a secondary activity and is not their primary goal or function.

Cooperatives

Cooperatives are organized to provide mutual assistance and financial cooperation among individuals. In Ecuador, they are usually

formed to help people of low income improve their financial security or reach some other common goal. Some agricultural cooperatives provide a limited irrigation service for their members, much like a user association. These cooperatives are most common in the sierra among small farmers.

Cooperatives must have statutes and regulations governing their administration approved by the Ministry of Social Security in order to be recognized as a legal entity. For our purposes, however, the most important fact is that some, but not all of them, distribute irrigation water. Agricultural cooperatives distribute a rather small percentage of the total irrigation in the private sector and are not too significant as water distribution organizations.

Agricultural societies

Agricultural societies or companies are somewhat similar to cooperatives but are almost exclusively found on the coast. They are most popular among larger, more financially independent farmers who are involved in raising cash crops for export. Each member of these societies contributes a certain amount of capital to the company for which he receives a proportionate percentage of benefits. Their primary purpose is promoting commerce and economic opportunity.

Although they are similar to cooperatives, they differ in their basic purpose and organizational structure. Some of them have become involved with irrigation, but again, their role as irrigation organizations is small. Agricultural societies, however, are one type of private institution which does distribute at least some irrigation water in Ecuador.

Private individuals

The largest distributor of irrigation water in Ecuador is the private individual who owns and administers his own water on an individual basis, and does not belong to any organization for that purpose. He is his own institution. Irrigation by private individuals is the most significant means of water distribution both in the coast and the sierra.

Classified in this group are those people who rent water to others, as previously discussed. Water rental is another way in which irrigation is administered, by private contract between two individuals.

Related to this type of individual administration are the large operations, such as San Carlos in Milagro. These are private entities who manage their own particular irrigation systems. They can also be classified as private institutions which distribute irrigation water. The above private individual means distribute the greatest percentage of irrigation by the private sector in Ecuador.

Informal organizations

There is also evidence that water is distributed by informal or unofficial organizations. This occurs when two or more users mutually agree to construct a diversion work and distribution canal, which they exclusively utilize themselves. This is an informal agreement by verbal contract only, without written terms, but is mutually recognized and respected by all parties. Such organizations are not recognized as legal entities but nevertheless exist in reality and actually administer irrigation water. The extent or number of such informal structures is hard to determine without further field research.

Water theft

One of the most common ways irrigation water is distributed is not through an organization but ~~is~~ by theft. Although neither legally nor socially acceptable, this method must be recognized as one means by which water is brought to the land, the ultimate goal of any irrigation administration institution. It would be impossible to determine what percentage of farmland in Ecuador is actually irrigated in this manner, but it is so common throughout the country that it must be considered a significant source.

Communities

Irrigation water is also administered by some communal villages, known as comunas or caseríos, which are small communities of indigenous people. The administration of irrigation by these communities is much like user associations only without written statutes and formal legal structure. Usually the traditional leaders of the village also govern the administration of the water as may be necessary. Little known of the real operating process of comunas except that tradition and custom prevail and dictate the conditions of delivery and use of irrigation water.

This completes the list of structures which distribute irrigation in the private sector in Ecuador. Though some of them may individually deliver relatively small amounts of water, collectively they comprise the sector responsible for the majority of the total irrigation output of the nation.

The Public Sector

We have looked at all the known private irrigation institutions. But the irrigation picture is not complete without also taking into consideration the other institutions of a public nature, besides INERHI, which to some degree are associated with irrigation. They are included in this chapter along with the private sector primarily because of the limited degree to which they are involved in actual distribution.

Each of these organizations operates on public funds and is therefore subject to the same economic struggle which plagues INERHI, except they are even more severely limited to their budgets. They are not nationwide public institutions but are restricted to specific regions or areas, and irrigation delivery is not their primary function. The total amount of irrigation these organizations deliver is almost insignificant to the public sector.

Regional development entities

Today, there are three regional organizations created to sponsor and carry out programs of social and economic development in specific areas of the country. In doing so, some have initiated limited irrigation programs.

The first of these entities is the Center for the Economic Development of Azuay, Cañar, and Morona Santiago, known as CREA. It was created in 1958. CREA operates three small canals in Chauliabamba and Pante, conducting some 500 liters each. This is the extent of its irrigation activities, which are practically insignificant.

The second regional institution is known as the Center for the Rehabilitation of Manabim or CRM, which was organized in 1962. Its primary programs are the improvement of culinary water systems, construction of water canals, and irrigation activities. CRM operates two large canals constructed by the old NBI with a capacity of 4.5 cubic meters each, and three smaller canals of 2 cubic meter capacity each. At present, it services about 3,000 hectares of farmland and charges some 80 sucres for each time a user irrigates. Unfortunately, little more than this is known of its irrigation activities. It is, however, the most significant of the three regional programs in terms of actual water delivery.

Third, is the Commission of Studies for the Development of the Guayas Basin, named CEDEGE, created in 1965. This commission was established for planning and executing development programs, including irrigation, in the Guayas Basin. This agency administers projects in parts of nine provinces. CEDEGE was organized to coordinate existing activities and incorporate them into a regional program. At the present time everything is still in the feasibility study stage, and construction of irrigation works has not yet begun. Therefore, as of yet, this organization is not providing irrigation service but is designed to do so in the future.

Provincial councils

Provinces are the largest political subdivisions in Ecuador. Each provincial council is charged with directing development programs for their respective provinces. Their primary activities have been in

electrical power development and education, not irrigation. Three, however, have tried to implement small scale irrigation programs.

The most successful of these is the Provincial Council of Loja and Zamora Chinchipe. It is mostly involved in the completion of the Macará project, of which 60 percent was constructed by the old National Bureau of Irrigation. The principal canal of the project is 30 kilometers in length with a capacity flow of 1.5 cubic meters. When completed, it will service approximately 1,000 hectares of cropland. At present there is no irrigation service.

Municipalities

Some municipalities have become involved with irrigation but to an extremely limited degree. Interest in supporting programs of this nature has dropped sharply in recent years. Usually if they have such programs it is for making use of city remnant waters or sewage waste water.

Each of the above organizations in the public sector faces one fundamentally crucial problem, insufficient budgets on which to operate. We have already seen how that situation is directly associated with the success or failure of irrigation programs. Small budgets, when coupled with a low level interest toward irrigation on the part of many of these entities, can account for the limited extent to which they are involved in irrigation distribution activities.

Summary

We have now reviewed all known institutions, large and small, formal and informal, which to some extent are administering and distributing

irrigation water in the public and private sectors. The amount of water they distribute varies as does their degree of significance to Ecuadorian irrigation.

Other than INERHI, the distribution entities of the public sector are only responsible for a nominal amount of irrigation delivery. The private sector is the most significant to the total irrigation output of Ecuador. Irrigation by private individuals and through water user associations is recognized as the most common means of distributing irrigation water in this sector. In comparison, the other private distribution entities are of little importance in terms of actual water delivery to the user. All of these organizations, however, must be taken into consideration in order to see the complete picture of irrigation distribution in Ecuador.

CHAPTER V
CONCLUSIONS AND OBSERVATIONS

Conclusions

As we may recall from Chapter I, the principal thesis objectives were two-fold. Basically, they were to identify the various irrigation distribution organizations in Ecuador while also attempting to single out certain kinds of factors related to their function and management. We have endeavored to meet these objectives throughout the text of this thesis. In conclusion, however, we should briefly review the findings.

Regarding the organizations or other means by which irrigation water is delivered to the water user, we find they fall into two categories or sectors, public and private. These terms help identify the basic nature of the institutions involved and how they are financially supported.

Public organizations are those which operate on a general public fund and are some form of government entity. The principal institution in this sector is the Ecuadorian Institute of Water Resources. INERHI is a national state agency charged with controlling the use of all national waters and administering water programs, and irrigation is one of the primary responsibilities.

There are also three regional entities which currently either deliver irrigation water or have projected irrigation programs for future development. They are:

1. Center for the Economic Reconversion of Azuay, Cañar, and Morona Santiago, or CREA.
2. Center for the Rehabilitation of Manabí, CRM.
3. Commission of Studies for the Development of the Guayas Basin, CEDEGE.

Some provincial councils, mainly that of the province of Loja and Yamora Chinchipe, and a few municipalities also include irrigation in their operations, but to an extremely limited degree.

This completes the list of public irrigation entities. The only one with any significant irrigation delivery programs is INERHI, which manages six irrigation districts in the country. The remainder of these organizations were created primarily for other purposes and irrigation is only a secondary component in their programs. The public sector is responsible for nearly 30 percent of the total irrigation output of Ecuador. This is primarily accomplished through INERHI's districts.

Institutions in the private sector operate on private sources of money whether they be formal organizations or informal structures of one kind or another. The most numerous organizations in this sector are the water user associations, of which there are some 250 in Ecuador, located almost entirely in the sierra. These organizations serve much the same purpose as canal companies in the United States and are legally governed by statutes and regulations. They are the only formal structured private institutions which are dedicated exclusively to irrigation activities. User associations provide a good percentage of the irrigation by the private sector and operate efficiently and economically.

Other legally constituted organizations of a private nature include some irrigation as supplements to their primary programs. These would be some agricultural cooperatives, agricultural societies or companies, and rural comunas or small communal villages.

A significant segment of this sector are the purely private individual means by which irrigation water is administered and delivered. Individual persons and large private enterprises divert and distribute a great deal of water for irrigation purposes solely through singly owned distribution systems. Some may rent water by contract to other users. Some private individuals also gather together into small informal groups for mutual irrigation purposes, still another kind of irrigation organization:

Theft of water for cropland irrigation is well known in Ecuador. We must conclude that it too, is a means by which water is distributed or taken to the land, be it legal or otherwise.

The private sector is very important for Ecuadorian irrigation. Through the above mentioned private means over 70 percent of Ecuador's irrigation is distributed to the farm or other point of use.

Briefly, those are all the different varieties of public and private institutions which distribute, administer and deliver irrigation water in Ecuador.

From examples in the text, we became acquainted with how various kinds of factors directly and indirectly influence the internal management of these irrigation organizations and the actual distribution of water. We were also able to reach several conclusions concerning such relationships. Let us now tie them together and make some general observations.

Many factors are so interrelated by nature that it would be difficult to single out a particular one and try to analyze it alone. Often, they need to be considered in light of each other. The degree to which the following relate to actual irrigation delivery may vary with time, region, climate or other circumstances, and they may appear in diverse combinations. What, then, are some of these factors in Ecuador?

Probably the most significant variable directly related to irrigation administration is revenues or budget, especially when money is in limited supply. The public sector, especially, suffers from insufficient funds. Because INERHI, for example, has large scale programs to operate, limited financial resources create problems of priority in spending. In addition, INERHI always receives only a fraction of the money originally budgeted to it by the central government, never the full amount. Consequently, some programs suffer more than others. In this case, it has generally been irrigation, and operation, maintenance, and construction have been downgraded.

Insufficient numbers of qualified personnel, low salaries, and poor condition of vehicles, equipment and facilities are other conditions which inhibit the efficient distribution of water, and can all be attributed to a restricted budget and low level of priority. The search for additional revenue sources also results in excessive administrative build-up and bureaucratization of the organization.

The limited budget it receives from the national government has prompted INERHI to seek outside funding for irrigation projects, usually from international organizations. The quest, however, has added to the severity of its economic problems by creating tremendous

administrative costs in INERHI's central office. So many studies must be conducted in order to obtain international loans that even more national money is diverted to administration than previously had been.

The above, however, are symptoms of the problem, not the problem itself. The problem is insufficient money to properly carry out irrigation programs. Economic considerations are therefore very important to good administration and water distribution.

Social factors, as well, are associated with actual water distribution. We have seen multiple examples of how history, custom and tradition, education, wealth, and land size and tenure can determine if, when, and how water will be used for irrigation. For water users, financial risk, lack of confidence in each other and in government programs and area labor shortages may be other variables that influence irrigation use decisions. The leadership capabilities of organizations also determine how well they may reach their goals and objectives.

Laws and government programs and policies have an impact on organizational decision-making, management, and ability to deliver irrigation to clientele. Laws often dictate the general structure and functioning process of legal irrigation entities. The political attitude of government toward irrigation needs and development can determine the degree to which it invests in government sponsored and funded irrigation programs.

The degree of political influence and power of individuals in the society can also be associated with water use or the initiation of irrigation programs in some instances. These are all decisive factors of a political nature and are important variables in water use and management.

Natural physical considerations like soil condition, security of the water source, and the natural deterioration of irrigation infrastructure through time and use are important to distribution. Though these factors are often included in planning stages they need new emphasis, especially as to their future implications after service has begun.

We can conclude that of all the variables discussed in this thesis, the ones which seem to be the most significant in their relationship to the distribution and use of irrigation water, and the management of water by distribution organizations, are the following:

1. Custom and tradition in irrigation practices. They are also associated with the history of irrigation water use in a specific area and the education of the water user.
2. Land size and distribution patterns.
3. The leadership capabilities of the distribution organizations.
4. Financial structure of the organization and the ability to secure adequate revenues to meet water management and distribution responsibilities.
5. The various public laws regarding irrigation policies and administration in the country.
6. Physical conditions of the environment which by nature inhibit the organization or water user from securing, distributing or using irrigation water.

This is a brief resumé of the material discussed and analyzed throughout the text. The most simple conclusion that can be drawn from the study is that the distribution of irrigation water is influenced

by, and directly related to, these factors. It is important to recognize that such a relationship exists.

Not only can such variables influence water delivery, but administrative decisions and programs can have the reverse effect on social and economic conditions. If progress is desired, even in what are considered purely technical areas, attention must be given to these points. They must be planned for and not ignored.

We have indicated some for Ecuador, which may or may not be the same for every society. They do, however, provide general guidelines which could be universally adapted.

Observations

First, that the private sector is vital to Ecuadorian irrigation. The state public agencies cannot satisfactorily meet the irrigation demands of the nation, especially for financial reasons. Private irrigation institutions are numerous and function effectively. One goal for INERHI could be to help these private organizations improve their ability to perform by providing them legal and technical support, thus strengthening the private sector. Not only would this sector become even more successful, overall irrigation would be enhanced and INERHI would be fulfilling its responsibilities toward irrigation without always being involved in a direct financial sense. Such a program would be a great social and economic benefit to the nation without the national government actually constructing expensive projects.

Since INERHI is not currently able to divert more money to operation, maintenance, and construction, one suggestion would be for it

to establish and organize types of water user associations within its districts. Such organizations could manage delivery schedules, operation and maintenance, and generally function as any other private association would, with additional technical aid from INERHI. A reorganization of this nature would free more INERHI money for other purposes, the 'district' would function just as effectively, and the individual user would probably pay less than he is at present for similar or improved service. This is a possibility worthy of serious exploration and consideration.

Regarding monetary problems, another observation is that INERHI needs more financial security than it currently has. We realize, of course, that the solution to this problem is not entirely dependent on the Institute. But without a more secure source of funds its programs will continue to suffer and it will be unable to fully carry out its functions.

This brings us to a fourth point, looking forward to the implementation of the new Water Law of 1972. This law gives increased administrative responsibilities to INERHI which under present financial circumstances it may be unable to fulfill. It must either receive more money or dedicate more of its present budget to these new duties, or the law, for all its good theory, will go unapplied. In the event current funds must be spread even thinner, the net result will be an overall decrease in INERHI's efficiency.

One final remark is this. What is the applicability and meaning of this thesis for technical assistance people? Principally, to help them discover the reality of conditions in Ecuador and find

meaning therein. Being aware of the main points of this study should help sensitize these people to more than the purely technical aspects of a project which are also highly relevant to its success. Resolving development problems rests on many factors, not strictly on technical assistance and scientific knowledge. There are additional factors which are also necessary ingredients for development and progress.

The author sincerely hopes the findings of this thesis have added to the growing body of knowledge in water management, specifically as to non-technical factors which are of interest to the success of development programs and technical projects. If it has helped us become somewhat aware of reality and provided guidelines for future study it has been successful. The thesis has attempted to explore these areas further with the hope of offering some conclusive evidence of the impact on organizational decision-making and management of various factors in the surrounding environment.

LITERATURE CITED

1. Thompson, James D. *Organizations in Action*. McGraw-Hill, New York. 1967.
2. Tullock, Gordon B. *The Politics of Bureaucracy*. Public Affairs Press, Washington, D. C. 1965.
3. Feder, Ernest. *The Rape of the Peasantry, Latin America's Landholding System*. Doubleday & Company, Inc., Garden City, New York. 1971.
4. Scarrow, Howard A. *Comparative Political Analysis: An Introduction*. Harper & Row, New York. 1969.
5. James, Preston E. *Latin America*. The Odyssey Press, New York. 1969.
6. Population Reference Bureau, Inc. *World Population Data Sheet*. 1972.
7. Martz, John D. *Ecuador: Conflicting Political Culture and the Quest for Progress*. Allyn and Bacon, Inc., Boston, Mass. 1972.
8. de la Torre, Luis Carrera. *Los Obras Hidráulicas y la Supervivencia del Ecuador*. Ecuador. 1972.
9. Ecuadorian Water Law, Executive Decree No. 269, May 18, 1972. Published in the Official Registry of Ecuador on May 30, 1972. Translated to English by David R. Daines and D. Craig Anderson. 1972.
10. Distrito de Riego del Chimborazo. Instituto Ecuatoriano de Recursos Hidráulicos. Ecuador. 1968.
11. Lloyd, Phillip H. *Impact on Rural Incomes of Improved Water Management in Milagro County, Ecuador*. Unpublished Master's Thesis, Utah State University, 1972.

APPENDIX

English Translation of
Statutes and Regulations
of the
Toallo Water User Association

translated by
D. Craig Anderson

S T A T U T E S

CHAPTER I

The Association

Art. 1 -- Be it officially established in the village of Alobamba, jurisdiction of the Tisaleo Parish, the Water User Association of the "TOALLO" Canal, which will be composed of legally accredited citizens who are property owners of said waters; bought by direct purchase from Mssrs. Manuel Bruno Fiallos and Juan Escobar or by any other title; waters that originate from the snows of Carihuayrazo and the springs known as "Las Alturas de Potrerillos," and other sources; the slopes of the point known "Pampas de Santa Rosa," "El Llullcahuaico," and "Cuchugto," all these with their respective sources.

CHAPTER II

Purposes of the Association

Art. 2 -- The purposes of the Association are the following:

- a. Watch over the good conservation of the canal for the conduction of the waters;
- b. Dictate the required measures necessary to avoid those illegal activities which constitute an attempt against a property right;

- c. Defend the ownership right of each user in the use and possession of said waters.

CHAPTER III

The Shareholders

- Art. 3 -- The Shareholders consist of:
- a. The founders; and
 - b. Those who, after the formation of this Association, express a desire to belong to it.
- Art. 4 -- The founders of the Association are all those citizens indicated in Art. 1, who concurred in the designation of the members of the Provisional Board of Directors.
- Art. 5 -- The rights, duties, and obligations of the shareholders are:
- a. Attend the regular and extraordinary sessions of the general assembly of users.
 - b. Elect and be elected.
 - c. Loyally carry out the charges given them by the general assembly or Board of Directors.
 - d. Be heard by the general assembly or Board of Directors in those claims which may be presented by them.
 - e. Pay, when due, the tariffs established in this statute and in the internal regulation, and those that the general assembly or Board of Directors may impose from time to time;
- and

f. Contribute, on the day indicated by the Board of Directors for the cleaning of the canal, two peons for each hour of water they possess and five for each functioning mill, or in their place, pay \$6 sucres for each peon not provided, when necessary for cleaning and other necessities.

CHAPTER IV

The General Assembly

Art. 6 -- The general assembly will be composed of all shareholders, and will meet regularly and extraordinarily; regularly between the 20th to 30th of December each year, and extraordinarily as soon as these Statutes are approved by Executive Power and convened for the purpose of designating the members of the permanent Board of Directors; and, when the President of the Board, on his own motion or by written petition of four or more of its members call for such.

Art. 7 -- The General Assembly will meet both regularly and extraordinarily with a majority of the shareholders attending. If the session does not have such, for lack of quorum, it will be deferred to another day, on which it conducts its business with whatever numbers of shareholders who may be present.

In the extraordinary sessions, there will be an order of preference of business according to the purpose for which they were called.

Art. 8 -- Attributes of the General Assembly in the regular sessions are:

- a. Review the annual written report presented by the President of the Board to the General Assembly, dealing with all matters related to the administration of the canal; the financial state of Association funds; investments made by the same; the measures which may have been taken on the order of maintainance of the canal; the solutions given to claims presented by the shareholders; and of the defense of property rights and any attempt or claim which may have occurred against those rights;
- b. Verify the election of the members of the new Board, which election will be by secret vote to the President and Vice-president and orally to the other members of the Board;
- c. Approve the annual and periodic tariffs that, according to the number of hours of water each possesses, each shareholder must contribute for the functioning of the Association;
- d. Reform the present Statutes, in a single session, on its own motion or that of the Board, which reforms will take effect upon the approval of the Executive Power;
- e. Approve the budget, earnings and expenditures, formulated by the Board.
- f. Audit, by means of special commissions, the investment of funds;

- g. Study and appraise, by such commissions, the general balance-sheets which should be presented by the treasurer eight days prior to the meeting of the General Assembly.
- h. To agree by common consent on the most efficient means for the just administration of the waters by the Board;
- i. Discuss and resolve the matters of business submitted for its consideration by the Board or any shareholder; and
- j. Delegate its functions to the Board of Directors.

CHAPTER V

The Board of Directors

- Art. 9 -- The Board of Directors shall consist of a President, Vice-president, Secretary, Assistant Secretary, four members of the Board, four alternate members of the Board, and a Manager-Administrator.
- Art. 10 -- The attributes and duties of the Board are:
- a. Formulate the Internal Regulation and submit for approval by the Executive Power said Regulation;
 - b. Submit, for the consideration and approval of the General Assembly, statutory reformations, if seemed necessary;
 - c. Take to its charge the administration of the referred to waters, according to the norms established in the Internal Regulation; for which purpose a registry of the shareholders will be formed, indicating the number of hours of waters corresponding to each and the calendar of distribution;

- d. Designate a water master to police the perfect maintenance of the canal and distribution of the waters at their diversion point in the community of Santa Rosa;
- e. Formulate the budget of earnings and expenditures to submit to the General Assembly for approval;
- f. Supervise the collection and investment of funds, as well as impose extraordinary contributions on the shareholders when circumstances so require;
- g. Impose the sanctions established in the Internal Regulation on those shareholders who neglect to fulfill their obligations or who have not paid the tariffs referred to in sub-paragraph "c" of Art. 5, or who are involved in the fraudulent privation of water, in this last case, without prejudice to the necessary of just civil legal action;
- h. Determine the date on which the shareholders should provide for the cleaning of the canal or any other work deemed necessary; and
- i. Exercise the functions delegated to it by the General Assembly.

Art. 11 -- The Board will function for a one-year period and any or all of its members may be re-elected.

CHAPTER VI

The President

- Art. 12 -- The duties and attributes of the President are:
- a. Convene and preside over the sessions of the Board of Directors and the General Assembly of users;

- b. Represent the Board in its external relations;
 - c. Authorize all acts of the General Assembly and the Board, correspondence, pay orders and other documents related to the administration of the canal;
 - d. Supervise the collection of funds and the correct investment of the same, and in that regard, frequently examine the financial records and verify the cash accounts when he deems necessary;
3. Present, at the termination of his office, the report referred to in sub-paragraph "a" of Art. 9;
- f. Resolve any urgent matter corresponding to the Board and inform the same of such action in its following session;
 - g. Comply with and require strict compliance of the Statutes and Internal Regulation and other resolutions established by the General Assembly or Board of Directors; and
 - h. Deliver to the Treasurer, by prior voucher, a financial statement of the funds which should be collected.

Art. 13 -- The President cannot be absent for a period of more than sixty days, in which case, the Vice-President shall convene a general assembly of users for the purpose of designating a person to replace him. But the new President will only function until the next regular meeting of the General Assembly, as elaborated by Art. 7.

CHAPTER VII

The Vice-president

Art. 14 -- In the absence of the President the Vice-president will perform his functions. In the absence of the Vice-president he will be succeeded by the members of the Board in the order of their appointment.

CHAPTER VIII

The Secretary

Art. 15 -- The obligations of the Secretary are:

- a. Compile and authorize the acts and correspondence of the Board and supply copies which may be solicited by prior order of the President.
- b. Give an account during Board sessions of the correspondence received and transact all resolutions adopted by the General Assembly or Board of Directors.
- c. Present to the respective persons any appointments designated by the Board of Directors or General Assembly;
- d. To give notice, by order of the President, of sessions of the Board and of the General Assembly;
- e. Present and justify to the Treasurer the periodic or extraordinary tariffs and fines which should be collected;
- f. Have in his charge the minute books and correspondence;
- g. Prepare the Registry of Rights according to the information given by the Board or the General Assembly; and

h. Look after the records of the Board and present the same to his replacement. This action must be authorized by the President and the member of the Board who at the time is the ex-officio controller.

CHAPTER IX

The Assistant Secretary

Art. 16 -- The Assistant Secretary shall assist the Secretary and replace him in his duties in the case of his absence.

CHAPTER X.

The Treasurer

Art. 17 -- The duties and obligations of the Treasurer are:

- a. Produce a fidelity guarantee secured by a mortgage, proportionate to the amount of funds in his charge and acceptable to the Board, before discharging the duties of his office. This guarantee remains in effect until such time it is declared that there has been no mishandling of funds on his part. If this guarantee is not so produced, the President will convoke a General Assembly to designate a person to replace him. The costs and/or premiums required by the guarantee will be paid from Association funds;
- b. Collect the annual and periodic tariffs, fines, and other earnings that for any reason may belong to the Association. These funds will be deposited in a banking institution of the province as soon as they are collected

and cannot be withdrawn except by order of the President and the approval of the ex-officio controller:

- c. Keep, with precision and clarity, the account books indispensable to his office, in which he will carry a detailed and documented account of the funds earned and spent;
- d. Pay the expenditures authorized by the budget and other such expenditures as ordered by the Board of General Assembly, always with the approval referred to by sub-paragraph "b" of this Article;
- e. Present monthly, to the Board, an exact account of the cash movements of Association funds, and the general balance-sheet according to sub-paragraph "g" of Art. 9 of these statutes; and
- f. Present to the Board, for legal action, a list of any shareholders delinquent in their payments and who refuse to pay such.

CHAPTER XI

The Members of the Board

Art. 18 -- Duties of Members of the Board are:

- a. Punctually attend the meetings of the Board and General Assembly;
- b. Serve, on a monthly rotation basis, and in the order in which they have been elected, as ex-officio controller.
- c. Carry out, faithfully, the duties placed upon him; and

- d. Succeed the President in the manner expressed by Art.15.

CHAPTER XII

The Ex-Officio Controller

Art. 19 -- Duties of the Ex-Officio Controller are:

- a. Review and approve pay orders and the withdrawal of deposited funds from the banking institution chosen for this purpose, accordingly set out in sub-paragraphs "b" and "d" of Art. 18; and
- b. Take note of the general development of the Association and report the same to the President.

CHAPTER XIII

The Manager-Administrator

Art. 20 -- Duties and obligations of the Manager-Administrator are:

- a. Exercise the function of the juridical person of the Association in all juridical and non-juridical matters of business in which it is involved;
- b. Give his opinion with respect to any matter laid to his charge by the General Assembly or Board of Directors, and inform the same of the state of such matters eight days prior to the regular session of the General Assembly; and
- c. Carry out all the duties corresponding to the Administrator as referred to in Art. 13 of the Internal Regulation.

CHAPTER XIV

The Association Funds

- Art. 21 -- The following shall constitute the funds of the Association:
- a. The amount of \$100 sucre for each hour of water owned or used by each shareholder;
 - b. The amount of \$10.00 sucres annually for each mill powered by such waters;
 - c. The periodic tariffs imposed by the General Assembly or Board of Directors as circumstances may requires; and
 - d. The fines which may be imposed by the Board, for an infraction of these statutes or of the Internal Regulation.

CHAPTER XV

General Provisions

- Art. 22 -- As soon as these statutes take effect as having been approved by the Executive Power, the Provisional President will convene a General Assembly for the purpose of designating the members of a permanent Board of Directors.
- Art. 23 -- At its convenience, the Board will formulate and send to the Ministry of Development, for its approval, the Internal Regulation, which describes the administrative proceedings of the Association in the management of the waters.
- Art. 24 -- The duration of the Association is indefinite, but in the case of its dissolution by a written petition of a majority of the shareholders because the Association has not complied with its purpose, all of the real and personal

property collectively owned will be distributed among the shareholders proportionately according to the number of hours of water each may have.

Art. 25 -- The Positions of Manager-Administrator and Secretary will be remunerated according to their responsibilities and may be conferred upon any person within or outside of the Association, as designated by the General Assembly or the Board. All other positions will be without remuneration;

Art. 26 -- Administrative costs and costs necessary for the functioning of a special Commission, will be paid by the Association.

For legal purpose, I hereby certify that these statutes have been discussed and approved in first, second, and third readings on the dates of the 5th, 12th, and 19th of this month of August respectively, in which it was decided that they be sent to the Executive for his approval, for the purpose of establishing a juridical person.

Alobamba the 12th of September, 1950

Manuel Bonilla Frallos
Secretary

I N T E R N A L R E G U L A T I O N

The Water User Association of the Toallo Canal, in use of the authority granted by ART. 12 of the Law of October 6, 1939, entitled Juridical Statutes of Water User Associations, and the Articles of its own Statutes, approved by Executive Agreement No. 415 of December 23, 1946.

D I C T A T E S

The Following Internal Regulation

TITLE I

Art. 1 -- For administrative and use purposes of the waters belonging to the shareholders of the Toallo Canal, said Canal is divided into four section, being:

- a. San Diego,
- b. Hanchi,
- c. Alobamba,
- d. Montalvo.

These sections correspond to the distribution of the bolume of said water. Properties, and in general all water rights, are established by the respective title of ownership, lease, benefits, etc.

Each section will be represented in the Association by a Member of the Board of Directors and an alternate, which will be elected from among the shareholders of that section

in the General Assembly accordingly prescribed in the Statutes. In the event of a tie in voting for Board members their nomination will be decided by the drawing of lots.

Water and land lessee's, water right users, etc., will represent the respective owner with their vote.

The General Assembly

Art. 2 -- The General Assembly will meet regularly and extraordinarily.

Art. 3 -- The regular sessions will be held quarterly on the date designated by the body in the children's local of the village of Alobamba, jurisdiction of the Tisaleo Parroquia, which building was acquired and constructed by the majority of the owners of these water. In these sessions preference will be given to the reports presented by the Board.

Accordingly statuted in the Decree of October 6, 1939, the General Assembly will session each year, on a fixed day, between the 20th to 30th of December, for the purpose of electing a new Board of Directors.

The extraordinary sessions will take place when the President convokes the same by petition of at least four members or when the Board believes necessary to handle matters of major importance.

Art. 4 -- The regular session cannot function without the quorum indicated in this Article, without prejudice to that prescribed in ART. 6 of this same Regulation.

It will be understood that a legal quorum will consist of half the shareholders plus one.

- Art. 5 -- For the purposes prescribed in the above Art., those persons will be considered members of the Association who justify their rights over these waters or who, in the capacity of renters, users, etc., represent the owner in conformity with that prescribed in Art. 1.
- Art. 6 -- The extraordinary sessions will take place with those shareholders that attend after the second notice is given. Those who neglect to attend and were legally notified, will have no right to oppose what was approved by the Assembly.
- Art. 7 -- Notices for the regular and extraordinary sessions will be given by written order of the President of the Association or by the Secretary with the authorization of the President. Said order and notice will be given designating the location, day, and hour of the session, to the respective Board member representing each section, who in turn will notify the shareholders in that section.

The Board members commissioned to give such notice will be responsible for any absentees from his section, due to failure in giving notice of the session.

The Board of Directors

- Art. 8 -- The Board of Directors, in conformity to that prescribed in the Statutes, will consist of a President, Vice-president, Secretary, Assistant Secretary, Treasurer, Manager-

Administrator, four members of the Board, and four Alternate Members of the Board in representation of the four sections in which the canal is divided.

Art. 9 -- The Board will meet regularly and extraordinarily when convened by the President. Notices to this effect will be signed by the Secretary who will take charge of giving such notices.

Common Provisions for the

General Assembly and Board of Directors

Art. 10 -- It is the duty and obligation of the General Assembly and Board of Directors to respect and comply with the Statutes, and submit themselves to whatever is not expressly stated as determined in the Legislative Decree of October 6, 1939.

Art. 11 -- The General Assembly and Board of Directors may impose special commissions upon their respective members and even upon any other member, commissions that should be obligatorily complied with under the penalty prescribed in Art. 23 of this same Regulation.

Art. 12 -- Only the General Assembly is given the power of interpreting the Statutes and the Board of Directors that of interpreting this Regulation.

The Administrator

Art. 13 -- The canal will be watched over in its total extension by a General Administrator who, according to that stipulated

in Chapter XIV of the Statutes, will be the Manager-Administrator.

Art. 14 -- The duties and obligations of the Administrator are:

- a. Watch over and personally dispose of the work of the peons supplied by the shareholders of the water, indicating to them the work location and the materials necessary;
- b. Require each user to strictly comply with such labor quotas;
- c. Watch that the waters are not obstructed and flow freely in the canal;
- d. Traverse the section of the canal on the days that, according to the set community distribution, correspond to each for use of the water that day to those users who, in conformity to that prescribed in Art. 1 of this Regulation, show proof of ownership;
- e. Formulate the pay rolls for the peons, and when necessary carry an accounting of the same for social security purposes with respect to the employer and employee shares;
- f. Have under his responsibility all the work materials and tools received by inventory. Without prejudice to the Administrator's responsibility, the workers under him will answer for all the tools and goods in their charge and for losses of the same;

- g. Distribute the tools in his charge to the workers on the canal and regather the same; and
- h. Strictly comply with the orders of the Board of Directors or the President.

The Members of the Board

- Art. 15 -- Each Board member will answer for the correct working order of the section he represents. It is his obligation to watch over and inform to the Board the labors of the Administrator and make any suggestions that good service may demand.
- Art. 16 -- No payment relative to the workers can be effected without the approval of the respective Board member.
- Art. 17 -- The Members of the Board have the authority to solicit from the President the imposition of fines on the shareholders in their respective sections, with reference to that prescribed in Art. 23 of this Regulation.

The President

- Art. 18 -- The duties and obligations of the President are those prescribed in Art. 13 of the Statutes.
- Art. 19 -- The President may administratively authorize expenditures up to twenty-five sucres monthly, with the responsibility of informing the Board and always with the approval of the Ex-officio Controller.

Art. 20 -- The Vice-president, in those cases in which he substitutes for the President with reference to that determined in the Statutes, will enjoy the same authority as the President.

TITLE II

The Association Funds and Their Collection

Art. 21 -- To accomplish the collection of the tariffs prescribed in Art. 22 of the Statutes, the following procedure will be carried out. The President will issue assessments corresponding to the tariffs which will be signed by the Treasurer. These same assessments will enter into the Treasury and will be recorded in the Accounting Book carried by the above mentioned functionary. The Treasury, with such documents, will proceed to immediate collection, employing for the same, every measure believed appropriate. The Treasurer will answer for all funds not collected due to his negligence.

Art. 22 -- All tariffs or amounts to be collected will be accomplished through the issuing of assessments, which are printed by order of the President.

The Sanctions

Art. 23 -- Every member of the Association that, having been summoned accordingly prescribed in this Regulation, does not attend the respective session, without justifiable cause and upon the consideration of the President, will be sanctioned by a fine of five sucres. This same sanction will be applied

to those members of the Board who without cause fail to attend its sessions.

To be fined in the same manner will be he that, having accepted a special commission or charge, fails to comply with the same. If for this failure to comply the interests of the Association suffer, the President will obligate to said person the repayment of the damages incurred and the same will be written in a book which will be kept for that purpose.

Art. 24 -- Whoever is found behind in the payment of the tariffs and financial quotas referred to in Chapter XV of the Statutes will be fined 25% of the amount owed plus the costs which such action may require.

Art. 25 -- Those who steal water will be sanctioned according to that prescribed in Art. 13 of the Decree of October 6, 1939. If the violator is a shareholder of the Association his use of the water will be suspended by 50% for the first offense, and if on a second occasion this violation upon the rights that all enjoy over the use of water occurs, the sanction will be increased, leaving this to the judgment of the Board of Directors, without prejudicing civil juridical action.

TITLE III

Salaries and Remunerations

Art. 26 -- Only servants, wage earners, workers, the Manager-Administrator, and the Secretary or his replacement will receive a salary or remuneration for their services. All other offices will be discharged without compensation. Said salaries and remunerations will be paid in conformity with that assigned by the respective budget.

TITLE IV

Formation of the Registry

Art. 27 -- The carrying of the Title and Registry will be to the charge of the Secretary, who should give to the Board detailed reports concerning all annual modifications, with which a list will be formed indicating the names of the shareholders and their rights with relation to the day and number of hours corresponding to each.

TITLE V

General Provisions

Art. 28 -- After three o'clock in the afternoon on Tuesdays, only those users who have contributed the necessary labor for the maintainance of the water works, will have a right to the use of remnant waters.

- Art. 29 -- Decisions can only be revoked by a two-thirds vote of the members of the Association.
- Art. 30 -- Conduction of the waters of the Community of Pataló in this canal is prohibited.
- Art. 31 -- He who, not being a right holder, steals these waters will be sanctioned by a fine of \$25 sucres for each hour of water and fifteen days in jail for the first offense. For the second, \$30 sucres and ninety days, which sanction will be imposed by civil judicial action.
- Art. 32 -- The Secretary and the Treasurer, unless they are shareholders or representatives of such, shall have all the rights of a shareholder except the right to vote in general assemblies. The Board of Directors will act as a consulting body but without the right to vote in general assemblies.
- Art. 33 -- These statutes will be regulated by the measures determined in the Legislative Decree of October 6, 1939, in which case the sessions will be conducted by parliamentary procedure.
- Art. 34 -- This Regulation will take effect after its approval by the respective Ministry.