IIMI **Country Paper – Pakistan – No. 4**

Institutional Factors Affecting Irrigation Performance in Pakistan: Research and Policy Priorities

IIMI Country **Paper** – Pakistan – **No. 4**

Institutional Factors Affecting Irrigation Performance in Pakistan: Research and Policy Priorities

Institutional Factors Affecting Irrigation Performance in Pakistan: Research and Policy Priorities

D.J. BANDARAGODA
and
G.R. FIRDOUSI

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

Bandaragoda, D.J. and G.R. Firdousi. **1992.** Institutional factors affecting irrigation performance in Pakistan: Research and policy priorities. Colombo. Sri **Lanka:** International Irrigation Management Institute. xvi + 81pp. (IIMI Country Paper – Pakistan – No. **4.)**

/ irrigation management / institutions / poverty / legislation / policy / Pakistan /

DDC 631.7
ISBN 92-9090-154-3

Please direct inquiries and comments to:

Information Office
International Irrigation Management Institute
P.O. **Box 2075**
Colombo
Sri Lanka

Cover photographs: Courtesy of the Directorate General Agriculture (On-Farm Water Management). Punjab.

Contents

Tables and Figures

Foreword

Their cautious approach in presenting facts and findings should not, therefore, be taken as a deficiency, but should be appreciated as a very practical way of conveying an important message.

The aulhors have rightly highlighted the importance of irrigation rules

often helpless in the absence of effective support from institutions. The paper correctly highlights this aspect and the fact that no management innovation can be easily applied in the field or in the organizations in view of the present institutional barriers. Some remedial action, however difficult and sensitive it might be, should be the urgent concern of many of us who are interested in improved performance of our irrigation systems.

R. K. Anver
Secretary. Irrigation and Power Department
Government of Punjab, Lahore

Acknowledgements

THE AUTHORS WISH to acknowledge with gratitude the encouragement they received from Mr. R.K. Anver, Secretary, Irrigation and Power Department of the Government of Punjab. They are also indebted to all the field-based officers of this Department, who kindly extended their cooperation by participating in interviews and readily responding to numerous questions.

The authors also wish to thank Mr. M. Saleem Malik, Social Scientist of IIMI Pakistan, who helped in carrying out field interviews.

Dr. Douglas J. Merrey, Head of IIMI's Sri Lanka Field Operations, provided very valuable comments on the first draft of this paper. His assistance is gratefully acknowledged. The authors also wish to thank Dr. K. Azharul Haq, Water Management Specialist of IIMI's Sudan program, who helped them with valuable advice as IIMI's reviewer on the final draft of this paper. Finally, the authors wish to record their appreciation of the very useful editorial comments provided by Mr. Kingsley Kurukulasuriya.

Summary

from a survey of literature on irrigation-related institutions, personal interviews with irrigation officials and fanners in the Faisalabad Zone in Punjab, and from other ongoing IIMI research activities in Pakistan.

A declining investment potential for continued irrigation development imposes severe limitations on continued enhancement of the resource base and technological inputs. Consequently, both the policymakers and the donors agree that the potential for further improvement in irrigation performance lies in the improved management of irrigation systems. However, it is also increasingly felt that management innovations cannot be

The stability that has been achieved in this regard is commendable. Despite the trauma of social and administrative changes in transitions, from empires to colonial systems and then to hard-earned independence, from separate provincial administration to one-unit administration and back to a federal system, from shared water sources to an independent network of reservoirs and link canals, Pakistan's irrigation sector now has a stable physical and administrative system. The credit for this acquired stability largely goes to the professionals in the sector.

This long experience has also led to the evolution of a strong irrigation tradition which has sustained the broad-based community interest in irrigation. The result is a very complex institutional milieu in which a set of formally established irrigation rules and organizations exists side by side with an intricate set of informal social institutions. The two sets act like a dual system, more often than desired, in conflict with each other.

Sporadic changes have resulted in another dualism — a clearly integrated composite physical system, and a very complex, but relatively uncoordinated institutional framework. Federal responsibility for allocation of resources, provincial responsibility for irrigation management, large organizations with centralized administration, large numbers of water users with little involvement in irrigation management decisions, difficult coordination among agencies and their subunits and functions, numerous laws and procedures mixed with traditional concepts and sporadic amendments by occasional enactments and promulgations, and more importantly the countervailing forces that act against formal rules, all contribute to this vast complexity of Pakistan's irrigation institutions.

These aspects of comprehensiveness, complexity, as well as strong traditions are in themselves the characterizing features of Pakistan's irrigation sector. More important features, however, appear to be the apparent incompatibility between the relatively outdated institutional framework and the emerging new requirements of irrigation management, on the one hand, and the general ineffectiveness of most of the formally established institutions in view of strong socially evolved institutions, on the other.

Despite the efforts to achieve stability through enhanced physical infrastructure and technological inputs, the overall outcome of irrigation performance is reflected poorly in low agricultural yields. Widespread

imgation misconduct, severe tail-end deprivation, low productivity of manpower and financial resources, and persistent rural poverty are easily identifiable features of this situation, and appear to be both the causes and effects of impediments embodied in the present institutional framework.

Thus, the main institutional factors which affect irrigation performance in Pakistan are identified as:

* The overriding effect of socially evolved informal institutions over the application of formal rules and management decisions.

* The obsolescence of irrigation rules, codes and procedures.

* The declining relevance of organizational structures in the light of changed circumstances.

management.

The stability of administrative and physical systems seems to be at stake when confronled with the overriding effect of some social institutions, when the "exception" becomes the "rule." An administrative style meant for strict compliance is no longer effective in the light of liberalized social behavior where unity and lines of command give way to numerous sources of pressure, objectivity is eroded by contradicting demands, and deviations from formal rules often stand unchallenged. This is the time when formal rules need to be reviewed and appropriately changed to attain the desired effects, taking account of the rigor of informal behavior that has emerged due to the changed and changing social circumstances.

Like the imgation rules, organizational structures have also undergone little change since their inception and these changes lag behind those that have taken place in the resource base and technology, and in social demand. Manpower and financial resource levels in irrigation agencies have remained constant or even declined while their work loads have increased manyfold. Data collection and processing procedure have remained the same while the need for more information has emerged. New organizational units have been added to the same management structure. The agency personnel are not only

constrained by outdated, ineffective and formal rules but also by inappropriate structures, lack of resources and increasing demand.

In this situation, the present forms of organization for irrigation need to be reviewed but changes should be considered in a more comprehensive manner, along with appropriate revisions of irrigation rules and procedures.

While a review of formal rules and role structures seems necessary to strengthen institutional support for irrigation performance, a similar exercise in improving the information processes for irrigation management and extension services would be necessary to reinforce such efforts. Improved mechanisms to produce and transmit appropriate and reliable information are a felt need.

More than other institutional aspects, the need to develop a wider awareness is very closely linked with broader issues of national policy. To increase literacy among rural people is an essential policy step associated with social goals of irrigation. High incidence of illiteracy hampers overall irrigation performance and subverts irrigation's potential to reduce rural poverty. The paper attempts to place this issue in the context of the present socioeconomic status of the country and of its greater potential for improvement in this regard relative to other developing countries. As institutions, policies and performance levels are closely interrelated, attention is drawn to the necessity of more positive policy initiatives for institutional reform to improve irrigation performance in Pakistan.

CHAPTER 1

Introduction

SUSTAINABILITY OF IRRIGATION systems depends not only on economic, technological and ecological factors but also on the institutional framework within which these factors interact. In most developing countries, the institutions would, in fact, be a major determinant of the potential for any further improvement in irrigation performance and for the sustained contribution of the latter to the development and achievement of social goals. The irrigation sector of Pakistan, though similar in many respects to those of other developing countries, seems to have some special institutional characteristics of its own.

To grasp some of these special characteristics of Pakistan's irrigation institutions, it is necessary to define and understand institutions in a wider perspective. The term "institutions" in its popular usage is usually given a restricted meaning to refer only to "organizations." But, as it is applied in this paper, the term also covers "rules" (laws, regulations, procedures, norms and conventions) which, in fact, underlie the organizations and determine the "work roles" of individuals and groups. In this sense, the term "institutions" means both "rules" and "roles."

Organizational behavior cannot be assessed or changed without reference to the institutional environment. However, the emphasis of most evaluations and attempted remedial action is often on organizations or structured work roles, with relative neglect of their underlying rules. The outcome, invariably, is not very successful. A broader definition of the term "institutions" draws attention to this neglected area of irrigation-related rules which are critically important in assessing the institutional impact on overall irrigation management performance.

The irrigation institutions in Pakistan, as in many of the South Asian countries, appear to remain conspicuously static. Their changes lag behind those that have taken place in the resource base and technology over the years. For this reason alone, their level of adequacy is perceived as to correspond more to their original purposes which were based on feudal and colonial requirements, than to present-day needs of social development. To

sustain overall irrigation performance, therefore, much greater attention is demanded for the institutional framework to be made adaptable to other changes. Consequently, the present irrigation institutions would have to be reviewed to assess their potential for the full realization of benefits both from the enhanced resource base and from the technological change.

Adaptability of institutions for sustainable irrigation performance also depends on the interaction of relative strengths and weaknesses of the various irrigation actors: policymakers, financiers, government agencies, private enterprises, landowners, and farmers. This interaction, in turn, is fashioned by the socioeconomic context in which the actors operate. Pakistan seems to offer some interesting evidence to support not only the fact that a country's irrigation institutions hear the characteristics of the social setting in which they have been established, hut also the fact that they continue to be circumscribed by the deep-rooted socioeconomic influences of that setting. An evaluation of Pakistan's irrigation institutions and their adaptation in the light of the country's changing needs should, therefore, take account of the country's socioeconomic context as well.

The institutional impact on irrigation performance is closely linked with the stubbornly persistent rural poverty in the region. The potential of irrigation for poverty alleviation is another relatively neglected area in research and policy, and needs to be considered urgently through appropriate institutional renewal.

The main objectives of this paper are:

i. to highlight the importance of irrigation rules (both formal and informal) within the institutional framework for irrigation management, with special reference to the case of Pakistan; and

ii. to draw attention to the major institutional factors that appear to affect Pakistan's irrigation performance, emphasizing the urgent need for a more comprehensive effort in related research and policy initiatives.

The paper is based on an extensive survey of literature dealing with irrigation-related institutions, and on primary data collected through field observations made and interviews conducted in the Faisalabad Irrigation Zone of the Punjah Province. Personal interviews were held with senior- and middle-level officers of the Irrigation Department and with fanner groups,

mainly to collect information on the application of formal irrigation rules and on the functioning of formal structures and the influence of informal rules on both. The field investigation was limited to a rapid appraisal which wasconducted to isolatethe main issues and problems, and should only serve as a basis for further in-depth studies on a more systematic format.

The paper starts with asection introducing a broader definition of the term "institutions," and proceeds to a section outlining the conceptual background relating to the institutional impact on irrigation performance. These two sections would help us to isolate the main areas of institutional requirements for improved irrigation performance in Pakistan. **A** brief description is then given of the salient features of Pakistan's irrigation institutions, with more specific reference to the Punjab Irrigation and Power Department, the country's largest irrigation organization which is described in the Appendix to the paper. This is followed by a discussion of the prospects for making this institutional framework more responsive to the present context, emphasizing on the importance of irrigation-related codes, rules, norms and customs, and on the essential linkages between institutional change and policy.

CHAPTER 2

Institutions: A Broader Definition

INSTITUTIONS ARE BASICALLY the established sets of rules derived from a combination of human perceptions and actions. The rules may be in the form of written-down laws, or of norms, conventions and traditional practices accepted by a particular society. These rules define and fashion normativeness or the sets of behavioral roles of individuals and groups in a given context of human interaction, aiming at a specified set of objectives.

In this sense, it is a cyclic phenomenon in which institutions are primarily determined by human action, and once established they in turn determine the scope and character of subsequent human action for desired objectives. Also, the roles determined by an initial set of rules, in turn, through implementation, may surface the need for certain periodic changes in such rules. This cyclic nature allows for a dynamic process in institution-building to cope with inevitable change. It also helps to establish a balance between the dual facilities inherent in institutions to both constrain and liberate individual and group action (Bromley 1987).

The dual facilities of institutions are of particular importance in irrigation. Most irrigation rules are meant to constrain the undesirable behavior in the distribution and use of water, whereas they are also designed to promote organization and provide various opportunities for individual and group advancement. Some rules were originally established to ensure centralized control, but they were also supposed to provide equity. Dualism also exists when some informal rules contradict formal rules. A dynamic process of institutional adaptation, therefore, corresponds to a need to maintain a balance between these dual functions of institutions.

Organizations are networks of behavioral roles arranged into hierarchies to elicit desired individual behavior and coordinated actions obeying a certain system of rules (Cemea 1987). This hierarchical arrangement is the "organizational structure," the effect of which on performance in a given situation may also depend on the particular technology of the task and the

size of the organization (Aston Group Studies),' whereas the underlying system of rules primarily determines the "organizational culture" which is highlighted here as a significant factor affecting performance.

In popular usage, however, "institutions" are usually regarded as "organizations." The connotation becomes much more common in the use of the term "institution building" which most often refers to the building up of new organizations (parastatal bodies, additional units in irrigation agencies, farmers' organizations, etc.). This way, any consideration of underlying and conditioning rules, norms and conventions as part of the overall institutional framework is usually avoided, and the lapse seems to have resulted in the limited success so far achieved in establishing appropriately comprehensive institutional mechanisms for irrigation management.

This preferred emphasis and its apparent failure can be compared lo an attempt to build and maintain physical structures without due attention to the relevance of construction and maintenance specifications, government regulations, environmental conditions, material quality and user preferences. Also, some selective organizational reforms are similar to piecemeal and ad hoc modifications on old buildings with no relation to the conditions and technology under which they were originally constructed. Both structures and rules are equally important operational conditions. Changed performance objectives that relate to changed circumstances would require review and reform in both operational structures and operational rules.

The International Imgation Management Institute (IIMI) gives the following interpretation of irrigation institutions (IIMI 1989:20):

---

1 The Aston group consisting of Pugh, Hickson, Hinings. MacDonald, Turner, and Lupton carried out research in the 1960s on data collected from 46 manufacturing and service organizations. The research was conducted at the Industrial Administration Research Unit of the University of Aston in Birmingham. England. and was reported in the Administrative Science Quarterly in a series of five articles (see for instance. Hickson et al. 1969). Their main thesis thal technology was a dependent organizational variable attracted much enthusiasm and criticism among others (Perrow 1970) who argued that technology was an independent variable. However. the undisputed conclusion that size. technology and structure are all related, is relevant to the understanding of large irrigation organizations and their performance. An interesting feature in the present context is that technology is also associated with some institutional component. a bias that affects the organization. Biases between irrigation and agriculture. and between civil engineering and agricultural engineering illustrate this influence.

The institutions that affect irrigation are not only those that manage it directly. Other kinds of institutions condition the legal, social, political and economic environment within which irrigation must function, and these can have significant impact on system performance.

This interpretation recognizes the usefulness of a broader definition of "institutions" to cover the various constellations of rules as well as roles associated with irrigation management. It also draws special attention to the types of institutions which tend to escape the normal reviews, but which are nevertheless important in attempts at performance improvement.

Although it is not uncommon to make definitional distinctions in sociology between institutions and organizations (Cernea 1987), this paper, without disputing the validity of such distinctions, refers to both aspects together and treats organizations as a subset of a more comprehensive institutional system.

Within this larger definitional scope, the main irrigation-related institutions include the following components:

*	Legal	:	Acts, Promulgations, Orders, Ordinances, international and national water agreements, contracts and Memoranda of Understanding;
*	Social	:	Customs and traditional practices (such as *warabandi*), land and water rights, informal behavior (such as corruption and rent-seeking), and tenancy relationships;
*	Political	:	Macro-level irrigation objectives (manifestos);
*	Economic	:	Water taxes, cost-recovery rules, land sale practices, and lease arrangements: and

* **Organizational** : **Irrigation and allied agencies, water users' associations, interagency coordinating organizations, arbitration tribunals, private sector enterprises, cooperatives and other farmers' organizations.**

Obviously, these categories are not mutually exclusive. Nor is the above list by any means exhaustive.

CHAPTER 3

Conceptual Framework

CONSTRAINTS, INSTITUTIONS, POLICIES AND PERFORMANCE

CERTAIN CONDITIONS ARE considered as "given" in analyzing a particular situation. Very often, these conditions are imposed on the socioeconomic system by its external environment and are referred to as "externalities." Internally too, the societies and economies have some built-in conditions that constrain changes. Both these can, in turn, act as externalities to socioeconomic subsystems such as the irrigation sector, whereas within the subsystems too, there can be some internal constraints to behavioral changes.

Viewed differently, the external and internal constraints against irrigation performance *appear* to exist in several ways:

* Physically, in forms such as weather, sources and supply of water, and soil conditions;
* Economically, in the international economic order as external terms of trade or fixed commodity prices. *sales* quota and international debt, and in internal terms of trade, pricing policies, subsidies, and budgetary limitations;
* Socially, in demographic structure, various forms of differentiation, rural-urban relationships, and health and educational status of the work force:
* Culturally, in religious beliefs and cultural habits; and
* Politically, as ideologies, the geopolitical structure, and the imperatives of international law.

Some of these external and internal constraints are adjustable in the long run: particularly the constraints of economic, social and political nature are

more amenable to change than any other type of constraint Overall, however, most of the external and internal constraints circumscribe the area of action for the policymaker and the system manager who have to consider them as given conditions. Thus, the changes in institutions and policies corresponding to changing objectives are possible only within the framework of these fixed constraints.

Recognizing these "given" conditions, it is customary in socioeconomic policy analysis to refer to uncontrollable and partly controllable variables in dealing with performance variables (Lecaillon et al. 1987). One such conceptual model refers to stepwise influences by constraints, institutions, and policies on performance, depicted in a series of concentric rings or circles.[1]

It is important, however, to clarify what is uncontrollable, and what is partly controllable. In the current irrigation situation, can the set of variables associated with institutions be classified as uncontrollable along with the external and internal constraints on which the policymaker has little control? However rigid in outlook, are all elements of the institutional framework unchangeable by new policy and management initiatives? The above-mentioned model of concentric circles provides neither clear answers to these questions nor any clear guidance as to how the institutions are to be treated.

In a static situation as envisaged in the model of concentric circles, where institutional aspects are also considered as given, the management

---

1 Figuratively, the made has been visualized by Lecaillon et al. (1987:43) as:— *...a series of concentric rings through which performance indicators are affected. The outer ring would represent the internal and external constraints which are exogenously determined. Even the most enlightened institutions and policies are neutralized by shocks beyond the reach of the policy maker. Moving inwards, the next ring could be thought of as representing the institutional framework which provides the foundations of society and the basis under which the socio-economic system works. Institutions can be altered but only with great difficulty and usually with somewhat unpredictable results. Still moving inwardly, the next two rings could be conceived of as consisting of the set of microeconomic and agricultural policy instruments over which policy makers typically hove a high degree of control. Finally at the centre of this series of concentric rings are the performance indicators which are affected by them. Expressed more simply, institutions are affected by constraints and, in turn, provide the foundations and the "rules of the game" within which macroeconomic and agricultural policies can be undertaken to influence the various development objectives through the performance indicators.*

innovations have virtually no relevance, or they may confront many difficulties which can have only limited success. With the resource endowment and technology becoming limiting factors, further improvement in performance would hc possible only with enhanced institutional support. A static institutional framework therefore becomes inappropriate and acts as a barrier to progress. The combined effect of uncontrollable constraints and unchanged institutions would be to make policy and managcmcnt action ineffective, and to gradually depress the levels of performance.

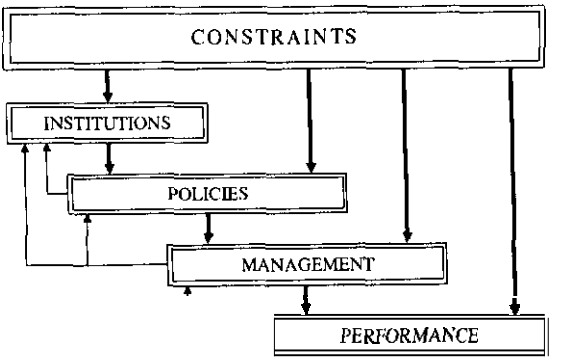
For sustainable improvement in performance, therefore, it is necessary to recognize the potential of a dynamic and cybernetic process of regular feedback and necessary rcmcdial action. This entails the appropriate adaptation of institutions according to changing needs and related changes of policy. Only such adaptation and changes will provide opportunities for improvements in management and performance. Howcvcr, any institutional change would he possible only within the framework of fixed external and internal constraints (uncontrollable variables): where such constraints arc many, such as in countries where cultural rigidities are dominant, institutional change is more difficult and sustained performance improvement more doubtful.

MODIFIED VERSION OF THE CONVENTIONAL MODEL

Considering these implications, the paper adopts a modified version of the above conceptual explanation of concentric influences. It recognizes the flexibility for institutional change that may exist within the system or the subsystem when controllable variables including those relating to institutions arc more effectively handled. It is argued that within a more dynamic management situation. both the system manager and the policymaker have a role to play in institutional reform. The modified conceptual framework acknowledges on the one hand. that constraints, apart from their adverse effect through the medium of institutions, could also directly affect policy formulation and performance: and on the other, that management and policy initiatives would be necessary to bring about whatever possible institutional

changes. Simply, it is to understand that institutions are not part of a fixed set of constraints within a socioeconomic system. This modified conceptual framework is as shown below in Figure 1.

Figure 1. Conceptual framework.



Influence flow in the static situation.
Possible feedback and remedial action.

Most irrigation institutions, except some of the socially evolved ones such as traditional and informal practices, are basically the expressions of policy (this supports the above cybernetic model). Primarily, such policy expressions are in the form of various water laws which then form the basis for administrative procedures, rules and regulations (subsidiary legislation). The laws also give rise to an implementation machinery (organizations) without which the primary and subsidiary laws become mere theory. The underlying philosophy for such codified and structured behavior is directly related to all the surrounding conditions in a given context. Irrigation institutions, can. therefore. he changed through appropriate policy changes, but within the given situational conditions. Even if the constraints are fixed, possibilities exist within their influence to formulate new policies for improvements in institutions, and thereby in performance. What a policymaker, a manager, or a change agent can do, therelore, is to focus on the controllable variables.

The above explanation can be used to clarify the following main conceptual aspects presented in this paper.

i. The external and internal constraints in any social system, or any subsystem such as the irrigation sector, affect the development of institutions which, in turn, affect policy formulation and management performance:

ii. Generally, the institutions that include both rules and role structures cannot be *easily* changed, and this apparent rigidity tends to be recognized as a given condition, thus restricting the potential for performance improvement:

iii. *With* some *effort*, at least some of the institutions can be changed, or made more responsive and adaptable to overall changing needs, if the constraining influences can be isolated and the potential for possible change can be identified,

iv. Such institutional adaptability is essential at this stage to enable the formulation and implementation of new policies: and

v. New policy initiatives are necessary to remove barriers against the application of management innovations essential for improved performance.

In summarizing the foregoing, the institutions are seen as being primarily meant to institute or establish some social control over any collective effort, for an orderly pattern of human behavior. and for equitable distribution of its benefits. They are in the form of an established set of rules and roles acceptable to the majority of those concerned, and concurrent with a desired set of objectives, but adaptable depending on the needs of the particular time and the contextual constraints.

FRAGMENTED RESEARCH ATTENTION ON INSTITUTIONS

Irrigation institutions are only part of the total institutional framework of any society, and their possible changes, therefore, have to be considered in the overall context. While in general, there has been little impact of research and development efforts on institutional strengthening, the few attempts specifically focused on the institutional aspects of irrigation have also tended to be too narrow and fragmented. Irrigation has attracted extensive scientific discussion, but the impact of this theoretical knowledge on the institutional environment of irrigation is minimal in relation to the contribution made by changes in the resource base and technology.[1] Consequently, the major weakness of the Asian irrigation sector has been identified as "not the lack of technology nor the lack of financial resources but a shortage of institutional organization" (Takase and Wickham 1977). Although financial resources have also now surfaced as a concern for many countries in the region, the institutional constraints have continued to be the major weakness which appears to have eluded sufficiently comprehensive attention.

Two main reasons are attributable to this apparent failure of institutional development. One is the emphasis placed on some selected components of the institutional aspects to the relative neglect of other equally important components. The other reason is, as mentioned earlier, the role played by external and internal constraints against institutional change, same of which

---

1 Many have commented on this gap in the application of available theoretical knowledge. The problems of "a bloated bureaucracy" (Borlaug 1987) and an "institutional vacuum" (Bromley 1987). which often characterize the field of irrigation management in developing countries are not seen as clearly and comprehensively addressed as physical and technical issues of irrigation. The low productivity and the socioeconomic inequalities in the current performance of irrigation systems are seen as the facets of the same fundamental problem: inadequate and inappropriate organization (Merrey and Wolf 1986). The "syndrome of anarchy" in irrigation management (Hart 1978), and pan of the failure of many irrigation systems are attributed to the inappropriate design of irrigation management organization (Wade 1987). These are presented as outstanding issues that call for a new research thrust aimed at institutional reform and a "professional revolution" (Chambers 1987). The essence of these comments is on the need to use knowledge and skills based on organizational and sociological theory in the design of appropriate institutional mechanisms or of their appropriate changes for sustaining present-day irrigation systems.

are linked with fairly deep-rooted sociocultural characteristics of developing societies. Very often, institutions were also treatedas given conditions, along with fixed constraints. Both the selective approach and the constraining conditions have tended to retard the process of institutional change, and have reached a stage where they Seem to act against the sustainability of irrigation performance.

Within a very rich tradition of research in the sociology of organizations, its effective application to irrigation management can be found only in a few areas of the vast institutional environment of irrigation. Correspondingly, the policy initiatives have also concentrated on a few selected aspects of institutions, This selectivity in research and policy concern Seems to lake place in three layers:

i. Of the broad institutional framework, greater attention is on organizational structures than on other institutional aspects, such as, water and land rights and rules governing them, tenancy relationships, informal behavior and widespread corruption (emphasis on roles rather than on rules);

ii. Of organizational aspects, greater attention is on farmers' organizations than on irrigation agencies and their interface with farmers (emphasis on the agriculture end of irrigation rather than on main system management): and

iii. Of farm-level organization, greater attention is on water users' associationsthan on composite multipurpose farmers' organizations (emphasis on "irrigators" rather than on "producers").

Notabie attempts in the application of theoretical knowledge can be seen in numerous field experiments and pilot studies undertaken on farmers' organizations for irrigation management. Empirical results from these studies add to the vast body of knowledge in this limited area of the farm level. However, the preoccupation with farmer participation and local organizations has tended to neglect not only several other important aspects of irrigation organization but also the underlying sets of rules and traditions that define the scope and character of such organization. The latter is almost totally neglected.

Of imgation organizations, at least three important aspects that have not received sufficient attention in the application of available knowledge can be identified. They are:

i. Interagency coordination;

ii. Farmer-bureaucracy interface: and

iii. Internal dynamics of irrigation organizations.

While the three aspects appear to be interrelated, an integrated approach to address them necessarily calls for an understanding and review of the broad institutional milieu including not only the organizations, but also the sets of rules that define them. Where the broad institutional issues have also been addressed more carefully (such as in Japan, Taiwan and South Korea), taking into account appropriate land reform, legal reform, and changes in the value system, greater has been the success in organizational changes and in the overall imgation performance.

Interagency coordination, at the abstract level, is primarily a broad institutional condition that affects imgation performance favorably or unfavorably. Wherever some degree of coordination has been achieved either through less formal arrangements (project committees, advisory bodies, etc.) or through formal mechanisms (area development authorities, integrated Ministries, etc.), the effect on performance has been favorable. However, overall, the common administrative culture in Asia which is noted for its preference for strict departmentalism resulting in traditional interdepartmental rivalry, is a significant unfavorable condition affecting the achievement of desired irrigation objectives. What this commonly seen institutional condition underlies is a set of uncoordinated work roles, which at this structural level is an organizational issue. The failure to rectify this situation by evolving suitable coordinated organizational mechanisms linking together the functions of agriculture and irrigation, or those of construction, maintenance and operation, is mostly attributable to the rigidity of long-established and entrenched institutions.

Farmer-bureaucracy interface often suffers from a lack of concern on the necessary organizational linkage between farmers and agencies. Farmers either get organized to act as a buffer against bureaucratic and policy constraints, or they are organized by agency-based initiatives to support the

objectives of agencies. Politically motivated pressure groups and lobby groups clamoring for a better deal in location-specific irrigation management needs and concessions against taxes and water charges are in the first category, whereas various forms of agency- or donor-sponsored water users' associations fall within the second. Often, these farmers' organizations remain as separate, independent entities which do not form an integral part of a composite irrigation management organization. Consequently, farmer groups traditionally have tended to perceive the irrigation bureaucracy as being insensitive to farmers' objectives and needs. The inevitable conflict can be seen in an almost insatiable demand from farmers and equally rigid defensive positions taken by the agencies in such matters as water deliveries and maintenance priorities.

In the field of irrigated agriculture. conflict is endemic. It can be seen between many individuals and groups competing for the control of scarce resources. The conflict between farmers and agency personnel is as common as that between racial and ethnic groups, or that between landlords and tenants (Lusk and Parlin 1988). In some instances, this has been identified as a conflict of interests between the farmers and the State (Lecaillon et al. 1987). The resolution of such conflict is often in favor of the more powerful, particularly in the context of large systems associated with Witfogel's "Oriental Despotism." Some forms of decentralized management have been tried to partly meet the resolution of this conflict, but the need to establish a viable farmer-agency interface as a natural extension of the irrigation organization has not received adequate recognition. It is an unavoidable requirement as long as any form of bureaucracy is involved in any part of the system management.

Organization is the appropriate means of managing social conflict. Ironically, an organization is also a part of social life which inevitably leads to conflict. The nature of the society or of any functional part of it (like irrigated agriculture), determines the extent of conflict that affects the organization. In societies such as in Asia, where political modernization has tended to grow at a faster rate than economic development, external social pressures generate a high degree of conflict within organizations. The individuals in organizations are pressed between external pressures and normative behavioral roles expected through internal rules and procedure. The field of irrigated agriculture exemplifies this situation. For improved

performance, therefore, the internal dynamics of irrigation-related organizations need to be studied in-depth to assess the appropriateness, viability and possible changes of the organizations in the light of their fast-changing environment.

CHAPTER 4

Irrigation Institutions in Pakistan

IN CONSONANCE WITH the abovementioned broader definition of institutions and the related conceptual framework, the following sections of the paper attempt to describe and analyze Pakistan's irrigation institutions in three categories: formal rules, informal rules and organizational structures. While the inevitable linkages between these three aspects are to be appreciated, the main purpose of this categorization is to highlight the importance of the "rules" component of imgation institutions when institutional changes are considered for improved irrigation performance.

FORMAL RULES

Most of the irrigation-related laws in Pakistan were formulated several decades ago. They were introduced at a time when vast tracts of newly irrigated land and newly established irrigation infrastructure had to be administered with minimum management cost, land was relatively abundant and control of water was relatively unimportant. Professional and technical resources were also scarce then. The main objective of irrigation was to allocate and distribute water within as large an area as feasible and as equitably as possible, and to minimize the burden of maintenance. Rules and procedures were meant to underlie a combined system of physical and administrative structures geared to administrative convenience than to any dynamic management, where stability of the system was valued more than its adaptability.

The rules were designed to be as comprehensive as possible so that their strict compliance would largely enable to achieve the above objective. Whenever some practical needs arose and legal loopholes became apparent, the rules and procedures were amended occasionally to meet those specific

purposes, but the basic structure of the original rules system remained unaltered.

The *Act of 1873.* The most important component of the formal rules governing Pakistan's irrigation operations consists of irrigation laws which are mostly centered on one major piece of legislation, the Canal and Drainage Act of 1873. The subsequent amendments and various offshoots for specific regional applications have kept this original Canal and Drainage Act as the core legal instrument dominating the irrigation scene. Subsidiary legislation providing operaling rules for the Canal Acts, various manuals of procedure, and revenue and rates manuals form the second component of formal rules. These are several in number and comprise very detailed instructions. The thud component is a series of new laws relating to other aspects such as land reform, reclamation, and water users' associations.

Selected list. Some of the more important laws and manuals of procedures established during this period, and still meant to bc operative, are listed in Table 1.'

Table 1. Some irrigation-related laws in Pakistan

1. Canal and Drainage Act (VIII of 1873) as amended by
   Canal and Drainage (Amendment) Act (XIV of 1952),
   Canal and Drainage Extension Act (XXIV of 1964),
   Canal and Drainage (West Pakistan Amendment) Ordinance (XXIII of 1965) and Act (VII of 1968).
   Canal and Drainage Extension to III Lora Canal of Bannu District Ordinance (XIII of 1969).
   Canal and Drainage (wen Pakistan Amendment) Ordinance (I of 1970) and (west Pakistan 2nd Amendment) Ordinance (IV of 1970),
   Canal and Drainage Extension to Rohri Canal Area Ordinance (XVII of 1970),
   Canal and Drainage (Punjab Amendment) Ordinance (XVIII of 1971). and
   Canal and Drainage (Punjab Amendment) Act (XXXII of 1975);

2. The Punjab Minor Canals Act (III of 1905);

I Engr. Sardar A. D. Nasir, an Irrigation Engineer and Lawyer, provides a detailed commentary on the Canal and Drainage A d (VII of 1873) and its subsequent Amendments. and on three other Acts. He also gives interesting references to some selected case laws, which provide an insight into rule application and adjudication. and farmer-agency interactions. See Nasir (1981).

3. Rules and Rates under the Punjab Minor Canals Act (1906);

4. Sind Irrigation Act (VII of 1879),
   Bund Manual, Public Works Department, Government of Sind (1954);

5. Punjab Soil Reclamation Act (XXI of 1952), as amended by
   The Punjab Soil Reclamation (West Pakistan Amendment) Ordinance (V of 1964),
   The Soil Reclamation (Punjab Amendment) Ordinance (VI of 1970), and
   The Punjab Soil Reclamation (Amendment) Act (IX of 1977);

6. The West Pakistan Land and Water Development Board (Reclamation Fee) Rules (1965);

7. Hand-Book of Professional Orders for the Guidance of Officers of the Irrigation Department, Punjab and North West Frontier Provinces (1914), 2nd Edition 1925;

8. Irrigation Manual of Orders (1912), 2nd Edition 1929, 3rd Edition 1940, 5th Reprint 1964;

9. Manual of Irrigation Practice (1943, Reprint 1963);

10. Schedule of Rates (1963, 1964),
    Vol.I, Part I (Specifications for Material Construction),
    Vol.I, Part II (Specifications for Execution of Works),
    Vol.II, Part I (Analysis of Material Quantities),
    Vol.II, Part II (Analysis of Labour),
    Vol.III, Part I (Schedule of Wage Rates),
    Vol.III, Part II (Labour), and
    Vol.III, Part III (Schedule of Composite Rates);

11. Public Works Department (Irrigation Branch) Revenue Manual, 4th Edition 1955, 6th Reprint 1987; and

12. Water Users' Associations Ordinances, 1981.

INFORMAL RULES

Irrigation behavior is determined not only by written-down laws, regulations and procedures, but also by a number of informal rules and traditional practices. In Pakistan, as in many developing countries where "soft state" conditions are prevalent, formal rules tend to get superceded by informal norms, values and practices which form a strong institutional basis for

organizational and social behavior. After years of tradition, they become a stable set of "rules" in their own right.

Although the origin of written-down irrigation rules in Pakistan does not go beyond the British colonial period, the basis for irrigation rules and organizational structures has a long history of water regulation which can be traced back to the Indus civilization and the later developments during the periods of *Aryan,* Greek and Arab influences.[1] Informal irrigation rules based on communal ownership and equitable distribution of water, in fact, have the stamp of these multiple influences.

While several institutionalized irrigation practices can be identified, two of them, the *warabandi* irrigation rotation system and the ***biradari*** relationship (behavioral pattern based on a feeling of brotherhood; *biradar* [brother]) are selected for emphasis in this paper. They seem adequately illustrative of socially evolved institutions which form part of the institutional framework of Pakistan's irrigation management.

Warabandi is a water management system which aims to achieve high efficiency in water use by imposing water scarcity on each and every user, and by focusing on equity in distribution (Malhotra 1982). Its origin can he traced to the early period of irrigation development in this region, over a century ago, when irrigation had to be extended to a much larger area than could be supported by the lowest available supply. According to this system, a central irrigation agency delivers water at the head of the tertiary level watercourse (irrigation distribution system within the command area served by a *mogha*), through a *mogha* (anoutletfrom the distributary or minor canal to the watercourse) which is designed to provide a quantity of water proportional to the watercourse's culturable command area, and farmers manage on-farm distribution of water?[2]

---

1 See more details in Radosevich (1975). Also, to consider water as a public good which should be subject to public administration is in keeping with Islamic concepts. See Caponera (1968).

2 Doug Merrey in a case study from Pakistan, describes how the route of a particular watercourse and the rotations on that watercourse have evolved over time. He refers to the lack of "fit" between the imposed irrigation technology and the preexisting social organization of the village, in explaining the current problems relating to the warabandi *system.* See "*The Sociology of Warabandi: A Case* Study *from* Pakistan" *in Irrigation* Management in Pakistan: Four Papers. Merrey and Wolf (1986).

The term warabandi literally means "fixed (bandi) turns (wahr)." The scheduling is for a time-based continuous rotation of water delivery, taking account of the practice of both day and night irrigation. The rotation begins at the head and proceeds to the tail of the watercourse. Usually, a seven-day rotation forms one complete cycle in which each parcel of land in a watercourse receives its water once per week. The allocation is basically a Compromise between demand and supply conditions, and during each farmer's turn which is roughly proportional to the area of his parcel of land, he has the right for all the water flowing in the watercourse. The arrangement of turns is mutually decided by all the farmers in the watercourse, and the agency does not interfere unless a dispute arises. This traditional system is an informal arrangement and is known as "kacha warabandi."

The flexibility in the old farmer-established kacha warabandi system was that while the order of turns was fixed, the day was not. According to the kacha warabandi practiced 10 to 15 years ago, if. for some reason, the canal was closed for a period of time during the irrigation season, the farmer who should have had his turn at that point of time would get his turn when the water returned, and the rotational schedule of turns would continue. Such flexibility ensured water for all the farmers, but the lack of a commonly accepted instrument to monitor the time and timing of turns increasingly gave rise to disputes among the members of farmer groups. With a fast-changing society gradually eroding into traditional rural leadership roles, this trend toward reduced interpersonal and intergroup harmony was not surprising. The effect of increased incidence of irrigation disputes, however, was an increase in the extent of agency control over the system.

An attempt to formalize the traditional arrangement has led to the more regulated "*pucca* warabandi"[1] system in which a weekly rotation is fixed by the canal officer on request by one or more farmers in a watercourse.[2] Once fixed, it assumes common agreement, the turns cannot be altered and become

---

1 The Punjab Public Works Department Revenue Manual (1987:3) gives the following definition: *Wahr-Bandi* — The scheme or list of rotational turns or times at which each shareholder in a watercourse obtains his supply or each outlet in a distributary is allowed to be open.

2 Appendix E of the Punjab Public Works Department Revenue Manual provides detailed instructions for preparation and modification of wahr-bandis, and explains the responsibilities of Patwaris, Zilladars and the Canal Officers.

binding on all the farmers who have to take water at his turn irrespective of his need. At the initial stages of the ***warabandi*** practice, day and night turns were assigned permanently for two sets of farmers, but later, these turns were also rotated to allow for each set of fanners to shift between day and night irrigation on an annual basis. The ***pucca warabandi*** has been introduced mainly to reduce disputes and conflicts among farmers and was also meant to ensure water distribution to be as timely and equitable as possible among all, including small and downstream farmers. While the regulated ***pucca warabandi*** system has helped in reducing the scope for disputes among farmers, it has also removed the element of flexibility embodied in the informal system and has tended to apply turns very rigidly irrespective of unreliability of water flow, soil and topological differentiation, and crop water requirements. Overall however, inequity appears to have been exacerbated.'

Biradari. While the socially evolved tradition of kacha ***warabandi*** has now developed itself into a more formal rule which is made applicable through written-down procedure, the tradition of ***biradari*** in many parts of Pakistan remains a strong social norm. often operating against the formal rules of irrigation. The term ***biradari*** as parenthetically stated earlier refers to a behavioral pattern based on a feeling of brotherhood? and is generally among members of an endogamous group who consider themselves related to each other (Mirza 1975). However, the term "endogamous" has to be given a wide meaning here, as biradaris have been observed to be local co-resident groups based on a combination of patrilineal descent and intra-biradari marriage (Merrey and Wolf 1986). This kinship relationship serves important economic and social functions in rural life, and tends to promote cooperation and conflict resolution, but when several biradari groups are present in a single irrigation command, inter-group competition and intra-group linkages of loyalty tend to make collective decision making and

---

1 Merrey (1990 chapter 28) questions the long-term sustainability of the present warabandi system in Pakistan in view of growing problems associated with it. While acknowledging the limitations of presently available technical alternatives and the embedment of warabandi in the local social structure, he highlights the need for more flexible and equitable management alternatives.

2 The term is of Persian origin and a derivative of the word *biradar* which means "brother" (Mirza 1975).

implementation difficult. Wakil (1970) observed that biradari, in fact, superceded all other loyalties and the formal rules.

Corruption. Among the informal behavioral patterns which affect irrigation performance can be included the fairly widespread practice of rent-seeking. Both officials and beneficiaries of their services tend to accept this as a normal practice in several activities that involve farmer-agency interactions. At least notionally, it is widely accepted as a practice pervading all patronage-based public services, particularly notable services in the irrigation sector being assessment and collection of revenue, construction and maintenance, and water distribution activities. Ethically, the practice is not condoned by the society, and the legal system is clearly against it; but its long-term survival and the lack of serious social sanctions against it tend to place it in the category of informal institutions. Some analysts have attempted to quantify its scope,[1] but in view of its wide acknowledgement such exactness does not seem necessary for identifying this as a problem which is fast being informally institutionalized.

Land tenure. Fairly well-established tenancy relationships characterized by the dominance of big landlords can be identified as another significant social institution that affects irrigation management. Land reform including land ceiling and restrictions on land subdivision has had some impact on tenurial patterns, but the influence of the large landowners on the one hand, and the fragmentation of land on the other, both seem to continue as significant institutional factors. Both these issues figured prominently in the field interviews conducted for this study. The changes that have occurred in the average farm size during the past couple of decades support the field observation regarding fragmentation of land. Table 2 which gives a comparison of agricultural census data, clearly shows a progressive increase in the number of farms in the lowest farm-size category.

---

1 In a fairly overregulated economic system in Pakistan, according to one of its authoritative analysts, Dr. Mahbub ul Haq, about 500 billion rupees form the annual economic patronage which is in the hands of the government servants. Assigning a very low estimate of 8 percent as corruption margin, he mentions that annually there is corruption in these activities to the value of Rs. 40 billion (Exclusive Interview with the News, February 23, 1991).

Table 2. *Distribution of farms according* loform *size (in percent).*

Year	1960	1972	1980
Farm size			
< 3 ha	34.1	43.6	50.9
3–10 ha	52.6	45.6	39.9
10–20 ha	9.4	7.7	6.5
20–50 ha	3.4	2.7	2.4
> 50 ha	0.5	0.4	0.3
Total	100.0	100.0	100.0

Source: Bhatti and Kijne, 1990.

ORGANIZATIONAL STRUCTURES

Following the South Asian tradition of institutional development for irrigated agriculture, Pakistan has inherited a multitude of state agencies and departments to share the sector's management responsibility. The broad division of responsibilities between irrigation and agriculture starts at the center itself with two separate Federal Ministries, and runs through the sector's whole structure of bureaucracies up to the farm level. Similar separations can be seen in respective line agencies of irrigation and agriculture, depending on different functions such as construction, management, extension and research, and on different components of the physical system such as dams, barrages, tube wells, watercourses and farms.

The Water and Power Development Authority (WAPDA), linked with the Federal Ministry of Water and Power, is an autonomous agency created in 1958 to supervise the construction of large-scale infrastructure in the Indus Basin Project, and remains as an agency basically responsible for the development of water resources in the country. WAPDA controls the storage dams which it operates in consultation with Provincial Irrigation Departments (PIDs) according to the water rights and seasonal allocations of the provinces. WAPDA has also been responsible for the planning and installation of tube wells under the Salinity Control and Reclamation Projects (SCARP), and for tile drainage work throughout the country. As in the case

of barrages and link canals constructed by WAPDA, the completed SCARP tube wells also have been transferred to PIDs for operation and maintenance.

Provincial Irrigation and Agriculrure Departments. Irrigation is basically a provincial subject according to the distribution of functions and duties under Pakistan's federal system. The major responsibility for irrigation management rests with the PIDs, and some of its elements are with the Provincial Agriculture Departments (PADs). PIDs undertake some construction work, but primarily attend to the operation and maintenance of irrigation facilities extending from barrages and main canals to outlets in the watercourses, and to resolution of conflicts among water users, while PADs attend to watercourse rehabilitation and on-farm water management.

Most of irrigation-related Acts and Manuals of Procedure define the various functions of PIDs relating to design, construction, operation and maintenance of the country's extensive irrigation systems, and for this purpose PlDs have acquired large numbers of human resources, thus becoming enormous bureaucracies. The Punjab PID itself has more than 50,000 employees, and the four PIDs together more than 80,000. Table 3 provides information about the salient features of Pakistan's irrigation system and its management organization consisting of four PIDs.

The Punjab Irrigation and Power Department with over 50,000 employees is a large organization by any standard. Apart from its size, its responsibility for managing the operations of almost 60 percent of the Indus Basin irrigation system lying within Pakistan makes it an organization of great importance in the country. Considering its significance, Punjab PID is selected for further description which is given as an Appendix to the paper.

To keep the scope of this paper within reasonable limits, its main focus of organizational analysis is restricted to the PIDs through the case material relating to the Punjab PID. This does not, however, discount the important role played by the PADs and federal organizations within the total institutional framework for Pakistan's irrigation, and in fact, the general comments outside the organizational aspects relate to this overall framework.

	Punjab	Sind	NWFP	Baluchistan
Irrigation canals				
Total length (km)	36.481			2,665
Design Q (cumecs)	4,288			
Command area ('000 ha)	8,321			
Numbers of staff				
Secretary	1			
Chief Engineer	13	7	1	1
SuperintendingEngineer	47	26	7	10
Executive Engineer	145	87	20	17
Sub-Divisional Officer	574	246	64	49
Sub-Engineer	2,312	873	208	177
Subtotal: Officers	3,092	1,240	301	255
Other staff	47.185	22,466	4.731	2,859
Total staff	50,277	23,706	5,032	3,114

CHAPTER 5

Deficiencies in the Present Institutional Framework

OF THE INSTITUTIONS mentioned above, the legal enactments and related subsidiary legislation are the most explicit components which explain the underlying requirements for individual and group behavior aimed at a predetermined set of objectives. In the principles enunciated and the behavioral rules specified, in great detail in some instances, they also seek to clarify the articulated interests on which they are based, and the objectives they wish to pursue. How well are these interests and objectives consistent with present needs, and therefore, how applicable are these formal rules and formal role structures to the present context? To what extent are they compatible with or capable of coping with other pressing, informally established institutions?

Merrey and Wolf (1986:31) after the case study of Gondalpur aptly summarize the effect of rather sporadic institutional changes attempted in Pakistan:

> *Just as the problems of rising water-tables, salinization, and inadequate supply of irrigation water are "solved" by installation of a network of tubewells. so it seems to be assumed, inadequate organization can be solved by installing a new farmer organization ....There has been no consideration of the dynamics, the adequacy, or the consequences of the present organization of the irrigation system...Although the major reports and recommendations are thick and comprehensive, none have seriously addressed the mostfundamental problem of allfor thefuture of the Indus irrigation system: how should it be organized? Whatshould be the role of the users in its management? Whathave been the consequences of the present organizational structure? Policy based on faulty assumptions about the goals, values. ability to co-operate, and behaviors of local users is bound tofail.*

Considering all the three categories of institutions (formal rules, informal rules and organizational structures) in the present irrigation-related institutional framework in Pakistan, two main interlinked problems are discernible. One is the increasingly felt obsolescence of most of the legally established rules and role structures in the light of changing social demand and new technology; and the other relates to the overriding effect of informal rules (traditions, norms and practices) over the formally established rules. Consequently, it is often seen that various contradicting influences by different sets of institutions bear upon organizational behavior, invariably depressing its levels of performance. Thus, the subordination of formal rules to more powerful social norms appears to characterize the post independence period of Pakistan's irrigation management.

OBSOLESCENCE OF FORMAL RULES

Only the formal rules and formal role structures (organizations) can suffer from obsolescence, as socially evolved informal institutions are most likely to get modified when they are no more relevant to the needs of the day. As for the obsolescence and redundancy of existing formal rules in Pakistan, only a few references are made to illustrate the scope of the problem. More concrete statements can be made only after a detailed analysis of the situation. This does not preclude, however, the validity of a general observation that irrigation rules and procedures in Pakistan are considerably outdated and need some urgent review.

As can be seen in the list given in Table 1, out of several items of such laws and formal procedures now operative in Pakistan. only a few have been substantially amended since their inception. Most amendments were sporadic and limited to a few paragraphs, and did not result in any meaningful change in the original scope and objectives. The 1873 Act was to go through a major amendment in 1975 in an attempt to remedy its increasing obsolescence. The background to this amendment can be seen in the following comment by Nasir (1981:3):

> ***The Canal and Drainage Act of 1873 was drafted more than a century ago when the irrigation in the Punjab was in its infancy. With the extensive***

development of irrigation. many new problems have arisen for which adequate and clear cut provisions do not exist in the Act. The growth in population and fragmentation of the land holdings have given birth to serious problems in the equitable distribution of canal supplies especially of internal watercourses within the standard canal irrigation unit of a square. The influential people have been and are resorting to unauthorized irrigation by tampering with the outlets or by cutting the canal banks or by using canal water out of their turns and in excess of their legitimate shares. The proposed amendments in the Canal Act are. therefore. necessary.

Evaluations made several years later do not indicate that any significant change has occurred in the imgation operations. Nor do they refer to any significant effect in farmer behavior.

i. In the words of the National Commission on Agriculture (1988289). "not only does the availability of canal water vary seasonally, the distribution process itself suffers from certain chronic inequities, the worst sufferers being tailenders, i.e., farmers at the extreme ends of the distributary system."

ii. In Punjab, the situation has been described as one in which "informal customs associated with kinship, caste and other social relationships frequently lead to an inequitable distribution of irrigation water; major problems are reflected in conflicts bctwcen farmers who hinder the maintenance of irrigation channels and the disruption of water flows by some farmers taking more water from the canal than has been allotted to them" (Mirza 1989:15).

iii. Similarly in Sind, although the facilities are monitored by the Irrigation Department staff, it has been found that "some farmers manage to tamper with the *mogha* in order to increase discharge, sometimes with the cooperation of ID staff," and that "the watercourses are generally in a dilapidated condition viz, unlined, not properly aligned, poor embankments, leakage, occasional cuts and inadequate free board" resulting in substantial water losses (Hai and Hussaini 1989:23).

The disappointing results of attempted amendments in the formal rules may be attributed to a lack of recognition given to other social institutions that have been left to bear unfettered influence over the formal rules. The above evaluations also indicate the futility of attempts to reinforce formal rules aimed merely at strengthening centralized control without any reference to local-level organizations.

Morerecent field data not only confirm this situation, but also signal the dangers ahead that the system's sustainability itself is at slake.' In the Lagar Distributary, out of the 23 breaches reported in 1989, 12 had been direct cuts across the bank, 10 of them by farmers for unauthorized irrigation. Another 9 breaches had been due to overtopping or weak canal banks, and the causes of the other 2 breaches were not known. Of the 23 incidents, 14 had occurred during night time, and most of the incidents had been first observed by farmers. A more recent survey conducted by IIMI during one week in mid-August, 1990, on the whole of the Lagar Distributary and its Minor Jinda and on part of the Mananwala Distributary and its Minor Karkan, indicates that the problem can be widespread. In this survey, 19 incidents of using seasonal pipes, 20 emhankment cuts, and another 13 "leakage" points were observed.

Substantial water distribution inequity has been observed in the Mananwala Distributary in the Lower Chenab Canal, where "outlet tampering" was found in the form of illegal modification of the outlet structure to draw more than its design discharge, and water theft through pipes, siphons as well as direct cuts referred to as "punctures" in the distributary embankments (Vander Velde 1990).

The frequency of these interventions, the openness with which they are carried out and the absence of any deterrent action illustrate the lack of recognition given to formal rules laid down in Canal Acts and other regulations.

---

1 A *preliminary observation* is that three main causes, unattended maintenance problems, tampering with the physical system and unauthorized irrigation – are having a combined effect on systems' sustainabiliiy. Bureaucratic insensitivity to these glaring problems can also be related to lack of their appreciation at policy level.

DOMINANCE OF INFORMAL RULES OVER FORMAL RULES

The conflict between formal and informal rules can be identified as a major deficiency in Pakistan's present institutional framework for irrigation. Although the laws, regulations and manuals of procedure call for a highly regulated pattern of behavior from individuals and groups, they are now often observed in the breach. While the written-down rules provide a set of norms for both irrigation staff and water users, both these groups seem to find that the deviation from rules is an unchallenged behavior and the two groups that can check each other find greater benefit in collusion and mutual reinforcement of their deviant behavior. The major reasons implied by strict irrigation regulation for desired behavior include the scarcity of water as a resource and the value attached to it, the complexity of the physical system that captures, conveys and distributes water, the need for timely and equitable distribution of water among a large number of users spread out widely in an extensive command area, and concurrently the need to keep the levels of management of all these activities at minimum intensity. Ironically, the same reasons appear to have subverted the original intentions. This has been possible mainly because the informally institutionalized behavior has succeeded in overriding the effect of formal rules.

In view of the changed circumstances, canal water is far more valuable now, and the consequent competition and the high rent-seeking potential associated with it make the efficient and equitable distribution of water more important than in the past. For equitable distribution of water and to ensure that the outlets draw their authorized full supply discharge, a strict and constant watch over the hydraulic performance of a distributary becomes imperative, requiring an equally strict discipline among the members of the staff. For this, rigid compliance with formal rules is essential, but ironically, it is now that such strict compliance seems to be easily circumvented by other social institutions, giving rise to a seemingly immutable vicious circle. The following instances illustrate the problem:

* When the prevailing supply level differs considerably from the authorized full supply level, technically it is not considered advisable to restore the designed full supply levels by haphazard silt clearance, and instead, a detailed hydraulic survey and remodeling of the whole

channel have to be undertaken. The remodeling of a channel generally involves alterations in the last hydraulic characteristics of the channel and consequent adjustment of control points and outlets. The procedure for this work is laid down as formal rules (departmental instructions) in the Revenue Manual, which specify that the longitudinal sections of all channels of a Division must be scrutinized at least once in five years. However, this procedure has now been discontinued, the attributed reason being the informal pressures exercised by politically and financially influential, large landowners. This is one of many instances where formal rules are circumvented by socially accepted informal practices.

* In view of the persistent and continued maldistribution in Khikhi Distributary of the Lower Gugera Branch of Bhagat Sub-Division of LCC East Circle, a remodeling scheme was framed in 1974.[1] The scheme envisaged regrading of the L-section, silt clearance as well as adjustment of the outlets, especially in the head reach. The scheme was abandoned due to large-scale, violent demonstration and agitation by the farmers of the head reach of the distributary. The government of the time could not withstand the pressure; not only was the scheme abandoned. but instructions were also issued discouraging such schemes in future. A rather disheartening effect on the departmental engineers in their efforts for equitable distribution of water was inevitable.

* A recent attempt in Pakistan to provide some legal backing to farmers' organizations illustrates further the effect of deep-rooted social institutionson formal rules. The outcome of this effort has been described by Mirza (1989:5) as follows:

> ***Until recently, informalfarmer organizations ,.. were responsible for collective decisions ofwatercourse cleaning, maintenance and scheduling of warabandi timings. Water losses were high and frequent conflicts among members made these modes quite ineffective ....Hence a switch to a formal legal mode of organizing***

1 This information is from personal experience gained by the coauthor of this paper, C. R. Firdousi, while he was a senior officer in Punjab PID.

water users was deemed necessary. For this purpose an ordinance requiring the change was promulgated in 1981. Since then organizations have registered with the On Farm Water Management (OFWM) department and have adopted written rules of operation. However, the prevailing norms of informal social system have continued to dominate in the day-to-day management of irrigation systems. The subsequent failure of legal modes to perform any better than the informal organization points to a need to understand the inter-connections between various social systems that regulate the overall relationships between farmers. It is unlikely that formal rules can be imposed in the distribution of a single resource in the context of traditions that contradict the legal rules in the distribution of other resources. A key reason for the persistence of the informal rules is customs associated with multiple inter-kin relationships.

Institutions which are not so explicitly established as the legally constituted ones, nevertheless attract greater compliance from the individuals and groups. The inference is that some of these informally established institutions have apparently shown greater relevance to the current needs; being socially evolved they have tended to be more adaptable to the ground situation through the very process of evolution.

Most of these informal rules, however, act against the intentions of the written-down laws. Their overriding effect makes the laws ineffective and obsolete. The informal and illegitimate behavior by irrigators as well as irrigation bureaucracies (Wade 1982), and the problems of a "syndrome of anarchy" and a lack of mutual trust[1] between officials and farmers (Hart 1978; Wade 1987), in fact, can be traced to this countervailing influence by socially established institutions over the formal rules.

Field observations and interactions with field-level officials point toward at least four main causes relating to the problem of conflicting institutional influences:

---

1 Robert Wade (1987) refers to a typical problem in the South Asian context, the lack of mutual trust between farmers and officials. Farmers tend to take water out of turn as they have no confidence in getting water on time, and officials lack the confidence that if they work hard to get water on time farmers will refrain from breaking rules. This is described as a "syndrome of anarchy."

* an increasing work load for all levels of irrigation officials:
* a rapid process of politicization of the administrative and social environment;
* a resultant change of attitudes and values toward the application of formal rules; and
* a situation of declining law and order in the field.

The four aspects have a mutually reinforcing effect, thus confirming the presence of a "syndrome."

The officials who have been given responsibility through formal rules to act against unauthorized irrigation cannot, in fact, cope with the task as they do not get adequate administrative and political support to apply the rules. Due to the rapid politicization process since independence, the bureaucratic power intended by the formal rules most of which imply the support of a colonial-type strict administration, has been substantially eroded, and can no longer be independently exercised in a populist democratic system. Consequently, the existing formal rules and implementation mechanisms have lost their significance. Staff supervision. disciplinary action, and legal and administrative measures for punitive action have all declined in their quality and effectiveness. Pakistan's current situation regarding irrigation institutions reflects a common problem that has been observed in many developing countries. The pool of knowledge and the lessons they offer, therefore, should be of great value.

When the irrigation bureaucracy lacks the resources and the willingness to enforce legal measures against breaches of the rules, the result is a situation of anarchy, which has been described by Walter Coward (1977:7) as the "Takahashi effect." Takahashi (1970) has observed through his case study in the Philippines that when the management of the irrigation system was nominally in the hands of the government, at the village there was anarchy over the use of water. Anarchy was seen to occur because the irrigators were not organized, and even when groups existed they lacked power or self-regulation, and also because the bureaucracy was not adequately capable of enforcing rules and regulations. The Philippines has since taken several steps to overcome this adverse situation, by changing the management structures, by making them more responsive and accountable to imgators,

and also by organizing irrigators effectively (Korten 1982). Some of these experiences should be of great relevance and value to the current situation in Pakistan.

Elsewhere, reference has been made to cases "of political influence, Of unofficial augmentation of official salaries. of falsification of water flow records, of turning blind eyes to infringements" (Chambers 1980). However, the fact that there are also the instances of imagination and courage to resist pressures and to improve performance illustrates the potential for change, possibly by making formal rules more relevant to the present context and their application more effective, thereby trying to reduce the dysfunctional compliance associated with countervailing influences of social institutions.

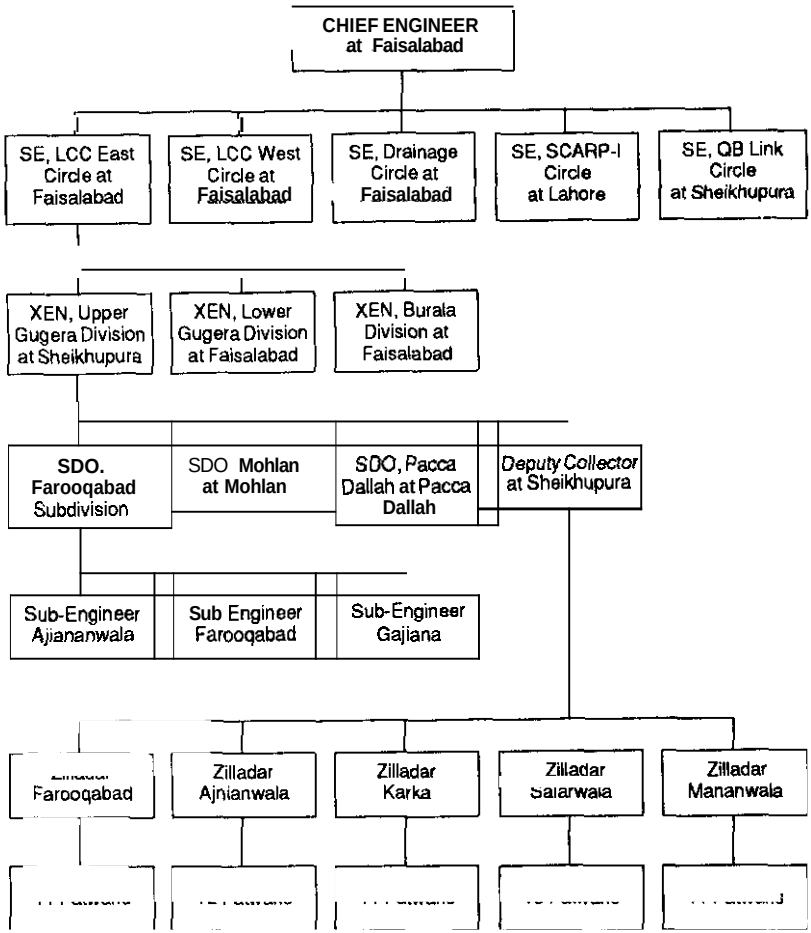
DECLINING RELEVANCE OF PRESENT ROLE STRUCTURES

The extent to which environmental. technical and social changes have superceded the relevance of irrigation organizations is as equally disconcerting as the degree of obsolescence in formal rules, and the need to assess their compatibility with the present context is equally compelling. Organizational structures, distribution of responsibilities and even the size of organizations basically remain in the Same form as left by the colonial administration. Minor sporadic changes have resulted only in some appendages, and consequent administrative anomalies.

For instance, the Punjab PID (see Appendix) which was created about a hundred years ago, despite its expansion with some new disciplinary wings such as Drainage, SCARP, Mechanical, etc., has not changed in its basic structure of the Open Canal Circles since its creation. Since then, the demand for water has increased manifold due to fragmentation of lands, changes in cropping pattern and expanded irrigable areas, all leading to increased problems concerning distribution of water and disputes among the irrigators.

The Lower Chenab Canal East Circle created in 1890 continues to have the same jurisdiction as was originally assigned, and its present staff deployment as illustrated in Figure 2, also remains at the same level as at the time of its creation. The Circle consists of the same numbers of Divisions

Figure 2. Organizational chart - Faisalabad Region.



Note: LCC = Lower Chenab Canal QB = Qadirabad-Balloki
XEN = Executive Engineer SDO = Sub-Divisional Officer
SE = Superintending Engineer

and Sub-Divisions and staff in each category. The Upper Gugera Division, for example, has the same 3 Sub-Divisions and Farooqabad Sub-Division has the same 3 Engineering Sections, 5 *Zilladari* (pertaining to a *Zilladar* who is the canal official who supervises about 10 *Patwaris*, who, in turn, are the Irrigation Department field officers who make the initial records of fields irrigated) Revenue Sections with 58 Patwaris.

A Patwari is basically required to work almost along with the water flow and record each field irrigated during the week. He is required to record 3,000 to 5,000 acres annually. His work was relatively simple when the typical unit of farm-holding was one "square" (25 acres). Due to subsequent fragmentation of land through almost three generations, the typical landholding has been reduced to 2 to 3 acres on the average. Due to pressure on land, every small farmer is keen to obtain water and cultivate as much area as possible with whatever quantum of water is available. The scarcity of water, especially during sowing and maturing periods, gives rise to disputes among the irrigators. In addition, the Patwari has to attend to many meetings at Village and Union Council level, attend camps of the checking officers, and thus, his work has increased substantially so that it is no longer humanly possible to perform his duties efficiently as required under the rules.

The work of a Sectional Sub-Engineer also has increased many times due to increased trespassing and misuse of the canal roads and tampering with supplies, especially during high demand periods. The punitive measures enforced a hundred years back are no more effective due to the increased economic value of such behavior.

The following details of canal mileage within the Pucca Dalla Sub-Division illustrate the work load of a Sub-Divisional Officer (SDO):

Name of canal	Length in feet
Jalluana Distributary	29,000
Mulley Distributary	54,000
Mangat Minor	54,000
Bijwana Sub-Minor	16,000
Khallar Sub-Minor	3,000
Khangah Distributary	27,000
Khingranwala Distributary	4,000
Mataba Distributary	18,000
Mahniawala Distributary	6,000

Khurrianwala Distributary	123,000
Chukery Minor	35,000
Rajewala Minor	28,000
Ranwala Minor	10,000
Shahkot Distributary	154,000
Shahkot Minors	24,000
Total	**585,000**

To travel along these canals once means a total distance of 117 miles. The SDO is expected, according to rules, to inspect them at least twice a month, to supervise field staff and check the recording of tail gauges and other field information. He is also expected to spend 10 to 15 nights, out of his headquarters in field locations. The SDO is not provided with any official transport, but is expected to manage within a fixed traveling allowance which is limited to Rs. 750 per month.

The work load of the Executive Engineer also has increased over the years. For instance, the number of meetings he has to attend has increased considerably. The Executive Engineer, the Upper Gugera Division has to attend all district-level coordination, development and other meetings called by the respective Deputy Commissioners (as the irrigation boundary of a Division does not coincide with the boundaries of the civil districts, the jurisdiction of the Upper Gugera Division falls within three civil districts: Faisalabad, Sheikhupura and Gujranwala), in addition to the departmental meetings regularly called by the Superintending Engineer, the Chief Engineer, the Secretary, Planning and Development Department, and the Minister. Audit and Accounts meetings are also held at regular intervals. The monthly tour journals show that an Executive Engineer remains most of the time away from his office in connection with these meetings. Thus, the time available for his primary duties of managing the irrigation system as required in the manuals of procedure is greatly reduced and, therefore, he is unable to spend the minimum requirement of 10 nights out of office in the field.

Similarly, at the Circle and Regional levels the work load has increased and the environment has changed. No extra staff has been provided to cope with Ihe changed circumstances. Lack of time and opportunities for program planning and monitoring at this level seems, in itself, to account for the present mode of "administered" operations, which is different from the more

productive management mode required in today's context. This has affected the working and efficiency of irrigation engineers and has contributed to the deterioration of the irrigation system.

The annual maintenance allocations have also been a constraint for the upkeep of the irrigation system. The yardstick for maintenance which was originally laid down in 1937, basically remains the same to date, despite the multiplier effect of all the changes on maintenance needs. The wear and tear of the canal bank take place at a much faster rate now due to increased trespassing by vehicular traffic, especially the farm machinery on the kachcha (unpaved) canal banks and roads. Trespassing on canal areas was a rare occurrence during the days when original maintenance norms were established, and of similar low level was the incidence of other acts of irrigation misbehavior when formal rules were strictly observed. The yardstick has been revised in 1982, but the current annual maintenance allocations do not meet even this yardstick due to inflationary pressure. The inadequacy of the present organization for maintenance, therefore, is a major contributor to the deterioration of the system.

SOME ANOMALIES IN THE PRESENT ADMINISTRATIVE STRUCTURE

The original administrative structure of the Department was established primarily to maintain and operate the canal systems for distribution of water. As described earlier, each canal system formed one administrative unit, called the Circle, under the charge of one Superintending Engineer (SE), a number of such Circles forming a Zone which was to be under the direction of a Chief Engineer (CE). A Circle was divided into three of four Divisions, each under an Executive Engineer (XEN) having a number of sub-Divisional Officers (SDOs).

With the passage of time, waterlogging appeared in the command areas of canals, and to circumvent this problem separate Sub-Divisions and Divisions were created for drainage functions and were attached to the Circles of the respective canals. With the increase in work load. it was later felt that for more effective administration of drainage functions, separate

Circles should be created. For example, Drainage Circle, Lahore, was created during the year 1951-52. The responsibility of the Circle was to cater to the drainage functions of the Upper Chenah Canal, the Depalpur Canal and the Lower Bari Doah Canal systems, whereby one unit of drainage administration was to overlap with more than one unit of canal administration. On this arrangement. the SE of Lahore Drainage Circle is under the administrative control of CE, Lahore Zone, but for drainage functions he overlooks the canal area in the Lower Bari Doah Circle which is under the administrative control of CE, Multan Zone.

To compound this further was the creation of SCARP Tube-Well Circles. A large number of tube wells were installed in the command areas of some of the canal systems to control waterlogging, and the responsibility for their operation and maintenance was placed in these separate Circles which also overlap the Canal Circles.

This three-dimensional operation (surface supplies, horizontal and vertical drainage) focusing on the same geographical area has naturally caused some administrative confusion in the Department. The headquarters of the CEs, SEs, XENs or even the SDOs and their Sub-Engineers for these separate functions are at different places, sometimes hundreds of miles apart and the resultant problems of coordination are the main causes of administrative confusion and poor service to the farmers.

The operalion of the Lower Bari Doab Circle (LBDC) system — see Figure 3 — illustrates the scope of the problem. This canal system first came into operation in 1912. The headquarters of the Circle was located at Sahiwal, almost in the center of the system to make it easily accessible to the irrigation community. The Circle is divided into three Divisions namely Balloki Division (Head to RD 255), Sahiwal Division (RD 255 to RD 450) and Khanewal Division (RD 450 to tail RD 660). Each Division has three or four Sub-Divisions with their offices located along the canal. The Sub-Engineers are also located in the canal colonies along the main canal and the major distributaries. The canal administration of the LBDC system is under the Chief Engineer in Multan at a distance of abut 180 miles from Balloki, 120 miles from Sahiwal, and 40 miles from Khanewal.

The drainage component of the LBDC comes under the jurisdiction of SE Drainage Circle and his CE, both located in Lahore. The office of XEN Drainage Division known as Sikhrawa Division is located at Sahiwal, about

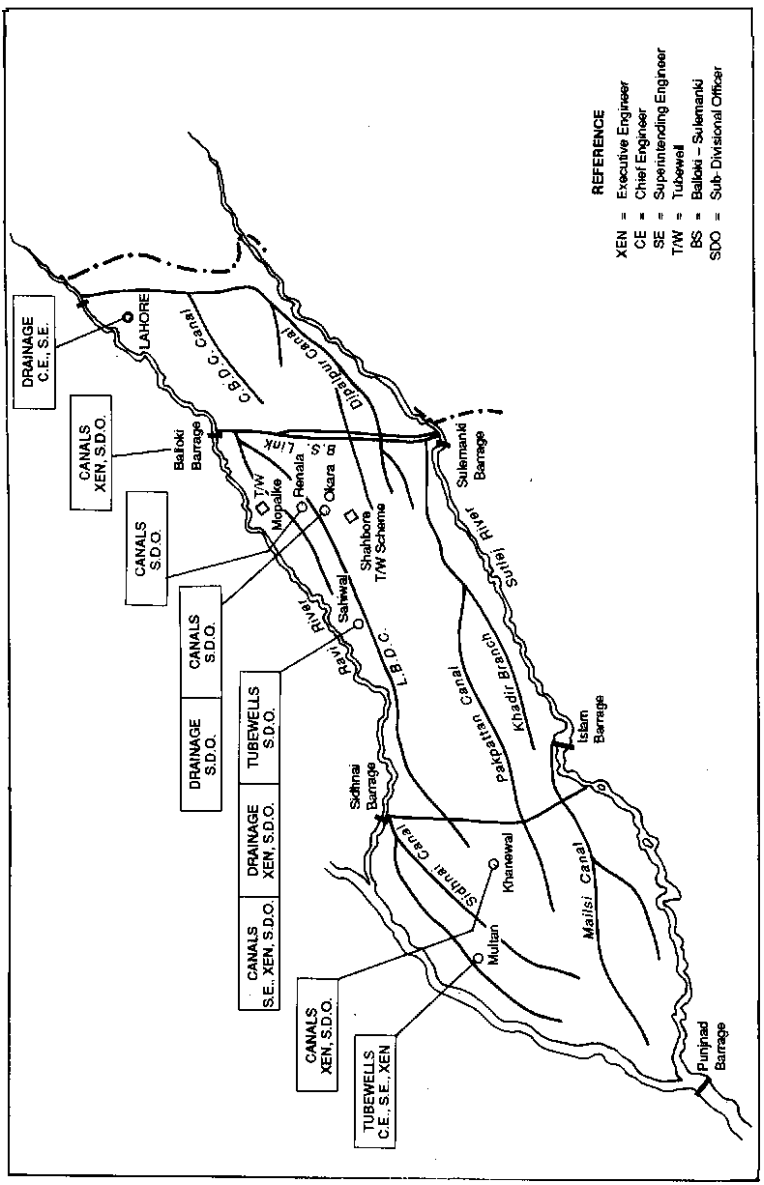


Figure 3. Administrative structure for the Lower Bari Doab Canal (L.B.D.C.) System.

100 miles from Lahore. The tube-well scheme at Shahbore toward the tail end of 4L distributary of LBDC, and some tube wells installed under the Grow More Food Project in Mopalke near the head reach of the LBDC, are maintained by the SE SCARP III Circle with headquarters at Multan, and his XEN's office is also located at Mullan, about 150-200 miles from the tube-well locations.

A fanner in Shahbore having any problem in canal operation has to first go to Balloki XEN's office about 60 miles away; failing to get redress there, he has to travel 40 miles to the SE's office at Sahiwal, or to the CE's office at Multan which is 155 miles away. For any problem concerning the functioning of the drains he has to contact XEN (Drainage) at Sahiwal and SE Drainage Circle and CE at Lahore, a distance of 80 miles from his location. For his problems concerning tube wells he is required to contact XEN and SE SCARP III Circle whose offices are located at Multan. Even at a closer level, for the same group of fanners in Shahbore, the office of the SDO (Canals) is located at Renala Khurd, of the SDO (Drains) at Okara and of the SDO (Tube Wells) at Sahiwal. The farmers have to shuttle between these offices.

This situation is also very embarrassing for coordination with other departments, especially with the civil administration. For example, the District Coordination Committee called by the Deputy Commissioner, Sahiwal will have to be attended by XEN Balloki, XEN Sahiwal, XEN Khanewal, XEN Drainage Sahiwal, and XEN SCARP Multan on behalf of the Department. For the same irrigation command area, three different XENs have to respond on issues of water deliveries, surface drainage and tube wells, respectively. Most other departments are represented by one person while the Irrigation Department is always represented by a number of persons. The situation at the various departmental meetings is similar.

The department has sporadically expanded through simple additions of new functions and wings, without any basis of rational or scientific study. The difficulties faced by the farmers have escaped attention when the legacy of the colonial period has been unduly protected. Changes seem necessary after some dispassionate study in this respect, to consider the costs and benefits of having a more integrated irrigation management structure at the Divisional level. Among the beneficial aspects of such a change would be not only the potential for enhanced administrative coordination, but also and

more importantly, the increased opportunities for decentralizing decision making to a level which can effectively involve the fanner community.

CENTRALIZED CONTROL OVER IRRIGATION

Public irrigation seems to exemplify the need for social control over collective efforts in managing natural resources. Refemng to Dante A. Caponera's (1968) excellent discussion on the history of water law. Radosevich (1975:1) highlights the role of social control over water in the following comment:

> ***Wateris a basic naturalresource. Withoutitspresence andproper control over the distribution and use, progressive civilization is not possible. Indeed, there is evidence that, where regulatory controls have been efficient, civilization has grown; but where these controls have been ineffective, civilizations have declined and often disappeared.***

Irrigation institutions serve to define and exercise this social control which can both facilitate and promote improved irrigation performance for greater social benefit. The scope and character of a country's irrigation institutions would determine whether this social control is to be largely exercised through central agencies, or through decentralized institutional mechanisms involving the water users in a significant role. This differentiation, in the words of Flannery (1972). is to identify whether the control is exercised through the "process of centralization." or through the "process of segregation."[1]

The evolutionary development of irrigation institutions in Pakistan, which was almost parallel to the steady growth of state intervention in irrigation, strongly suggests that the country's chosen process for social control over irrigation was centralization. The early centralized control of the feudalist order was basically retained and, in fact, further strengthened during the

1 For an analysis of Pakistan's irrigation based on Flannery's model, and from a systematic sociocentric perspective, see Merrey (1987).

colonial period. No notable effort has been made since independence to arrest this continuing process of centralization.

Merrey (1987) points out that the "settling" of *mauza* (revenue villages), after the detailed surveys carried out by the British in the middle of the 19th century, created a village community with a new legal basis, and that this also initialed the process of "centralization" since a higher-level order took over the control on land rights. With the expanded canal irrigation system and the establishment of large central agencies to undertake its administration, the process of centralization was reinforced and accelerated.[1] The long conveyance system and the very complex infrastructure made it more difficult for the individual farmer to monitor his irrigation sources or supplies. Even for problems of closer proximity, such as waterlogging and salinity, the farmers were to depend on centrally formulated decisions and remedies. More and more organization mechanisms were gradually added to the original setup of canal administration, following a typical process of "linearization" referred to by Flannery (Merrey 1987: 367). The path of centralized control on irrigation seems to have ended up in a blind alley, a very static situation as far as performance is concerned, where formal rules are no longer relevant and are circumvented by numerous informal practices, and where the organizational structures have already outlived their validity. The most visible among the main causes for this impasse is the persistent low literacy among the rural people and their lack of awareness which have entered into a vicious circle with centralized control.

The situation calls for attempts to find viable options with decentralized mechanisms. A hypothesis at this stage is that the dominance of informal rules over the centrally established formal rules can be substantially reduced if greater responsibility for management is transferred to the beneficiaries.

---

1 However, our point of departure from this analysis is that it was not the process of centralization that was initialed by the British, but the formalization and the reinforcement of a process which had existed during the feudalist period. The people had only a concession to occupy and cultivate land on behalf of their feudal lords whose decisions were to be carried out by the subjects without question. The inundation canals were constructed and operated in a similar manner. The individual farmers before the colonial period were as remote from the decision-making process as they were during that period. The rigidity of compliance expected from them and the severity of penalty in case of noncompliance were the same. While the control was lifted to a higher level by the colonial administration thereby increasing the degree of centralization, the status of the individual or the group was not in any way altered.

Some evidence in support of this view is emerging in pilot projects of various forms of farmer participation in other countries in the region (e.g., Sri Lanka, the Philippines), but the issue has not yet been seriously addressed in Pakistan. Interestingly, before the advent of colonial administration in the region, despite autocratic political control, the management of local resources such as water was substantially in the hands of the local people, and even a little later, kacha warabandi was seen to be a locally managed system. At least some pilot studies in transferring responsibility to farmer groups in Pakistan may be a worthy attempt to arrest the country's main problem in irrigation management, the overriding influence of informal rules over the formal rules.

However, to prepare a healthy environment for effective implementation of such attempts, a field-level capacity for proper information exchange seems to be an important requirement.

INFORMATION PROCESSES AND SERVICES

The contradictions between the various institutional components seem to be closely linked with the lack of general awareness among the concerned people on relevant issues. The general awareness[1] in turn, depends on the institutional backup available for developing the necessary capacity among the people to gain that awareness. This institutional impact is reflected in the status of literacy[2] and education of the population in general and of the rural

1 "Awareness" in this context has been defined as a developed level of perception and knowledge relating to the substance and significance of water issues, and an associated development of attitude and motivation toward appropriate action (Sadler 1987). Although water has a pervasive influence over human action. an adequate awareness on water issues does not occur without deliberate efforts. Such an effort should cover both water users and officials.

2 The rate of adult illiteracy in Pakistan is among the highest in developing countries. According to World Development Report (1990), the male illiteracy rate in Pakistan is 70 percent which places itself between Nepal (74%) and Bangladesh (67%) (see Tables 3 and 4). Considering the heavy reliance on agriculture and on the large rural population for further advancement in industry. this deficiency is likely to be the most critical impediment against progress.

sector in particular. Like many other items of social infrastructure, institutional support for information and education is heavily concentrated in urban centers, a feature that tends to perpetuate an unhealthy communication gap between the uneducated information seekers and the educated extension and operational staff who invariably have an urban bias. Rural-urban and inter-regional disparity in literacy rates as shown in Table 4 below can, to a large degree, represent other disparities affecting social capacity.

The statistics in this Table show not only an alarming feature of regional disparity, but also an embarrassing revelation of a very slow progress in a decade of development, including even an apparent decline in Literacy in some areas. The reasons for this significant rural development issue to have so persistently escaped the attention of the planners are not very clear. In this context, a major question would probably be to what extent can any motivation for change be established among those who mostly stand to benefit from the weak formal institutions and from the strong traditional practices, and whether they would see any value in developing an institutional capacity on a broader basis.

A reasonable standard of literacy and awareness among farmers, a professional outlook and the necessary knowledge and skill among the officials are essential for the long-term support and collaboration for institutional strengthening. An overall human resources development strategy including appropriate technical training can enhance the capacity to develop the necessary institutions and improve irrigation performance. The valuable role played by the USA Land Grant Colleges over the years in developing a strong base of public and private sector irrigation institutions is illustrative of this potential.

A reliable database is an essential ingredient and a fundamental resource for policy planning and management. Mechanisms established to collect, analyze, use and disseminate information obviously constitute an important institutional aspect What is not so obvious is the institutional character of the way in which information handling is perceived by the people in general, and of the value attached to this subject. Both these aspects of institutionalized information handling directly affect irrigation performance.

A recent study has shown that farmers in Pakistan seek information mainly from other farmers rather than from line agencies and extension

Table 4. Literacy rates in Pakistan, 1972, 1981 (in %).

	Rural			Urban			Total population		
Unit	Male	Female	Both	Male	Female	Both	Male	Female	Both
Baluchistan									
1972	9.2	1.2	5.6	42.4	19.2	32.3	14.8	4.2	10.1
1981	7.3	0.8	4.4	37.7	14.3	27.9	12.5	2.9	8.2
1972	19.0	2.2	11.0	44.7	19.9	33.7	23.1	4.7	14.5
1981	18.7	2.5	10.9	42.8	18.8	32.1	22.7	4.9	14.3
1972	22.9	5.2	14.7	47.8	28.0	38.9	29.1	10.7	20.7
1981	26.4	7.4	17.3	51.5	33.2	43.1	33.5	14.4	24.5
Sind *									
1972	27.5	5.8	17.6	55.8	45.0	51.2	32.6	10.0	22.5
1981	20.8	3.4	12.7	60.0	48.8	55.0	30.0	10.0	21.0
Pakistan									
1972	22.6	4.1	14.3	49.9	30.9	41.5	30.2	11.6	21.7
1981	23.1	5.5	14.8	51.5	33.7	43.4	31.8	13.7	23.3

1 Merrey identifies *izzat* (honor. esteem. reputation, status or face) as the most fundamental concept in rural Punjabi culture, which is a natural conflict-generating element of the society. discouraging cooperation on a long-term basis. In the historical and sociological origins of izzat, he finds it to be leading only to contextual and temporary "unity" at m e level. in opposition to other units at the same level. It is a zero-sum game in which one's gain of izzat is at some other's loss of izzat (Merrey and Wolf 198637-40). Also. see Merrey (1979). According to others who were interviewed for this present study. izzat can serve as a more positive social institution where it can be used to develop cooperation through *esprit de corps*, a regard for the honor of the group to which one belongs. However, there is no strong research basis to support this perception.

competitive status enhancement or one-upmanship, and group loyalty prevent the seeking of information from formal and proper sources.

The heavy reliance on traditional methods even for information dissemination by official channels has been identified as a problem. The National Commission on Agriculture (1988:268) draws attention to the obsolescence of present formal mechanisms:

> *The process of information dissemination to the farmers still relies heavily on the traditional means of communicarion which are known to be slow and inefficient. The coverage of all the villages (more than 45,000) and 4 million farm families by a limited number of extension staff using these traditional means will be impossible. The extremely rapid advances in communication technology have made the dissemination of rechnical information not only easier but also speedier and much more effective. But our extension staff are neither adequately trained nor have access to modern communicarion facilities and the use of audio-visuals in the rransfer of technology has been minimal. As a result, the impact of technology generated at the research institutes has reached only a limited proporrion offarmers.*

Another area of concern should be the low value attached to the accuracy of data at the point of collection as well as at the various stages of collation. The value-based attitude is shown in a general lack of supervision on routinely collected and analyzed data, resulting in relatively invalid and even distorted information.

It is no longer a mere notion that the leakages in the form of under-booking and recording of higher abiana (water rate, i.e., the rate charged for canal water supplied for purposes of irrigation; this is also interpreted as the occupier's rate) crops as lower-abiana crops take place. Consultants' have reported to the government that leakages occur not only at the stage of booking, but also at the time of transferring records from *khasras* (field books) to *khataunis* on which demand bills are issued. Their conservative estimate is that about 33 percent of revenue leakage can be saved if data

1 See Associated Consulting Engineen' March 1990 report on the Nationwide Study for Improving Procedures for Assessment and Collection of Water Charges and Drainage Cess. Leakages through under-reporting are estimated at 4-5 percent in Punjab and NWFP. 25 percent in Sindh and around 55 percent in Baluchistan.

handling is controlled at the first stage, and another 5 percent at the second stage. IIMI's own research found that in one watercourse command in the Upper Gugera Division, the cropped area in *kharif* (summer season from mid-April to mid-October) 1988 was 45 percent greater than shown in the official khasra for that season. Preliminary analysis of data from a sample area also indicated a strong bias to record lower-abiana crops for higher-abiana crops in the official documents.

The implications of unreliability of information, as illustrated by this level of underreporting of a significantly important item of field data, cannot be overestimated. It directly affects not only the collection of revenue, but also many other imgation management aspects such as the scheduling of water supplies, the determination of cropping patterns and intensity, and the formulation of valid agricultural and investment policies. Lack of serious concern on management information can also be seen in the way canal discharge measurement data are collected and used. Significant differences have been observed between officially recorded data and actual discharges according to IIMI's measurement data for the Lagar and Pir Mahal distributaries. The main reason for this discrepancy could be that the gauge observers in these two Sub-Divisions are using discharge tables that are typically more than 20 years old (Vander Velde 1990), but the effect of possible complacence on the part of official supervision cannot be totally overruled.

Information processes are a major determinant of the assimilation of various institutional components. Lack of general awareness, of information, of reliability of information, and of concern on all these aspects combine to form an adverse effect on the validity and effectiveness of formal rules, and in the absence of appropriate remedial action they all tend to consolidate the supremacy of informal rules. A critically important facet of this phenomenon is that informal rules have a greater tendency to favor the socially more advantaged groups.

IRRIGATION AND POVERTY ALLEVIATION

The ground situation demonstrates that despite notable advances made in overall agricultural production in Pakistan and its apparent contribution to the development pockets mostly in urban areas, its impact on the poor in rural areas has not been very satisfactory. The official recognition of this fact can be seen in the following statement by the National Commission on Agriculture (1988:9):

> *During a period of declining public investment in agriculture and irrigation, expenditure on research and extension has exceeded the target, though it would seem that there has not been a comparable impact of this on small and low-income farmers.... In fact, performance regarding the lot of small farmers has been least satisfactory. No specific policy instruments or packages have as yet been devised for this category of producers despite the stated objectives. The Sixth Plan policies of input subsidies and price supports for cash crops worked more to the advantage of large farmers who also managed to pre-empt a major portion of the subsidy on credit and fertilizer. In fact, most of the increases in production resulted from the minority of the large and the medium farmers and the yield gaps between the progressive and tradirional farmers remain wide. The overall institutional support has not adequately benefitted all crops nor all categories of farmers.*

The overall national statistics also confirm the observable poor conditions in rural areas where the drama of irrigation is actually played. The average per capita income in Pakistan's rural areas where about 70 percent of its 106 million population lives is currently less than half that in urban area, and value added per worker in agriculture which employs about 50 percent of the work force is less than one-third of the rest of the economy.[1] The apparent prosperous scene in the major cities belies the poor status of, and contribution by, the majority in rural area: the effect of this poverty burden can be seen in Pakistan's low per capita gross national product of only US $350, lower than in some of the other less-resource-endowed countries in the region

1 See for more details. OECD's "Agriculture Growth and Economic Development: The Case of Pakistan" (Hamid and Tims 1990).

(World Bank 1990). Pakistan's relative position in its overall socioeconomic status compared to some similar developing countries can he seen in Table 5.

The reasons for this conspicuous anomaly have to be found in the national policies which obviously, as indicated earlier in the conceptual background to this paper, are closely related to the current institutional framework. Its static nature acts as an impediment to the formulation of progressive policies, illustrating the vicious circle in which policies and institutions are interlinked. In an overview of the policy scene of the past few decades, Hamid and Tims (199012) make the following comment which confirms the observations on ground

> *No noticeable progress has been made over the past 25 years in rural education: literacy has remained at a low level. even compared to that of other countries at the same or lesser stage of development. This is a major handicap fur the lower income strata, even if the labour market develops in a manner that promises full absorption of supplies. Also health extension services are scarce and in most cases inefficiently used. Access to rural health facilities appears in facr to have declined. There is a remarkable contrast in Pakistan between rhe attention paid to the improvements of its agricultural base and on-farm capitalization. and the relative neglect of rhe supporting environment. Little care has been given to the people or the social infrastructure.*

The policies that were aimed at improving the agricultural base and economic development through investment, price adjustments and income transfers ignored two, apparently interrelated, major features of the country's irrigation sector. The policies were not only insensitive to the earlier-mentioned skewed social capacity within the sector, hut also to its uneven land distribution. Consequently, the opportunities and incentives provided by such well-intended policies favored the few large landowners. The average farm size in Pakistan is about 4.7 ha, depicting basically a small-farm structure.

country	GNP per capita (US$, 1988)	Growth rate (%)	Agriculture % of GNP	Life expectancy (years)	Illiteracy (%)	
					Female	Male
Bangladesh	170	0.4	46	51	78	67
Bhutan	180		44	48		
Nepal	180		56	51	88	74
Burkina Faso	210	1.2	39	47	94	87
Nigeria	290	0.9	34	51	69	58
India	340	1.8	32	58	71	57
Pakistan	350	2.5	26	55	81	70
Sri Lanka	420	3.0	26	71	17	13
Indonesia	440	4.3	24	61	35	26
Sudan	480	0.0	33	50		
Philippines	630	1.6	23	64	15	14

Country	Infant mortality rate/1,000 live births)	Maternal mortality (/100,000)	Population (million)	Annual population growth rate (%)
			109	2.8
				2.1
Nepal	126	..	18	2.6
Burkina Faso	137	600	9	2.6
Nigeria	103	1500	110	3.3
India	97	500	816	2.2
Pakistan	107	600	106	3.2
Sri Lanka	21	90	17	1.5
Indonesia	68	800	175	1.7
Sudan	106	607	24	2.7
Philippines	44	80	60	1.9

Source: World Bank. World Development Report, 1990.

However, the overall distributions of farms in number and size are skewed. In such a situation, access to major inputs is fairly inequitable and so is the access to benefits from irrigation water. Although land distribution and hydrological layout cannot be clearly correlated, it has been observed

1 The developing countries mentioned in this Table are some of those in which irrigation is used as a major development strategy, and where IIMI programs are also located.

that "canal supplies tend to be pre-empted by large farmers near the distribution channels, while small farmers occupying the far reaches of the system may receive inadequate and unreliable supplies" (Hamid and Tims 1990). More clearly seen is the skewed access to tube-well water, the cost of which only the larger farmers can easily afford.

This brings to focus an area at which allocative policies can probably be directed. While scale-neutrality is assumed for the benefits of canal water supply as its distribution is based on the extent of land to be irrigated, in terms of access to benefits, the location and the size of land seem to place the large landowner and the head-end farmer in a more favorable position. The ownership of land is concerned with a broader national-level allocative policy involving agrarian and land reforms, but the location-based equity problem is a typical irrigation management policy issue. Incentive structures for groundwater development can provide opportunities to help the water-starved tail-end farmers, and if the institutional barriers are appropriately handled they can even be directed toward methods of conjunctive use of canal and groundwater aimed at reducing the present disconcerting features of inequity.

In large-scale, publicly administered irrigation systems such as those in Pakistan, the possibilities of helping the sizeable section of the land-poor (the landless and agricultural labor) in the rural population cannot be clearly seen, but must be sought through conscious efforts (Silliman and Lenton 1987). However, for irrigation to contribute effectively toward poverty alleviation, this significant section of the rural poor should also be within the ambit of irrigation-related policies.

CHAPTER 6

Institutions as a Determinant of Performance

IN PAKISTAN, LAND and water are both becoming limiting factors of agricultural production. The annual growth rates of farmgate water availability have gradually declined as can be seen in the figures for periods 1960–67, 1968–78, and 1978–86 which were 3.9 percent, 2.7 percent and 1.6 percent respectively.[1] A greater decline was seen in the growth rates of irrigated area for the same periods, from 2.7 percent in 1960–67 to 1.5 percent in 1978–86. Observing the rapidly approaching limits to the expansion of productive land under irrigation in Pakistan, the National Commission on Agriculture (1988283) points out that:

> Of ***all the inputs in agriculture. the greatest gains can be expected from more efficient use of water, which also maximizes gains from other inputs such as fertilizer. Increasing agricultural production will, therefore. depend crucially on the rational use of land. land improvement, increasing the supply of water*** *by* ***reducing the water losses, more efficient water use and berter agronomic practices.***

This view corresponds with a global concern on irrigation development and management. Irrigated area in the world has increased from 40 million hectares in 1900 to more than 225 million hectares, but the investments have not proven to be as productive as originally anticipated (Johnson 1990). With the realization that the enhancing of resource and technological inputs is reaching its own limitations, there is an increasing concern on the way these two factors are managed to produce desired goods and services. The

1 See the Report of the National Commission on Agriculture (1988:283-288). The time periods have been chosen to coincide with significant infrastructure development. Mangla Dam in 1967 and Tarbela in 1976.

emphasis is on the proper management of irrigation systems than on further infrastructure development.[1]

An issue of special concern to Pakistan is the declining growth rates of food production and crop yields as compared to the rapidly increasing population. The National Commission on Agriculture (1988) refers to a yield growth requirement of 3 percent per year to match the growth in the demand for wheat by the year 2000. Even to achieve an annual yield growth rate of 2 percent, it is estimated that the average yield in irrigated areas would need to increase substantially from 1.8 tons per hectare in 1984-86 to 2.5 tons per hectare by 2000 (Byerlee and Siddiq 1989). Annual yield and production levels in both wheat and rice for the last decade as shown in Figure 4 and Figure 5 indicate. the difficulty in achieving this target.

When neither the irrigated area nor the cropping intensity can be increased any further, the effort has to be necessarily in increasing the productivity. An increasing realization under these circumstances is that productivity improvement has to result from better management and by bringing about a "management sense" into the systems operations which are currently in an "administrative mode" and also by benefiting from modern tools of management science.

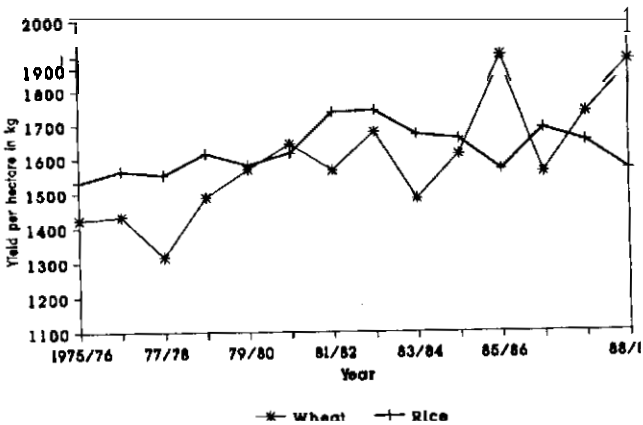
It is arguable, however, whether any management innovation that has been or can be developed can be of effective assistance when confronted with the existing static institutional framework. What can be more often identified is a gradually worsening situation regarding the institutional impact on performance, which is leading the irrigation systems to a stage of "unmanageability" (Murray-Rust 1989). It is an easier task to develop management innovations and even to bring about an awareness on the value of a more dynamic management approach, than to see them applied in the "real life" situation which is often characterized by institutional barriers rather than by institutional support.

What management science can offer in this instance, in terms of management techniques or decision-support systems, is of limited value. It is in this institutional context that management has been found to be a myth

---

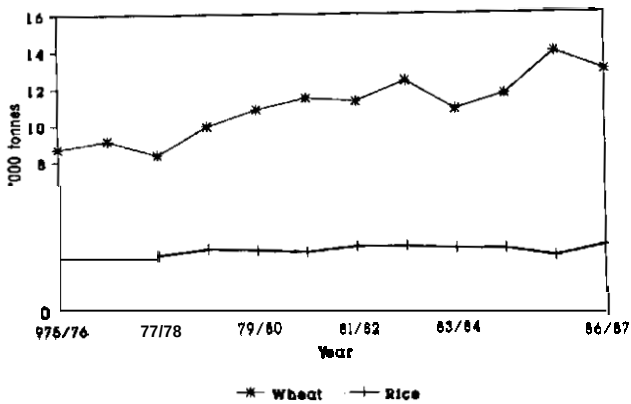
1 See Johnson III (1990). Analyzing data on irrigation investments by donor organizations and development banks, Johnson points out that better O&M funding and improved management would determine future levels of investment in irrigation in Asia. The failure on the part of Asian countries to make the necessary policy changes is identified as the major problem.

Figure 4. Annual yields of wheat and rice



Source: Agricultural statistics of Pakistan 1988-89.

Figure 5. Annual production of wheal and rice.



Sources: Agricultural statistics of Pakistan 1985, and National Commission of Agriculture 1988.

in most irrigation projects in the tropics (Bromley 1987).[1] The reason for considering this as a myth in the South Asian context is further clarified by the following authoritative statement by an Indian analyst (Sundar 1984):

> *In a socio-political situation where what is legitimate is what one can get away with, can there be any concern about public system performance? And if there is no desire to manage, what can management techniques do? In the land of nudists, what can a washerman do?*

Some of the recent research findings by IIMI in Pakistan point toward similar difficulties in the application of management innovations. The existing equity conditions along the secondary canals of the Lower Chenab Canal Gugera Branch were found to differ substantially from the design assumptions (Bhutta and Vander Velde 1989; Bhutta 1990), and different management options to reduce inequity were developed by means of a computer-based hydraulic model (Bhutta 1990). The application of any of these options, however, requires not only some structural modifications (changes in existing design criteria), but also changes in several operational rules and procedures. Without positive support from departmental policymakers, the system manager is unable to effect any change at his level. More importantly, without the cooperation from the more influential farmers who stand to benefit from the existing pattern of operations, new management options can never be effectively introduced.

An emphasis on **resource** development and technological change neglecting the necessary adaptation in the overall institutional framework does not achieve desired optimum results in irrigation performance. Also, an emphasis on sporadic structural adjustments in existing irrigation organizations without considering the need to review their underlying rules is also unproductive. In attempts to improve irrigation performance in many

---

1 Bromley argues that management is the missing key ingredient in the successful operations of irrigation systems in developing countries because they have not yet addressed the real market value of water. An unappreciated distinction between technique and institutions. divisions of responsibility, and an institutional vacuum that has existed in many countries since the demise of colonialism are seen by him as parts of this problem. While agreeing with his observation that management techniques are useful only in the presence of proper enabling institutions, this paper identifies the problem of excessive influence by informal institutions which negates the effect of formally established institutions.

instances, irrigation rules have been a relatively neglected area. While management improvement is seen as the most fruitful intervention at this stage when resource and technical inputs are reaching limitations, returns to such interventions can be realized only by appropriately changing the rules and roles to remove the institutional barriers which hinder effective application of management innovations.

A few attempts at organizational experiments aimed at better inputs coordination and user cooperation (e.g., Command Water Management Projects and Water Users' Associations) have not yielded desired and satisfactory results. The failure is attributable to perceived narrow objectives of these pilot trials, and the fragmented approach to institutional change. More importantly, the passive role of the PIDs in these attempted innovations seems to have contributed to this failure in no small measure.

CHAPTER 7

Conclusions

ACCORDING TO THE broader definition adopted in this paper, institutions include both rules and roles. In the management of irrigation systems, the imgation rules comprising formal laws, regulations and procedures, as well as informal traditions, customs, rights and practices are as equally important as the irrigation organizations which, in fact, are the structured work roles determined by such rules. Some of the formal rules are also the tools of management in its regulatory aspects.

In any social system, its external and internal constraints, formal and informal institutions, and its ability to formulate policies are closely interlinked. Together they determine the degree of management performance. However, within a given framework of constraints, possibilities exist to change institutions and gain flexibility for formulating and implementing new policies, provided that the mutuality of influence between institutions and policies is given due recognition. The greatest barrier to foster improved performance is an attitude that tends to show reluctance and diffidence in changing existing institutions and policies, despite the common realization that they are inappropriate for current needs. In such a static situation, illiterate farmers, politicized administration, and informal social pressure are the persistent reasons attributed to suboptimal performance.

Among the institutional factors that affect Pakistan's irrigation performance are the problems of complex and outdated formal rules and procedures compounded by the overriding effect of several socially evolved informal institutions, and the associated management deficiencies of a static administrative structure. Original intentions of ensuring strict discipline for codified behavior in water distribution, as well as in water use, can no longer be achieved through the present institutional framework, due to changed circumstances in the social and physical environments.

With the changes in the sociopolitical systems after the demise of colonialism. the modem democratic values and the old cultural values have Started to run parallel to each other. often resulting in conflicting

manifestations in the field. An appropriate congruence between these two aspects should be the basis for any reform in irrigation rules to make them widely acceptable, and reasonably beneficial to the majority. The changes in the physical environment such as increased population, increased demand for land and irrigation, newly surfacing ecological threats, newly introduced technology, and the advent of groundwater development pose interesting challenges to irrigation management. To meet these challenges effectively, the system managers require appropriate institutional adaptations to convert present institutional barriers to useful institutional support.

A centralized administration designed to control a large supply-oriented canal irrigation system has lost its effectiveness, if not largely its relevance, in an emerging demand-oriented system. The regional and location-specific management requirements imposed by additional tube-well water on the one hand, and different cropping patterns and intensities, different environmental conditions and different social characteristics on the other, characterize this emerging demand pattern. Centralization needs to be replaced by appropriate decentralized mechanisms, remote control by more intimate performance monitoring, and narrow departmentalism by greater coordination.

Review of formal irrigation rules, measures to arrest the dysfunctional effect of some informal rules, and an overall assessment of the whole structure of irrigation organization are the urgently needed research and policy initiatives. They are the prerequisites for appropriate institutional adaptation to meet the changing needs of improved irrigation performance in Pakistan. More specifically, the paper identifies the following priorities:

i. Revising of Canal Acts and Amendments into a composite set of legal instruments taking account of present needs and the increasing rigor of informal institutions, and incorporating more viable implementation mechanisms with adequate beneficiary participation;

ii. Updating all manuals of procedure into a composite code to enable improved planning, implementation and management control at different levels:

iii. Rationalizing forms, registers and returns making them not only compatible with modern management information systems but useful for current needs of performance assessment;

iv. Reviewing present organizational structures of PIDs with a view to removing present administrative anomalies and making them more effective in supporting and monitoring irrigation management at Divisional level where greater farmer participation can be achieved in decision making: and

v. Introducing measures to increase general awareness and communication among the farmers as well as the operating staff.

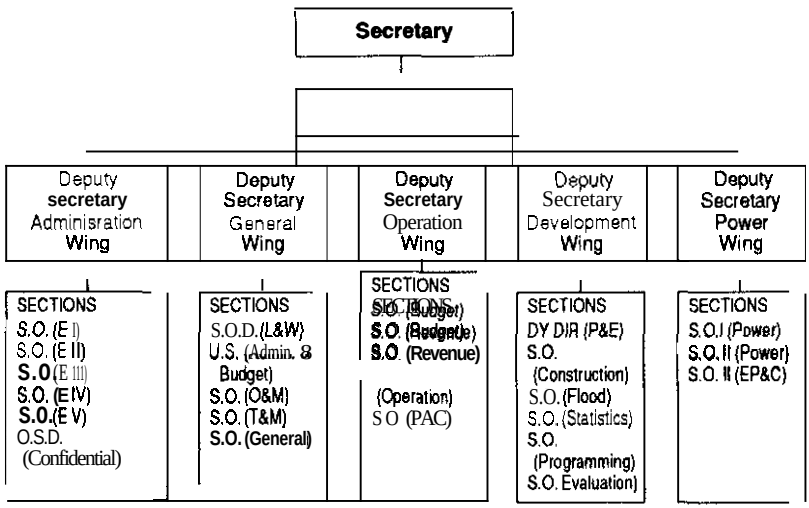
Any form of institutional change requires positive support from senior managers and policymakers. Such attempts can be fruitful when they are strongly based on local initiatives and on a full understanding of the prevailing internal and external constraints, and when they are correctly placed in the socioeconomic context.

Appendix

Punjab Irrigation and Power Department

THE DEPARTMENT IS headed by the Secretary, Irrigation and Power, under the direction of the Minister for Irrigation and Power. The Secretary is assisted by one Additional Secretary and five Deputy Secretaries in charge of five Wings: Administration, General, Operation, Development and Power. The secretariat has about 200 members of supportive staff. Figure 6 gives its organizational pattern up to the level of Section Officers.

Figure 6. Organization at secretariat level, Punjab PID.



Notes: S.O. = Section Officer; U.S. = Under Secretary; O.S.D. = Officer on Special Duty; E. = Establishment; T&M = Tubewell and Machinery; PAC = Public Accounts Committee; P&E = Planning and Evaluation; DY DIR = Deputy Director; EP&C = Evaluation. Planning and Coordination; L&W = Land and Water Development; Admin. = Administration

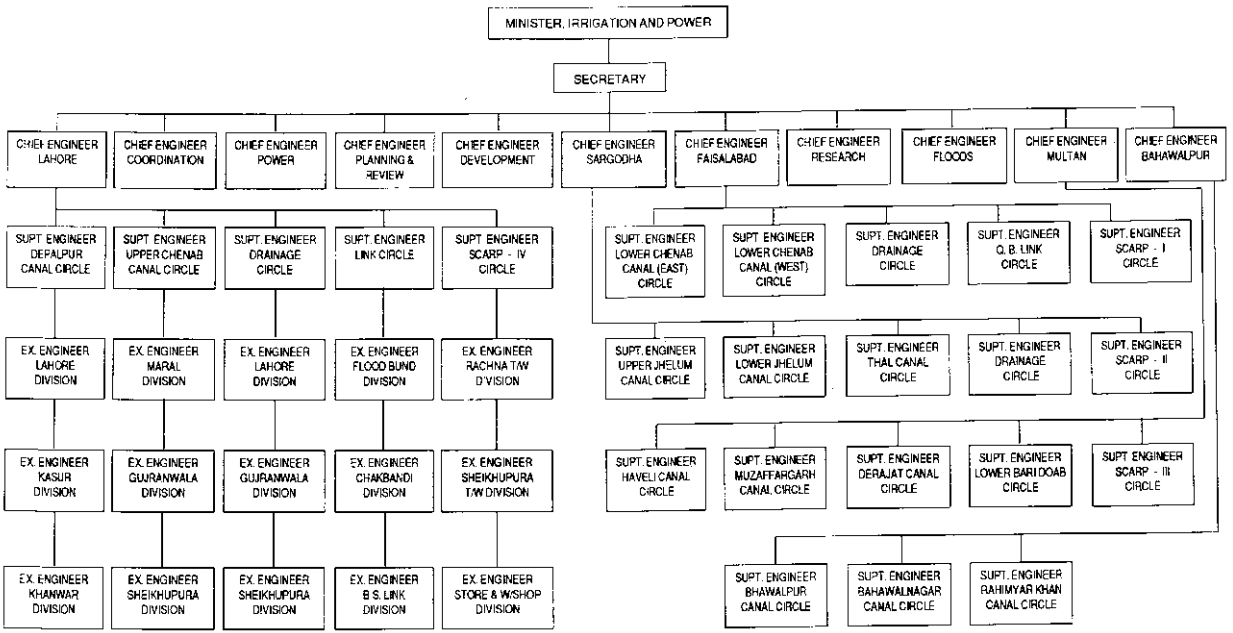
For administrative purposes, the Department is divided into ten Zones or Regions, each administered by a Chief Engineer. Among them, five Chief Engineers have territorial jurisdiction over different parts of the irrigation system, while the other five Chief Engineers have functional duties and provide services to the territorial Chief Engineers. For example, Chief Engineer, Research is responsible for research in hydraulic problems and other allied fields connected with Soil and Water, and Chief Engineer, Development provides services such as excavation machinery and workshop facilities required by the field. The schematic representation of this arrangement is given in Figure 7.

As seen from the schematic diagram, each Region or Zone headed by a Regional/Operational Chief Engineer (CE) has a number of Circles, each under the charge of a Superintending Engineer. These Circles are of two types: Operational or Open Canal Circle, and Functional or Servicing Circle. In each Region, there are two to three Operational/Open Canal Circles, and some subject-specific Circles such as Drainage, Tube-Well Operation, and Link Canal.

CIRCLES

So far as the management of the canal system is concerned, an Open Canal Circle is a complete unit responsible for operation, maintenance, regulation, water distribution, recording of irrigated area and assessment of water revenue of one complete canal system under its charge. A Superintending Engineer (SE) being head of a circle is responsible for all operations concerning one canal system. His headquarters is normally located close to the center of the system to provide easy access to the irrigators. As shown in the schematic diagram in Figure 7, there are 15 Main Canal Systems and thus there are 15 Open Canal Circles. His jurisdiction is territorial and extends up to the irrigation boundary of the canal system in his charge. For example, the jurisdiction of the SE, the LCC East Circle extends from the Head of the Upper Gugera Branch at Sagar to the tails of the system up to the Haveli Canal, a length of about 150 canal miles, to distribute 4,029 cusecs through

Figure 7. Organization chart, Punjab PID.



Notes: SUPT. = Superintendent
Q.B. = Qudirabad - Balloki
EX. = Executive
T/W = Tubewell
D.S. = Deputy Secretary
W/SHOP = Workshops
B.S. = Balloki - Sulemanki

3,006 outlets serving a culturable command area of 1,607,935 acres. For this purpose he has to maintain and operate channels about 1,271 miles long.

A Superintending Engineer has powers under the Canal and Drainage Act VIII of 1873 as Superintending Canal Officer to hear appeals of the irrigators against the decisions of Divisional Canal Officers (Executive Engineers) and his decisions are final and binding on all parties.

DIVISIONS

For operation and maintenance of a canal system, a Circle is further divided into two or three Divisions. An Executive Engineer, popularly referred to as XEN, is in charge of a canal Division under the administrative control of the Superintending Engineer. The Division is the executive unit for operational activities, and the Executive Engineer is the "kingpin" of the department. The engineers above him are controlling and directing officers while engineers and staff under him are to assist him to perform his field duties. He is the custodian of basic records and has up-to-date information on the situation in the command area, and monitors the regulation and water distribution of all channels in the Division.

An Executive Engineer has multidisciplinary duties to perform and is given authority in this regard. He is required to conduct surveys and investigations, prepare schemes and estimates and execute works, with approval by the SE in case of estimates above the value of Rs. 25,000. He is required to collect hydraulic and other technical data, to watch the performance of the channels in his charge, and to initiate action for corrective measures.

On financial and accounting matters, an Executive Engineer, as Head of a Division, is independently responsible to the Director, Audit, Finance Department, Punjab. For this purpose, the Director, Audit, posts a Divisional Accountant as his representative to assist the Executive Engineer to maintain the accounts of the Division properly and to exercise initial check.

To administer the canal supplies and to settle the disputes of irrigators, an Executive Engineer is gazetted as a "Divisional Canal Officer" under the Canal and Drainage Act of 1873. He is declared a First Class Canal

Magistrate to perform his duties under the Canal Act. All claims, disputes and complaints of irrigators are decided upon by him as the Divisional Canal Officer.

An Executive Engineer also has to perform duties as a Revenue Officer. In this capacity he is responsible for recording area irrigated under each outlet along with crop data and then preparing demand statements for the collection of water rates at the end of each crop season. These demand statements are submitted to the District Civil Administration for collection of revenue. The Executive Engineer has, under his control, a Revenue Wing headed by a Deputy Collector.

SUB-DIVISIONS

A Division is further subdivided into three or four subunits known as Sub-Divisions, each headed by a Sub-Divisional Officer (SDO) who is a qualified engineer. He is also recognized as the Sub-Divisional Canal Officer under the Canal and Drainage Act of 1873 and has the powers of a Magistrate Class I1 to adjudicate cases concerning the canal offenses under the Canal Act and to settle disputes among irrigators. He holds delegated administrative and financial authority for his area as a subunit of the Division.

The SDO is responsible for the operation and maintenance, distribution of water, and "booking" the irrigated area in the portion of canal commands in his charge, under the administrative control of the Executive Engineer of the Division. A Sub-Division, ordinarily, consists of three or four Engineering Sections and two to three Zilladari Sections.

SECTIONS

The smallest unit on the Engineering side is a "Section." The Head of a Section is a Sub-Engineer who is basically a diploma holder in Civil Engineering. He is responsible for the distribution of supplies and the maintenance of distributaries/minors up to about 100 to 150 cusecs

discharge. Sub-Engineers' offices are located in canal colonies along the channels at about 5-mile intervals to ensure more intimate surveillance over irrigation supplies. The Sub-Engineer who is assisted by Masons, *Mistries* (a Mistry is the supervisor of 3 to 4 Mates; he also assists the Sub-Engineer), Males (a Mate is the head gangman of a gang of 8 Beldars) and Canal Patrols/*Beldars* (a Beldar who is also known as a gangman is an Irrigation Department workman who patrols canal embankments and carries out routine maintenance. One Beldar is usually employed for 2 miles of main canal and for 6 miles of distributaries or minors) for maintenance and watching of channels, also has gauge readers under him for regulation and observation of water flow. Each canal colony has a Rest House for inspecting officers to stay and a telegraph/telephone office for transmitting the gauge readings and other important regulation and urgent messages.

The smallest unit in the PID's revenue organization is the Zilladari Section, headed by a Zilladar, the canal official who supervises the work of about 10 *Patwaris* (Irrigation Record Keepers). A Zilladar is a direct recruit having a degree from a recognized university, preferably a B.Sc. in Agriculture. After selection, he undergoes six months' field training under a serving Zilladar and is required to pass the Patwari examination after which he is posted as a Patwari for one crop period. A further four-month training is given in the Land Revenue Department before he is posted as a Zilladar. A Patwari is selected from accepted lists in each Division, and given not less than three months' practical training after which he has to pass the Palwari examination for being posted as a canal Patwari. Each Patwari is supposed to record an extent of irrigation of 3,000 to 5,000 acres, and thus, a Zilladar's supervision covers an area of about 30,000 to 50,000 acres. Zilladars' offices are also located in canal colonies along with the Sub-Engineer to facilitate easy access for irrigators.

Figure 2 gives the Organization Chart of the Zonal Chief Engineer, Irrigation, Faisalabad (with details on one SE and one XEN), and illustrates the hierarchical arrangement involving different levels of staff in a typical Zone.

SE, THE LCC EAST CIRCLE

The Superintending Engineer, the Lower Chenab Canal Fast Circle is responsible for the operation, maintenance, regulation and distribution of water of the Upper Gugera Canal taking off from the LCC at Sagar Head with adesigndischargeof 6,000 cusecs along with the Mianwali Branch with a dischargeof 523 cusecs, having a territorial jurisdiction over the command area of the Upper Gugera Canal, the Mianwali Branch, the Lower Gugera Branch and the Burala Branch canals. It covers a gross area of 1,910,877 acres from Sagar up to the Haveli Canal where the tails of the Lower Gugera and Burala Branch canals end.

The Circle is composed of three Divisions: the Upper Gugera Division, the Lower Gugera Division and the Burala Division. Their salient statistics are given below in Table 6

Table 6. *Salient statistics of the LCC East Circle.*

Name of Division	Length of channel (canal miles)	Q cl channel (cs)	No. of outlets	GCA (acres)	CCA (acres)	Annual irrigation (acres)
U.C. Division	435	1.653	1,050	701,133	576,233	763,612
L.G.Division	429	1,834	989	621.524	521,064	696.677
Burala Division	408	1,542	947	588.220	510,638	704.723
Total	1.271	4,029	3,006	1,910,877	1,607,935	2,165,012

UPPER GUGERA DIVISION

The Upper Gugera Division extends over the irrigation boundary or commandarea of the Upper Gugera Branch Canal from its offtake p i n t from

the LCC Main Canal at Sagar Head to RD 282,000 covering a gross area of 701,133 acres. This Division maintains 444 miles of channels and distributes 1,632 cusecs of water through 952 outlets and irrigates about 763,600 acres annually.

The Executive Engineer, the Upper Gugera Division is also the indenting officer for the LCC East Circle. He collects indents from all three Divisions and places a composite indent on XEN Khanki Division for releasing supplies to the Upper Gugera Branch at Sagar Head.

The Upper Gugera Division is further subdivided into three Sub-Divisions: the Farooqabad Sub-Division, the Mohlan Sub-Division, and the Pucca Dalla Sub-Division.

FAROOQABAD SUB-DIVISION

The Farooqabad Sub-Division is responsible for the O&M of the Upper Gugera Branch Canal from Head to control point RD 161,000 and the distributaries offtaking from the Upper Gugera Canal in this reach. The jurisdiction of the SDO, Farooqabad, covers a gross area of 216,367 acres for which a discharge of 462 cusecs is distributed through 226 outlets with an annual irrigation of 237,800 acres. The SDO is responsible for the O&M of 137 miles of the distributaries.

The Farooqabad Sub-Division is further subdivided into three Engineering Sections: the Farooqabad Section at Farooqabad Canal Colony, the Ajinianwala Section at Ajinianwala Canal Colony, and the Gajiana Section at Gajiana Canal Colony.

Each Section is headed by a Sub-Engineer, a diploma holder in Civil Engineering. This is the smallest engineering unit, which is also closest to the farm level. The Sub-Engineer of the Farooqabad Section is responsible for the operation and maintenance of the Ghaurdour and Lagar distributaries, and thus in volumetric terms, for the distribution of about 100 cusecs. His jurisdiction as far as water delivery is concerned is only up to the canal boundary or the *mogha* (outlet). He has a labor force under his charge for watching and maintaining channels. The Sub-Engineer, Farooqabad, has the following establishment for performing his duties:

Supervisors/Mistries	=	3	
Assistant Supervisors	=	5	
Gauge Readers	=	11	(One for each Regulation Site)
Regulation Patrols	=	10	
Canal Patrols/Beldars	=	39	(One Beldar/2 miles of main canal and One Beldar/6 miles of distributaries/minor)
Gatekeepers	=	2	
Bullockmen	=	3	(One cart + 2 Bullocks)

The Farooqabad Sub-Division is also divided into five Revenue Sections, each headed by a Zilladar. A Zilladar has jurisdiction over the watercourse command, beyond the outlets, and supervises the work of about 10 "Canal Patwaris" under his charge. A Canal Patwari is the official who makes the initial recording of area irrigated on which the canal water revenue is assessed and collecled. A Canal Patwari is placed in charge of a Halqa consisting of a defined group of villages. A "Halqa" is generally defined on the assumption that each Patwari will cover about 3,000 to 5,000 acres of irrigation per annum.

References

Associated Consulting Engineers, **1990.** Nationwide study for improving procedures for assessment and collection of water charges and drainage cess. Report (Volumes I-III) submitted to the Government of Pakistan.

Bhatti, M.A. and J.K. Kijne. **1991.** Irrigation allocation problems at tertiary level in Pakistan. ODI-IIMI Irrigation Management Network Paper 90/1C, London: Overseas Development Institute.

Bhutta, M.N. 1990. Effect of varying discharges on the equity of water distribution in the irrigation system. Ph.D. dissertation, Centre of Excellence in Water Resources Engineering, University of Engineering and Technology. Lahore, Pakistan.

Bhutta. M.N. and E.J. Vander Velde. **1989.** Performance of secondary canals in Pakistan Punjab: Research on equity and variability at the distributary level. Paper presented at the Internal Program Review of IIMI. Colombo, Sri Lanka: International Irrigation Management Institute.

Borlaug, N.E. **1987.** Making institutions work A scientist's viewpoint, in Wayne R. Jordan (ed.), Water and Water Policy in World Food Supplies. College Station, U S A Texas University Press.

Bromley, D.W. **1987.** Irrigation institutions: The myth of management, in Wayne R. Jordan (ed.), Water and Water Policy in World Food Supplies. College Station, USA. Texas Univenity Press,

Byerlee, Derek and Akmal Siddiq. **1989.** Is Pakistan's green revolution sustainable? An analysis of wheat yields in the Punjab. **1965-2000.** Mimeo, Mexico: CYMMIT.

Caponera, Dante A. **1968.** Evolution and concepts of water legislation, *Annales* Juris Aquarum, Proceedings of the International Association for Water Law, September **1968.**

Cernea. Michael M. 1987. Farmer organization and institution building for sustainable development, in Regional Development Dialogue, Vol. 8, No. 2. Nagoya, Japan: United Nations Centre for Regional Development.

Chambers, R. 1980. In search of a water revolution: Questions for managing canal irrigation in the 1980s, in Report of a Planning Workshop on Irrigation Water Management. Los Banos, the Philippines: International Rice Research Institute.

Chambers, R. 1987. Food and water as if poor people mattered: A professional revolution, in Wayne R. Jordan *(ed.)*. Water and Water Policy in World Food Supplies. College Station, USA: Texas University Press.

Coward, E. Walter Jr. 1977. Small groups and large projects: Technology, organization, and irrigation performance. Paper prepared for the 13th American Water Resources Conference, Tucson. Arizona, **USA.**

Flannery, Kent V. 1972. The cultural evolution of civilizations. Annual Review of Ecology and Systematics, 3:399-426.

Government of Punjab. 1987. Punjab Public Works Department Revenue Manual.

Hai, Akhtar A. and S.A. Hussaini. 1989. Factors impeding the formation of effective water users associations in Sindh, in Jamshed Tirmizi and Bradley Parlin (ed.), Societal Dynamics and Irrigation Systems, Islamabad, Pakistan: Pakistan Council of Research in Water Resources.

Hamid, Naved and Wouter Tims. 1990. Agricultural growth and economic development: The case of Pakistan. Development Centre, Paris: OECD.

Hart. H. 1978. Anarchy, paternalism. or collective responsibility under the canals. Economic and Political Weekly 13, Bombay, India.

Hickson, David J.; Derek S. Pugh; and Diana C. Phesey. 1969. Operations technology and organization structure: An empirical reappraisal. Administrative Science Quarterly, 14: 378-397.

International Irrigation Management Institute (IIMI). 1989. The strategy of the International Irrigation Management Institute. Colombo, Sri Lanka: IIMI.

Johnson III, Samuel H. 1990. Progress and problems of irrigation investment in South Asia in Water International. Vol. 15. ***USA*** IWRA.

Korten, Frances. 1982. Building .national capacity to develop water users associations: Experience from the Philippines. World Bank Staff Working Paper No. 528.

Lecaillon, J.; C. Morrisson; H. Schneider; and E. Thorbecke. 1987. Economic policies and agricultural performance of low-income countries. Development Centre Studies. Paris, France: OECD.

Lusk, M.W. and B.W. Parlin. 1988. Bureaucratic and farmer participation in irrigation development, WMS Report 89, Logan, USA Utah State University.

Malhotra, S.P. 1982. The warabandi system and its infrastructure. Publication No. 157. New Delhi: Central Board of Irrigation and Power.

Merrey. Douglas J. 1979. Irrigation and honor: Cultural impediments, to the improvement of local level water management in Punjab, Pakistan. Lahore: CSU Water Management Research Project, Field Report No. 9.

Merrey, Douglas J. 1987. The local impact of centralized irrigation control in Pakistan: A sociocentric perspective, Chapter 17 in Lands at Risk in the Third World: Local-Level Perspectives, Peter D. Little et al. (ed.), London: Westview Press,

Merrey, Douglas J. and James ,M. Wolf. 1986. Irrigation management in Pakistan: Four Papers, IIMI Research Paper No. 4. Sri Lanka: International Irrigation Management Institute.

Merrey, Douglas J. 1990. Warabandi in Pakistan, Chapter 28. In Management of Farm Irrigation Systems (Prepublication Draft). American Society of Agriculture Engineers.

Ministry of Food, Agriculture and Cooperatives. 1985. Agricultural statistics of Pakistan 1983-84. The Government of Pakistan. Islamabad.

Ministry of Food, Agriculture and Cooperatives. 1991. Agricultural statistics of Pakistan 1988-89. The Government of Pakistan, Islamabad.

Mirza, Ashfaq H. 1975. A study of village organizational factors affecting water management decision making in Pakistan. Water Management Technical Report No. 34. Fort Collins, USA Colorado State University.

Mirza, Ashfaq H. 1989. The dilemma of organizing water users associations in the Punjab, in Jamshed Tirmizi and Bradley Parlin (ed.), Societal Dynamics and Irrigation Systems. Islamabad, Pakistan: Pakistan Council of Research in Water Resources.

Murray-Rust D. Hammond. 1989. Selecting the appropriate management strategy. Proceedings of the Asian Regional Symposium on Rehabilitation and Modernization of Irrigation and Drainage Systems, Vol. 2, Hydraulic Research, Wallingford, UK.

Nasir, A.D. 1981. A practical treatise on analytical study of the Canal and Drainage Act (VII of 1873). Lahore, Pakistan: Mansoor Book House.

National Commission on Agriculture. 1988. The report of the National Commission on Agriculture. Islamabad, Pakistan: Ministry of Food and Agriculture.

Nayman, Oguz B. 1988. Information-seeking habits of farmers: An exploratory survey. Punjab-Pakistan (unpublished report).

Perrow, Charles. 1970. Organizational analysis: A sociological view. Belmont California: Wadsworth publishing Co.

Punjab Public Works Department Revenue Manual. 1987.

Radosevich, George E. 1975. Water user organizations for improving irrigated agriculture: Application to Pakistan, Water Management Technical Report No. 44, Fort Collins, USA Colarado State University.

Radosevich, George E. Water laws and institutions in Pakistan: Colorado State University.

Sadler, B.S. 1981. Communication strategies for heightening awareness of water. Report 2 of IHP II, Paris: UNESCO.

Silliman, Jael and Roberto Lenton. 1987. Irrigation and the land-poor, in Wayne R. Jordan (ed.), Water and Water Policy in World Food Supplies. USA: Texas University Press.

Sundar. A. 1984. Modern techniques for management of irrigation systems: What can they do in theabsenceofcommitmenttomanage? Wamana, July, Indian Institute of Management. Bangalore, India.

Takahashi, Akira. 1970. Land and peasants in Central Luzon: Socio-economic structure of a Philippine village. Honolulu: East-West Center Press.

Takase, K. and T. Wickham. 1977. Irrigation management and agricultural development in Asia. Paper prepared for the second Asian agricultural survey, Asian Development Bank.

Vander Velde, E.J. 1990. Performance assessment in a large irrigation system in Pakistan: Opportunities for improvement at the distributary level. Paper presented at the Regional Workshop on Improved Irrigation System Performance for Sustainable Agriculture, Food and Agriculture Organization, Bangkok, 22-26 October 1990.

Wade. Robert. 1982. The system of administrative and political corruption: Canal irrigation in South India. Journal of Development Studies, 18, 287-328.

Wade, Robert. 1987. Managing water managers: Expropriation, or equity as a control mechanism, in Wayne R. Jordan (ed.), Water and Water Policy in World Food Supplies. College Station, USA Texas University Press.

Wakil, Pervez A. 1970. Exploration into the kin-networks of the Punjab society: A preliminary statement, in Muhammad Fayyaz *(ed.)*. Pakistan Sociological Writings, Vol. 1.

World Bank. 1990. World Development Report. 1990.

Zaidi, Akbar S. 1990. The big picture, In Election '90 Special Issue of The Herald, October 1990. Karachi.