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IMPROVING PERFORMANCE OF IRRIGATION BUREAUCRACIES: SUGGESTIONS FOR SYSTEMATIC ANALYSIS AND AGENCY REORIENTATION

Norman Uphoff

with

Priti Ramamurthy and Roy Steiner

Irrigation Studies Group
Cornell University
Ithaca, New York

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Previously a working group at Cornell focused on improving irrigation management through increased farmer participation, leading to a policy paper (Uphoff et al., 1985) and a book (Uphoff, 1986). This study goes beyond that analysis by considering how to improve the performance of bureaucracies having responsibility for irrigation management in developing countries. The authors of this study organized a series of seminars on this subject with members of the Irrigation Studies Group during the fall of 1986 to clarify issues and concepts for our analysis. During the academic year 1986-87, we prepared a draft of this report, which was reviewed both critically and constructively at a workshop held at Cornell May 13-15, 1987. Participants in that workshop who helped improve the analysis by criticisms and suggestions are acknowledged below. With these comments plus further review of literature and case studies, we revised the report to its present form.

Because the subject of irrigation bureaucracy is a relatively new one for analysis, however old it is in practice, we regard this as a first effort to define and shape an important field of inquiry and prescription. Some of our conclusions are analytical and others are prescriptive. Analysis is seen as preparing the ground and offering guidance for prescription. As our title suggests, we believe that improving performance of irrigation bureaucracies involves both (a) systematic analysis of factors that affect irrigation system performance and of the bureaucracies contributing to this, and (b) agency reorientation through strategies that alter the structures, processes, norms and capacities of bureaucracies.

We undertook this effort hoping to find common ground between irrigation practitioners -- engineers, technicians, administrators, policy makers -- and researchers -- social scientists of various disciplines and, we hoped, students of business and public administration. There are major knowledge gaps with regard to irrigation management as conducted by government agencies. By seeking to communicate with such a wide-ranging audience we run the risk of satisfying few readers. However, we trust there are enough practitioners who are attracted by academically-informed inquiries into problems that they continually confront and enough academics who want to engage in research and evaluation to improve the use and payoff of scarce resources so that this book will find an influential readership. We were encouraged in this hope by the response from participants in our May 1987 workshop. They, to be sure, may not agree with everything we have written and should not be considered responsible for the formulations here (except where credited).

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Norman Uphoff
Department of Government
Cornell University

Priti Ramamurthy
Dept. of Social Science
Syracuse University

Roy Steiner
Dept. of Agric. Engineering
Cornell University

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Ithaca, New York

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It is people who make changes, and those with the greatest power to make them are the managers in charge. Whether it is improving scheduling, reducing losses at night, instituting farmer-joint management, or other interventions, the managers usually hold the initiative. They are not just part of the system. For purposes of reform they are the key. To understand their environment, motivation and behaviour is, therefore, crucial in the search for realistic ways to improve performance.

Robert Chambers (1988: Ch. 9)

PART I

FACTORS AFFECTING IRRIGATION PERFORMANCE

Chapter 1

ASSESSING PERFORMANCE OF IRRIGATION BUREAUCRACIES

There is widespread agreement in international circles on the need to improve the management of irrigation systems in developing countries, to increase the efficiency of water use and the productivity of irrigated agriculture. Indeed, a new international research center, the International Irrigation Management Institute (IIMI), has been set up based in Sri Lanka to augment the worldwide knowledge base and stock of expertise on this subject.

The U.N. Food and Agriculture Organization, the U.S. Agency for International Development and other donor agencies which have previously promoted the expansion of irrigated area are now giving priority to "management" concerns on the grounds that existing irrigation systems should be utilized more efficiently before investing more resources in new ones. More and more national governments, facing mounting financial problems and fewer good sites for new systems, are establishing irrigation management units, branches, divisions, etc. These are expected to enhance the capacity of bureaucracies to achieve more comprehensive and coherent supervision of irrigation activities.

At one time, the tasks of irrigation management were seen as essentially "technical," as being within the domain of certain specialists, particularly engineers. Without denying the need for such expertise, irrigation is increasingly understood as a *socio-technical* enterprise, with organizational and cultural factors weighed alongside physical and material ones. While technical personnel are integral to irrigation success, so are the objectives and capabilities of water users.[1] Still although *farmer participation* has begun receiving considerable attention, the *government agencies* responsible for management of many irrigation systems have not gotten much consideration from researchers, apart from suggestions that reorientation of these agencies is needed (e.g., Korten and Uphoff, 1981). Governments are searching for ways to improve the performance of their irrigation bureaucracies, yet there is little knowledge base that they or the donor agencies and consultants assisting them can draw on.[2]

As there is now fairly wide acceptance of participatory irrigation management, we see a need for more systematic analysis of the tasks and problems of irrigation bureaucracies, presuming that officials and water users are to function together in joint but differentiated management roles. This will involve reexamination of the structure, capacity and performance of agencies responsible for the operation and maintenance (O&M) of any irrigation systems not wholly under user management.

We all use the term "management" to refer to actualizing the potential of existing irrigation systems. It thus encompasses all those responsibilities designated by the standard shorthand term, O & M, standing for operation and maintenance, rather than activities of design and construction which establish irrigation systems. Activities of redesign and reconstruction do, however, from such a perspective constitute part of irrigation management.

1.1 ANALYZING AND IMPROVING IRRIGATION MANAGEMENT

Focusing on irrigation management leads one to view irrigation not only as a socio-technical enterprise but also as an organizational-managerial one. It requires drawing on disciplines like public administration and social psychology and on interdisciplinary bodies of theory like organization theory and cognitive science. This is unfamiliar intellectual terrain for most persons working in and on irrigation management. Because the conjunction of these academic concepts and practical concerns is so new, our efforts to bring them together must be exploratory. We hope that our analysis will promote wider examination and experimentation by providing a more coherent map of the subject.[3]

Before improving the performance of irrigation bureaucracies, this performance must be assessed in appropriate ways. We see assessment as having three main points of reference:

(a) the irrigation *system* itself -- what kind of system is involved? What are its physical possibilities and constraints as well as the human relationships associated with it? The socio-technical system sets certain *limits* on and provides certain *opportunities* for water management, which one should know before trying to make improvements.[2]

(b) the *objectives* of irrigation management -- what and whose values are to be maximized or optimized? What if these are in conflict? How will they be reconciled? How may objectives change over time? Objectives provide the *criteria* according to which management is undertaken and by which it is to be evaluated.

(c) the *context* of irrigation management -- what are the surrounding conditions affecting what is possible and what is desirable? Context determines or modifies not just the *criteria* but also the *capacity* for irrigation management.

These focuses of concern are analyzed in the following three chapters. In Chapter 2, appreciating that irrigation management tasks will not be the same in all systems, we develop a *typology* of irrigation systems and look at differences in the *structures* through which irrigation is managed, introducing the concept of administrative "gradient" and suggesting descriptive variables for comparing these structures.

In Chapter 3, we consider *objectives* of irrigation management, recognizing that irrigation bureaucracies are continually "in the middle." Three different sets of actors have goals for an irrigation system which need to be considered and accommodated. Unfortunately, listing them this way implies that each category is more homogeneous than is in fact true. Within each of these sets there is likely to be some *diversity* and even *conflict* of objectives, though each has different interests within the irrigation enterprise vis-à-vis the other two. The difficulty and success of irrigation management will be crucially affected by the respective expectations of:

(a) *national policy makers* -- they have invested public resources in the irrigation system and usually perceive a stake in what it accomplishes in terms of increased output, reasonable operating and maintenance costs, year-to-year stability of production, etc. They are also interested in things like elections and regime stability.[4]

(b) water users -- they value adequacy and reliability of water deliveries along with other criteria, seeking understandably to maximize household benefits and to minimize household costs, not only in economic terms but viewed comprehensively to include also social, status and other factors.

(c) irrigation agencies -- while these are established to further the objectives of (a) and (b), they are also concerned with minimizing their own costs (in terms of budget, effort, embarrassment, etc.) and maximizing their returns (security and amount of income, stability and power of agency, etc.) as analyzed by Downs (1967), for example.

It might be argued that the personal considerations of irrigation staff should not be considered because they are employees of the government (and indirectly of the public, which includes water users). They should therefore do as they are instructed. However, achieving the objectives of policy makers and water users depends to a significant extent on supportive performance of irrigation agencies, on more than minimum levels and on a quality of service that cannot be coerced but rather requires a degree of voluntarism. So the interests of (c) cannot be ignored if only because of considerations of morale.

The irrigation bureaucracy plays a key role with regard to management objectives because it is in the middle between the government and the public, whose goals do not always coincide. Even if there is a coincidence of goals, such as between certain politicians and more advantaged (bigger) farmers, such a situation leaves the bureaucracy "in the middle," dealing with pressures to downplay equity and efficiency and yet satisfy publicly-stated aims.

To the extent that national policy makers do not want what the large majority of farmers want for themselves, but instead stress other objectives like improving the balance of payments or having the lowest possible government expenditure, the bureaucracy is caught in between, and assessing and improving its performance becomes that much more difficult.

The term "bureaucracy" is used throughout our discussion, it should be said, without any negative connotation. Our discussion here is in the tradition of the German sociologist, Max Weber (1947), who analyzed bureaucracy as providing needed expertise, skills and organizational capacities to manage "modern" technologies and public affairs. Others may use the term pejoratively, but we do not.[5]

One major consideration in assessing performance, as discussed in Chapter 3, is the extent of compatibility of objectives between government and water users. Staff of the irrigation agency constitute a critical third set of actors who can tilt one way or the other -- or operate somewhat independently of both. This latter possibility is not desirable or tenable, but the point is that no one should not assume that the bureaucracy will invariably be working to further others' goals.

The influence of a system's environment on the goals for its management and on agency performance (as well as on the assessments to be made thereof) should not be underestimated. Yet it should not be treated in a deterministic way.[6] There is so much variation in performance within countries or regions, where environmental influences are essentially the same or quite similar, that these influences offer weak "causal" explanations. However, they still they need to be examined because they affect what performance can or should be aimed for.

We would identify six categories of contextual factors:

(a) agro-ecological,
(b) technical,
(c) economic,
(d) historical,
(e) socio-cultural, and
(f) political-legal.

The latter of these (d, e and f) tend to be more uniform within a country than the first ones (a, b and c), which are more likely to differ from system to system. Yet all can have substantial bearing on the performance of irrigation bureaucracies, so we examine them in Chapter 4.

Before attempting to suggest how such performance could be improved, one must analyze the structure, orientation, activities, capacities and linkages of irrigation bureaucracies themselves. This is a large task and could be the subject of an entire book. In Chapter 5, we deal with it in a summary but systematic way. This provides an analytical foundation for the suggestions that follow in Part II.

This second part presents different strategies for improving bureaucratic performance, guided where it seems appropriate by techniques and concepts from business and public administration since so little is available on irrigation management as such in the literature. Chapters 6, 7 and 8 lay out alternatives and principles and, where possible, offer experience to guide any efforts to make irrigation agencies more effective in achieving their goals consistent with those of policy makers and water users.

Our strategy has been to build on whatever richness in description, rigor in analysis, and cogency in evaluation we can draw from diverse published sources, as discussed below. The bibliography at the end of this study (pages 263-290) will itself be of interest to readers.

Beyond our own efforts, we have enlisted the thinking of colleagues elsewhere who have experience and insights relating to the problems of development administration and specifically of irrigation management. We have invited a number of commentaries on our analysis and suggestions for Part III. A final chapter pulls together our conclusions from this collaborative effort.

1.2 BUILDING AN EMPIRICAL BASE

Recognizing that the literature on irrigation bureaucracy is thinner than for our previous endeavor analyzing farmer participation in irrigation management, we settled for a smaller number of "cases" -- 10 instead of 50 -- to be focused on from available materials. These are listed in Table 1.1. We chose them for geographical representativeness; the majority are from Asia because most LDC irrigation is to be found there.

Cases with extensive documentation on the performance of irrigation bureaucracy were hard to come by for several reasons. Whereas anthropologists and sociologists, and sometimes economists and political scientists, have examined farmer participation in system management, few researchers have focused on the bureaucracies involved in irrigation. Access to them is more difficult to obtain than for rural communities of water users. An unstated and significant reason may be the sensitivity of the subject. The detailed case studies done by Bottrall as a data base for his excellent analysis of "management and organization of irrigation projects" (1981) were never published for this reason.[7] We hope that by making this subject more analytical and less arbitrarily judgmental,

Table 1.1
CASES REVIEWED FOR STUDY OF IRRIGATION
BUREAUCRACY PERFORMANCE

SOUTH ASIA

INDIA: Andhra Pradesh systems (Ramamurthy, Wade)
Large-scale bureaucratic systems; "administered" by zones and regulation; water allocation down to lower levels

PAKISTAN: Punjab systems (Merrey, Clyma, Lowdermilk, Wolf)
Large-scale bureaucratic systems; "administered" by warabandi system of water allocation down to middle levels

SRI LANKA: Gal Oya (Uphoff, Wijayaratna, Murray-Rust)
Medium-scale bureaucratic system, with revised system of management to include water user associations

SOUTHEAST AND EAST ASIA

PHILIPPINES: NIA systems (Bagadion, de los Reyes, Valera)
Formerly bureaucratic systems, with new approach of joint management involving WUAs after BRO

SOUTH KOREA: FLIA systems (Wade)
Medium-to-small scale bureaucratic systems with structured farmer involvement in management

TAIWAN: Irrigation Association systems (Abel, Levine, Moore, Stavis) All scales of system; devolved management with irrigation staff being employees of water users

AFRICA

KENYA: Mwea (Chambers and Moris)
Medium-scale highly bureaucratic system, with some change over time

NIGER: ONAHA systems (Goldring, Laucion, Norman)
Small-scale pump systems, operated by bureaucracy, with improving relations with farmers

LATIN AMERICA

MEXICO: SRH systems (Greenberg, Hunt, Lees)
Bureaucratically-run systems of various sizes

PERU: Plan Meris and other systems (Lynch, Mitchell)
Bureaucratically-run systems of various sizes

our work can encourage more published documentation on the workings of irrigation bureaucracies.

The cases listed in Table 1.1 on the previous page were analyzed using a proforma developed for extracting and comparing data from published materials, augmenting these with knowledge from within the Cornell Irrigation Studies Group of those systems where members had personally done research or consulting.[8] We had, of course, broad familiarity with the general literature on irrigation management to draw on. Moreover, the empirical review for our previous study had covered some 50 cases worldwide and gave varied glimpses of irrigation bureaucracy performance that added to the knowledge base for this discussion. Unlike that previous sample of experience, however, here we have limited our purview to cases where irrigation management was solely or substantially the responsibility of a government agency.

Readers will find frequent reference to the Gal Oya system in Sri Lanka because that is where we have had the most extensive personal involvement with these issues. (Also there has been substantial improvement in the performance of the irrigation bureaucracy and irrigation system there.) Directly or through colleagues we have enough contact with the other situations that we feel comfortable taking them as empirical reference points, not relying only on the written record. Unfortunately, not all the cases have exhibited much improvement in performance. So not all offer much guidance in positive terms as do, for example, the Philippine and Taiwan cases.

1.3 MAJOR DIFFERENCES IN SYSTEMS AND THEIR OPERATION

Most of the variables we deal with in this analysis are continuous, that is, they represent a continuum of cause or effect. However, at our workshop, there was consensus that two major differentiations -- practically typological distinctions -- need to be made when considering irrigation management. One differentiation reflects the <u>kind</u> of system being dealt with, whereas the other contrasts the <u>strategies</u> proposed to remedy shortcomings. We sketch these distinctions in this first chapter here because they have broad implications for analysis and prescription.

1.3.1 Existing vs. New Systems of Irrigation.

In some ways, it looks as though there is a contrast to be made between "Asian" and "other" systems in terms of their management requirements. Where irrigation bureaucracies are starting up new systems, which may include resettlement of farm families, establishing input supply and marketing networks, training water users in irrigation techniques, etc., as often necessary in Africa or sometimes in Latin America, the complexities are several-fold greater than where irrigation is a long-established enterprise, as in most of Asia. There water users and engineers, merchants and administrators, moneylenders and maintenance personnel all know their tasks and are able to proceed with less intervention and ad hoc adjustment.

We concluded that the differences for management were not between continents, however. A practical distinction arises in terms of how many generations the various parties to irrigation management have been involved in their tasks and have been accustomed to working together. Most of the systems in Asia are fairly long-established, especially compared to the majority of systems in Africa. (Latin American systems cover the full range from old to new.) Rather than construct a geographic typology, we decided to call attention to the difference it makes in the extent and kind of management required when one has an irrigation system several or many generations old compared to one in the first or second generation of operation.

A newer system's advantages in terms of usually requiring less maintenance may be more than offset by disadvantages arising from operational uncertainties and confusions therein. Agencies managing older systems are likely to be focused on water supply and delivery, whereas in younger ones, to ensure utilization and promote profitability, agencies are commonly given a variety of social and economic tasks beyond simply technical activities to perform. This issue is treated specifically by Roe in Chapter 11, highlighting the challenges facing irrigation management in Africa. The assessment of irrigation management problems in Latin America by Bromley in Chapter 12 similarly gives attention to the difficulties arising from a preoccupation with new design and construction compared to those of operation and maintenance, though the priority for the former under conditions of macroeconomic austerity in turn aggravates the latter.

1.3.2 "Managed" vs. "Administered" Systems. A second distinction derives from the orientation of the 12 agencies that have responsibility for irrigation systems. Some agencies are oriented toward flexibility and adaptation, toward learning new methods and strategies, varying activities in accord with differentiated or changing conditions and objectives; others proceed more according to predetermined schedules, criteria, instructions, guidelines, etc. The distinction can be described as "managing" systems in contrast to "administering" them. [9]

In our analysis and prescription, we have tended to favor the first. But this reflects the orientation one finds in the literature on business and public administration which emphasizes flexibility and adaptation in organizational practice. The literature has a preference (some would say bias) for dynamic, "learning" organizations. On the other hand, it can be argued that for the specific tasks of irrigation, one wants predictability and reliability above all; so if operations and maintenance can be completely routinized, they should be. Careful optimization of water use may be beyond the information and staffing capacities of an agency or perhaps it is less important an objective than quite predictable or equitable distribution. Then a highly routinized operation may be better than a continually changing and adapting one.

There are partisans on both sides of the debate. Some consultants seek to build flexibility and learning capacity into irrigation bureaucracies; others wish to orient the whole bureaucratic system around an "administered" irrigation regime such as the <u>warabandi</u> system used in northern India and Pakistan.[10] Which is a better approach will depend in large part on the objectives and context of irrigation, analyzed in Chapters 3 and 4. There is probably some correspondence between this and the preceding distinction (in Section 1.3.1), with an administrative approach being more appropriate to more established irrigation systems than to new ones, other things being equal.

The choice between "management" and "administration" of irrigation systems may not lend itself to a compromise -- adopting some of both alternatives to achieve an optimum. Organizations probably need to head in one direction or the other, since combining the approaches may undermine the benefits of each. Introducing some "flexibility" into a system can undermine its reliability and predictability, and having even some "regimentation" tends to interfere with learning and adaptation.

Perhaps the two approaches can be combined by applying them at different levels (as defined in Section 2.1). Or maybe they should be utilized at different times under different conditions, as Levine (1987) has documented for Taiwan.[11] There is not enough basis in the theoretical or empirical literature to take sides on this issue, to try to chose between "administration" and "management." As noted already, their merits are situation-specific, so no broad generalizations are offered. But we will consider this distinction from time to time in our analysis and we want readers to think about these contrasting approaches.[12]

1.4 ASSUMPTIONS ABOUT PERFORMANCE

Because this study seeks realistic assessments of performance, management will always be considered in <u>relative</u> terms, with regard to the characteristics of the system itself and in terms of prevailing objectives and contexts. No absolute standards such as hypothetical "efficiency" (equal to 100%) should be erected or applied. Absolute judgments only make for confusion and hard feelings.

Second, the <u>costs</u> of management always have to be taken into account, to understand the <u>net benefits</u> from any attempted improvement. Because costs are an ever-present reality -- and usually increase as the intensity of management goes up -- one needs to think in terms of "optimizing" rather than "maximizing" management. Perhaps reluctantly, engineers have concluded that 100% efficiency in water use is not just unattainable but also undesirable. However attractive such a goal might sound, attaining it is uneconomic because as management inputs are increased, the returns to management diminish and the unit costs of management rise, eventually exponentially.

Improvement in irrigation bureaucracies' performance is thus not to some abstract ideal. It should be commensurate with the cumulative benefits attainable -- for the government, for water users, for the bureaucracy itself -- relative to the combined costs which all of them must bear in achieving and sustaining a particular level of management. Otherwise, no matter how polished and professional is the performance of the organizational-managerial system, that of the socio-technical system it serves cannot be maintained and will suffer.

FOOTNOTES

[1]This concept of irrigation as a socio-technical enterprise was discussed in Chapter 1 of Uphoff (1986). This study follows from but goes beyond the documentation and analysis presented in that 1986 work coming from the Cornell Irrigation Studies Group on farmer participation in irrigation management.

[2]Efforts such as described in Jones and Clyma (1987) can help to improve irrigation agency performance through training, using techniques such as Diagnostic Analysis, but their foundations are more pragmatic than theoretical.

[3]The International Irrigation Management Institute (IIMI) has recognized the importance of this subject and initiated some work on this subject about the same time that we started our research under the Water Management Synthesis II Project supported by USAID. IIMI has made only a modest investment so far in terms of commitment of staff time. As noted in the Acknowledgments, we benefited from long-distance interaction with the IIMI professionals considering this subject, Dr. Douglas Merrey and Dr. Namika Raby.

[4]Within this category there may be locally-based politicians who have certain interests that diverge from nationally-defined ones. In so far as they have some influence on national policy makers, the impact of this category becomes more complex.

[5]When this study was reported on to several institutions doing irrigation research, training and management in India during the summer of 1987, the term "bureaucracy" had to be removed from the title of the presentation. Such sensitivity vanished as soon as discussion of the subject began, because this is a concept widely understood and used by engineers themselves.

[6]In a quantified study of the influence of environmental factors on organizational performance, few significant associations were found (Esman and Uphoff, 1984). A detailed case study of rural development experience in Botswana tried to establish a strong role for the physical or cultural "environment" as a determining factor. But it could not do so because performance varied so widely within a common physical and cultural environment (Brown, 1987).

[7]In the report itself, a World Bank Staff Working Paper, any identification of country or project covered by the four field studies from India, Indonesia, Pakistan and Taiwan was eliminated (p. ii). We were able to review but not to cite the case studies in question.

[8]The ten countries were well covered by participants in the workshop who had previously worked in one or more of them: India: Anders, Blair, Chambers, Keller, Kumar, Levine, Ramamurthy, Staines, Wade, Walter; Kenya: Chambers, Roe; Mexico: Goldring, Palacios-Velez; Niger: Goldring, Lynch, Norman; Pakistan: Clyma; Peru: Bromley, Lynch; Philippines: Levine, Moya; South Korea: Wade; Sri Lanka: Chambers, Clyma, Levine, Parlange, Senthinathan, St. Julien, Uphoff; Taiwan: Levine, Montgomery. Other countries where workshop participants had experience related to irrigation management were the Dominican Republic, Egypt, Ghana, Indonesia, Israel, Morocco, Nepal and Malaysia. A senior administrator from ONAHA in Niger was invited but unfortunately could not attend.

[9]We use the terms here as Jon Moris does: "Administrative skills are in large part routine. Managerial responses consist of diverse actions taken to meet changing demands" (1981: 119). The terms can be variously defined and distinguished, even regarding "management" as routine activities to attain preset goals and "administration" as the more creative, parameter-changing activity.

Fairchild and Nobe (1985) describe how in Pakistan a "management by result" system, noted in Chapter 6, is being introduced to convert a system of irrigation "administration" into one of "management." The distinction they make is between a system where attention and control of managers (administrators) are focused almost entirely on inputs, while greater weight is given in the latter to performance monitoring and evaluation.

[10]This is a system where water is distributed among farmers' fields within fixed allocations of time (flow) that are in proportion to the fields' respective areas. Farmers get their water according to a prearranged schedule that is supposed to be strictly followed, whether or not the water received meets farmers' estimation of need. As there is not enough water to meet all demands, this system is one for rationing scarce supplies in a predetermined way, as described by Reidinger (1974).

[11]Levine says that under "normal" conditions, a Taiwan irrigation system "operates as an 'administered' system rather than a 'managed' one, i.e., the water is delivered continuously to the outlets in accordance with pre-established rules. Water allocations generally are in accord with 'prior rights,' the rights that were associated with the original canals, modified to insure that all areas receive at least the minimum considered necessary for reasonable operation of the system." When there is a shortage of water supply, with agreement among farmers and system managers, the operation shifts to "technical rules" and original rights no longer hold. "Water allocation is then made at the working station level in accordance with the needs of the crops as locally determined. Water measurement is more careful and more often." Farmers are encouraged to hire a "common irrigator" (usually someone from another area) to handle water distribution continuously and intensively. (See footnote 1 of Chapter 3.) Levine says that under stress, management control defaults upward in Taiwanese systems. "A greater proportion of the system is being managed and a smaller fraction administered." (1987: 7-11) In one system where such "management" was introduced in a season with water supply only 50% of normal, 95% of normal production was achieved.

[12]Having introduced an analytical distinction between "administration" and "management," we have a problem of what to call the generic activities of irrigation system operation and maintenance that can be carried out in either a more "administered" or a more "managed" way. We will use the word management as the general term because that is the sense in which it is most widely and commonly used. When we want to distinguish between the approaches analyzed in this section (1.3.2), we will use quotation marks.

Chapter 2
VARIATIONS IN IRRIGATION MANAGEMENT STRUCTURES

Structure is one of the most common terms used in discussing irrigation, covering many different aspects. An irrigation system contains multiple _physical_ structures such as weirs, channels and gates that capture, convey or control water. All together these make up the physical structure of an irrigation system as a whole (examples are sketched in Figure 2.1 below). Bureaucratic agencies and water user associations each represent _organizational_ structures that establish patterns of authority, communication and other interaction among the people involved in irrigation. Taken together these constitute the _management structures_ of irrigation systems. Such structures, the subject of this chapter, arise from the relationships that exist among technical and administrative staff and water users who are respectively and jointly engaged in the management activities analyzed in the first section of Chapter 3.

Any structure of management is shaped by existing physical and organizational structures. But most important, it must be suitable to the kind of irrigation system that is to be managed. So we begin by considering different _types_ of irrigation systems that may be needing better management. Then we look at ways in which their overall management structures can vary. These structures are mostly made up of bureaucratic organizations and personnel, but include water user associations where these exist.

Starting with a focus on _structures_ is not to suggest that this fully or adequately represents the many _processes_ involved in irrigation. Looking at the "skeletal structure of irrigation is no substitute for understanding the "metabolic processes," but it is a more tangible and intelligible place to begin. Structural analysis has the limitation of not giving enough attention to factors of emergence and change, but we will bring in more dynamic aspects of irrigation management as our analysis proceeds.

2.1 TYPES OF IRRIGATION SYSTEMS

To continue with biological analogies, the animal kingdom offers some interesting parallels for analyzing the variety of socio-technical systems found in irrigation. Among animals there are obvious differences in <u>size</u>, as between an elephant and a mouse; in <u>structure</u>, e.g., among creatures having wings, fins or legs; in <u>technology</u>, e.g., whether oxygen is obtained through lungs or gills; and in <u>organization</u>, e.g. whether living in herds, packs, flocks, schools, etc. or as isolated individuals or pairs.

Irrigation systems analogously vary from large to small, having different structures resulting from various combinations and layouts of physical parts, acquiring water by alternative means (dams, weirs or pumps, for example), and with several kinds of management arrangements possible. Moreover, like animals, some irrigation systems can <u>respond and adapt</u> readily to changes in their environment while others cannot. This characteristic is important for systems' survival. It derives from flexibility in physical structures but even more from capacity to learn and to modify behavior.

One advantage which irrigation systems have over animals is that their physical structures can be deliberately planned and changed and their operation altered. As human enterprises, adaptability, learning and improvement should be part of irrigation systems' capacity, though as discussed in Section 1.3.2, the goal may be to arrive at a steady-state, pre-programmed manner of operation and maintenance.

A prerequisite for improvement is better understanding of the elements involved and of how they relate to each other. This requires both <u>analysis</u> -- breaking complex phenomena into categories that produce insight -- and <u>synthesis</u> -- putting the pieces together into effective wholes. <u>Both</u> analysis and synthesis are based on induction and deduction because each kind of effort to improve understanding requires empirical observation and logical coherence.

What is desirable and possible in an irrigation system's performance will be conditioned by the nature of that system. To return to our analogies from the animal kingdom, size, structure, technology and organization in irrigation systems represent major variables to be considered along with flexibility and learning capability. For animals, the accepted classification scheme has been developed according to the principle of propinquity of descent. This differentiates mammals, birds, fishes, insects, etc. more or less by their structures and their biological technologies.[1] These variables do not appear so suitable for classifying irrigation systems, however, as size and mode of organization appear more illuminating.

This is partly because the physical structure of irrigation systems is relatively similar across all kinds, as suggested in Figure 2.1. The main difference found in the structure or layout of systems is in the number of levels of operation and organization they have, defined by a hierarchy of points at which water can be divided and controlled. This number correlates with size, since the number of levels in systems corresponds generally to "orders of magnitude" in respective command areas.[2] But the number of levels does not translate directly into size, or vice versa.

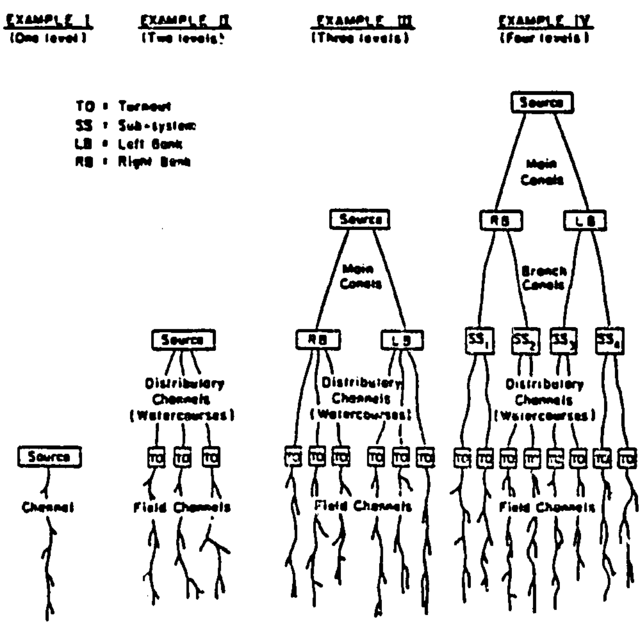

Figure 2.1: IRRIGATION SYSTEM STRUCTURES, BY NUMBER OF LEVELS

Levels essentially replicate themselves, and there is great similarity across systems when comparable levels are considered, that is, when levels are numbered from below.[3] There is no evident way to use structure, an inherently qualitative variable, for constructing a typology of irrigation systems except through classifying systems by their number of levels of operation and organization, as suggested below.

Differences in the structure of irrigation systems do not appear to be associated with the type of technology used for water acquisition.[4] Gravity flow and groundwater systems, when one controls for size, are similarly configured as in Figure 2.1 above. All have a water source with main and subsidiary channels that carry, divide and spread the supply.

It is true that some technologies can present certain difficulties for management -- pump systems, for example, require a reliable supply of power and spare parts -- but their effects lie not in the technologies themselves. If pumped water is managed more carefully by agency staff and water users, it is because such water is usually more costly. In gravity-fed hill irrigation systems in Nepal, for example, where much effort must be expended by users to get and maintain a supply of water, it is managed as carefully as in any pump system (Martin and Yoder, 1987).

Although reservoir systems in principle have a more known and predictable water supply than river diversion systems, in areas of reliable rainfall the latter can have very steady water availability, while some reservoirs have considerable year-to-year variation. Thus what bears on management is characteristics like cost or certainty of supply, rather than technology as such. The main organizational options, discussed next, are also similar across technologies.

Alternative modes of organization do diverge across sizes of irrigation system, at least to some extent. This provides a basis for classifying systems, to sort out a limited number of types of systems from the large and heterogeneous variety found throughout the world. The principal options for operating an irrigation system according to differences in organization are:

(a) management entirely or mostly by water users, or

(b) management mostly by agency personnel.

The latter option (b) in principle includes the entire management of irrigation by agency staff, that is, down to the farm level. But in practice even in "agency-managed" systems, water users play some role at least at the field channel or watercourse level in decision-making, resource mobilization, communication, and conflict resolution, the four basic organizational activities involved in irrigation management analyzed in Uphoff (1986).

In "user-managed" systems (a), on the other hand, while agency personnel may play a supportive role at higher levels, it is farmers who are basically responsible throughout for decision-making, resource mobilization and management, communication and coordination, and conflict resolution.[5]

The variable of size is in principle a continuous one, there being no natural cut-off points according to command area or the volume of water flow that can be applied across all situations. However, by considering differences in structure (the number of levels sketched in Figure 2.1), one can make distinctions of scale that are reasonably objective and relevant to tasks of irrigation management. These interact with the organization variable to produce a simple but differentiating typology. Irrigation systems can be classified as follows:

(a) small-scale systems have either one or two levels of operation and just one or a few points of water control where the flow can be reduced and/or divided. These systems usually serve less than 100 acres or only several hundreds of acres.

(b) medium-scale systems have three or four levels of operation at which water flows can be reduced and/or divided by control structures. They will range from about 1,000 acres upward to several tens of thousands of acres; the maximum is in the range of 50,000-100,000 acres but with no more than four levels of water division and control.

(c) large-scale systems have more than four levels and command areas from 50,000 to 100,000 acres or more, up to millions of acres in some countries.

The reason for making these distinctions is that management tasks differ considerably in such scale terms.[6] Users can handle irrigation responsibilities for one or two levels of operation quite readily in autonomous systems, just as they can manage such activities in the lower one or two levels of larger systems if given authority, even <u>de facto</u>, and some support. It is not efficient for agencies to deploy staff to manage very small systems or to work at these lowest levels, unless there are special circumstances like the need for technical skills to maintain the pumps that serve certain small-scale ground water schemes.

When an irrigation system has more than two levels, it is possible for users to continue to discharge management responsibilities, but a more formal mode of organization and some equivalent of "bureaucracy" is needed even in a user-managed system, with specialized, hired personnel. Beyond two levels, there is more reason on grounds of efficiency and technical need for an irrigation agency to exercise control over the water source and distribution. Still, the tasks of management in this range of size and complexity are not so demanding compared to large-scale systems.[7]

With more than four levels, both size and complexity transform the problems of irrigation management. It is practically impossible for water users on their own to handle such systems, and the mode of organization for agency management must take on a more prominently bureaucratic form.[8]

The three <u>size</u> categories given on the preceding page subdivided by <u>mode of organization</u> produce five types of irrigation systems as shown in Figure 2.2. They could each be subdivided and differentiated, but we consider them here as general types. Other criteria could be used, such as water conditions (abundance vs. scarcity) or cropping system (paddy/rice vs. other crop production).[9] But the types below we think have more robust definition and these other criteria get considered in Chapter 4 on the <u>context</u> of irrigation management.

Three of these types (B, C and D) encompass the large majority of irrigation systems and the largest share of irrigated acreage. We find some cases of user-managed, medium-scale systems (E) with elaborate and impressive organizational mechanisms for mobilizing resources, allocating water, resolving conflicts, etc. Examples include farmer-managed systems in the plains of Nepal and in the Philippines which cover 10,000 and even 40,000 acres (Pradhan, 1983; Yoder et al., 1987; Siy, 1982). Still, large multi-tiered organizations are more the exception than the rule in farmer-managed systems.

	Small-Scale (1-2 levels)	Medium-Scale (3-4 levels)	Large-Scale (5+ levels)
Agency-Managed	A	B	C
User-Managed	D	E	Not Found

Figure 2.2: TYPES OF IRRIGATION SYSTEMS, BY SIZE AND ORGANIZATION

Small-scale agency-managed system (A) are somewhat more common, though complete agency management for gravity flow systems of just one level, under 100 acres and served by a small reservoir or weir, is infrequent. The costs of providing such management are simply too great, and farmers are quite capable of handling irrigation of this scale and complexity. Agencies sometimes have responsibility for pump systems where the technology is unfamiliar to farmers, and problems of maintenance and fuel supply must be overcome, as with the SAED irrigation systems in Senegal (Fresson, 1979). In so far as pump technologies tend to serve command areas under 1,000 acres, there is some correlation between technology and scale.

The one type not found is large-scale, user-managed systems with more than four levels of operation and organization, a hypothetical F. At least we have not seen any documentation on this kind of irrigation system.

When size or scale get defined in terms of structure and there is some correlation with technology, the resulting typology based on size and organization actually reflects all four of the variables discussed at the start of this section. The other feature mentioned -- adaptability and learning capacity -- is not treated as a defining characteristic of types because it is a variable in all kinds of systems.

Having made some general distinctions among types of irrigation systems, we will look analytically at variations in the available structures for carrying out management activities.

2.2 SHAPES OF IRRIGATION MANAGEMENT STRUCTURES

It is no accident that the layout of irrigation systems is similar for all types. The first requirement of all systems is acquisition of water and then conveyance to fields. This requires the division and subdivision of flows as water is moved from one or a few sources to many points of use. The resulting structure resembles the branching of trees (or their root systems) as shown in Figure 2.1 above.

A hierarchical system of decision-making and communication, with resource mobilization and conflict resolution first within and then between branches derives from physical relationships that are common to all irrigation systems. Not to follow the pattern they establish would be like having a platoon in one military regiment report to and take orders from officers in a different regiment.

Having a hierarchy of units, sub-units and sub-subunits need not determine the shape of the resulting organizational pyramid, however. To examine such relationships, we switch to geometric metaphors. An organizational structure can be relatively tall and narrow, steeply sloped as in Pyramid A below, or it can be shorter and broader with flatter gradients as in Pyramid B.

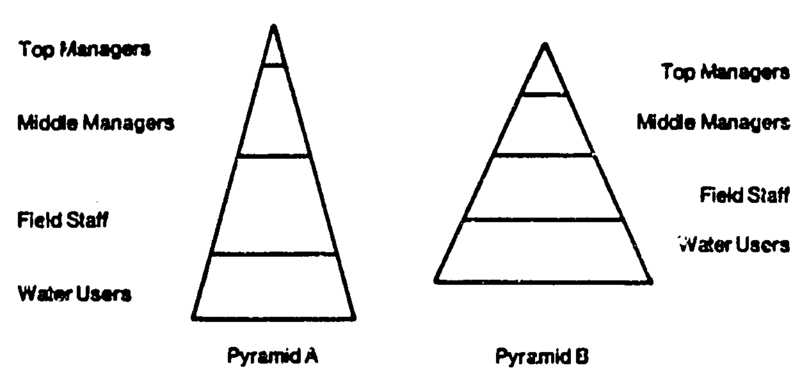

Figure 2.3: ALTERNATIVE SHAPES OF ORGANIZATION MANAGEMENT STRUCTURES

This graphic representation of management structures points to differences in what can be called the height and gradient in organizational systems. These reflect and in turn affect <u>the extent and ease of cooperation and communi-</u>

cation within the structure. In irrigation management where a government agency is involved, the terms apply to relations between levels within the bureaucracy and also to those between the bureaucracy and water users. As suggested at the start of this chapter, agency staff and water users together make up the management structure of an irrigation system.

In larger systems, the pyramid will tend to be taller simply because there are more levels. The management structure for a large-scale system must have more overall gradient than for a small-scale one because five or more levels are involved, compared to one or two. But a three-level system with much distance between levels, as discussed below, could have a "taller" organizational structure than a four- or even five-level system where different kinds of distance are kept to a minimum.

2.2.1. Distance. Within organizations, distance between persons and between levels, has a number of dimensions. First, there is spatial distance between persons who have different operation and maintenance responsibilities. This will inhibit interaction within and between levels when persons are spread over a large area. Its effects can be offset, however, by appropriate investments in transportation and communication facilities that reduce the time required for communicating and getting cooperation. Although spatial distance is essentally geographic, its effects on management, impeding communication and cooperation, are temporal as well as social or psychological. It can therefore be better measured in terms of "real time" than in miles or kilometers.

Social distance between senior and junior engineers or between agency staff and water users can be greater or smaller depending on things like cultural norms of maintaining hierarchy or egalitarianism, or on social factors like caste or ethnicity, discussed in Chapter 4. The status attached to higher educational attainment will affect the social distance in a bureaucracy and within the overall management structure. Less educated persons may be expected to "keep their distance" from those who are better educated, to defer to them and to accept whatever the latter say.

There can be also cognitive distance, reflecting degrees of dissimilarity in the way people at different levels within a system view and comprehend the world. If top engineers assess water delivery in terms of its contribution to crop production, as do farmers, there will be less cognitive distance between them than if engineers evaluate delivery in terms of matching some pre-set schedule or minimizing the amount of issues. Maintenance work can likewise be viewed variously at different levels as a duty, as a challenge, as a nuisance, as a source of employment, as an opportunity for profit, or as a means to increase the efficiency of water distribution. Divergent understandings of maintenance will "distance" the various contributors to it from each other.

If the spatial, social and cognitive distances between senior and junior staff or between agency personnel and water users are all great, the corresponding management structure will be more like Pyramid A than Pyramid B in Figure 2.3. Communication and cooperation will be impeded by these different distance factors, as the "height" of the pyramid arises from these factors as well as from the number of levels of operation and organization.

2.2.2 Gradient. In considering differences in irrigation management structures, we found the organizational equivalent of gradient productive of insights. Gradient is a function both of the several kinds of distance just discussed and of the angle of interaction between levels, considered below. A flatter organizational gradient results:

- when the flow of decisions and information is fully two-directional;

- when authority is delegated to lower levels, or when there is participation by those at lower levels in decision-making at levels above them, particularly with regard to control over resources and resolution of conflicts; and

- when persons at higher levels have more accountability to persons at lower levels; in irrigation systems this includes accountability of various bureaucratic levels ultimately to water users.

Conversely, a steeper gradient results from the opposite of these:

- when the flow of decisions and information is more downward than upward;

- when authority is held mostly at higher levels, and persons at lower levels participate little or not at all in decisions such as in allocating resources or resolving conflicts; and

- when there is little accountability of persons at higher levels to those at lower levels.

While the "angle of interaction" is more figurative in our discussion than is distance, it can be given concrete representation in terms of the ratio of downward flows of decisions and information to upward flows. The higher the proportion of top-down communication and control, the greater is the angle. Where there is more delegation of authority, more participation from lower levels in higher-level decision-making, and more accountability of those with authority to persons at lower levels, the structure will be more like Pyramid B because the ratio of upward-to-downward flows is thereby increased. Participation in this context, it should be said, applies not just to water users but equally to agency staff at middle and lower levels in making higher-level decisions.

Although gradient in organizational systems is difficult to quantify, anyone who has studied bureaucracies (and certainly anyone who has worked in them) knows it is a real factor affecting the way organizations function. There is an association between gradient and the types of irrigation systems described above. Small-scale systems will have flatter organizational pyramids as a rule because they have fewer levels, two at most, but also because there is more interactive communication, participation and accountability. Not only will spatial distance be less; there is also likely to be less social and cognitive distance between persons in different management roles, certainly in user-managed systems (D) but also in agency-managed ones (A).

In larger systems, spatial distance will always be more, but the other kinds of distance are likely also to be increased. Managers of large-scale systems will usually have higher educational qualifications than those superintending smaller ones. Social and cognitive distances between the top managers and the lowest level of agency staff will accordingly be greater quite apart from the impedance of communication attributable to physical distance. Investments made in modern transportation and communication facilities to reduce the effects of spatial separation will produce less improvement in performance if social and cognitive distances remain large.

This suggests the importance of decentralization, participation and accountability, which can reduce the angle between levels even in a large system. The number of levels for any given system is fixed by its physical layout and size, but cooperation and communication between levels is promoted or impeded by social and psychological factors. The height and steepness of a five-level organizational pyramid thus depends on how it is structured and managed. It can never be as flat as a two- or three-level structure of organization. But the organizational structure of a certain large-scale system, figuratively speaking, may be twice as high as that of another system with similar command area because of the greater gradient (distance and angle) maintained between levels.

One cannot eliminate all distance, and there must always be some angle. Otherwise the pyramid would collapse and there would be no organization. As in irrigation, one always needs some gradient. Things do not flow without it. But the "hydraulics" of management differ from those in irrigation, where higher gradients are generally more desirable so long as the amount of erosion is not too great. Higher gradients move water more quickly and efficiently, with less loss, whereas low gradients increase siltation and lead to a sluggish system.

In management the reverse is true. Sluggishness increases with steep gradients, and flow is accelerated by low ones. The equivalent of "erosion" may be feared by some managers if the flow of information and decisions becomes too fast. But that is less debilitating for an organization than styles and structures of management that "clog up channels" by discouraging free flow of ideas and honest reporting, make control structures inoperative, and reduce social energy levels within the agency.

2.3 VARIABLES IN IRRIGATION MANAGEMENT STRUCTURES

Having used biological and geometric analogies to shed analytical light on irrigation management structures, what more should be said about them? The literature on organization theory offers some standard kinds of social science analysis. Empirically-based organizational variables can complement the analysis offered in Section 2.2. The four variables discussed below affect an agency's capacity for arrying out irrigation management activities and achieving the management objectives discussed in the next chapter.

Within the field of organization theory, some of the most widely respected studies have been done at the University of Aston in England.[10] Their goal was to identify several fundamental dimensions of structure in bureaucratic organization that are essentially independent of each other. The first two variables singled out by Aston researchers represent two major dimensions of management structures:

(a) concentration of authority, the extent to which authority to make decisions is located at higher levels in the hierarchy and the extent to which outside units, e.g. headquarters, control decisions affecting the organization. (This relates to the factor of gradient discussed in the preceding section.)

(b) structuring of activities, the extent to which an organization exhibits characteristics of:

(i) specialization, division of labor within the organization and distribution of duties among a number of positions performing distinct, specified roles,

(ii) standardization, procedures that are applied invariably, though possibly modified by rules that cover specific circumstances,

(iii) formalization, the extent to which rules, procedures, instructions and communications are written rather than conveyed verbally.

The latter three variables (i-iii) were initially postulated as independent structural dimensions, but factor analysis grouped them together (Jackson and Morgan, 1977: 92-93).

Aston researchers found the variables of concentration and structuring to be inversely correlated; the more concentration, the less structuring. But the opposite appears to be true in irrigation bureaucracies; concentration and structuring (specialization, standardization and formalization) usually go together in the cases considered for this study. Perhaps this is because industrial and agricultural tasks have different management dynamics.

Based on our reading of the irrigation management literature, we would add two additional major variables:

(c) accountability, the extent to which the performance of managers and staff is monitored and can be controlled, either by senior officials and/or by water users in an agency-managed system (or by farmers in user-managed systems); the opposite end of this scale is personnel autonomy.

(d) responsiveness, the extent to which the organization has information flows and decision-making mechanisms at all appropriate levels that permit informed changes in operation for modifying water and other resource use; the opposite of this is unresponsiveness or rigidity.

This latter variable may seem to be the opposite of the second one, which includes standardization. It may be said that there is a tendency in all bureaucracies toward routinization and rigidity, so that structuring takes precedence over responsiveness. But in fact, a bureaucracy can be structured with standardized procedures to be responsive. It was pointed out in our workshop discussion that in Peru there is need for a more effective monitoring system to trigger action by irrigation agencies to deal with flash floods there. These periodically come from the mountains, dumping rubble-loaded water on irrigation systems in the plains. Preventive action could and should be taken to reduce the huge costs of repairing breaches and of removing debris, by closing gates and diverting water into drains in a timely manner.[11] Responsiveness could be routinized.

We considered adding another variable, focusing on agency capacity for learning. An irrigation agency can be responsive with or without learning as exemplified by contrasting two of our cases, India and Taiwan.[12] Severe droughts occurred in Andhra Pradesh in 1976 and 1981. In the first instance, system managers dealt with the shortage of water by devising rotations and by working as much as 18 to 20 hours a day. Unfortunately, when drought recurred five years later, it was as if this had never happened before, as the agency scrambled to devise coping means anew. In Taiwan, on the other hand, after a severe drought in 1955, irrigation authorities established an Institute for the Study of Rotation in Irrigation. After sending out persons to collect and analyze data on dealing with drought, they proposed and institutionalized procedures for abnormal water conditions. In the Taiwan case, one can identify structural features associated with the variable of capacity to learn, absent in the Indian case. Still, learning is a consequence of many things, not just of structural factors. So learning is better regarded more as a consequence of, rather than as a variable in irrigation management structures.

Each of the four main variables can be specified in terms of roles and mechanisms that establish certain kinds of organizational capacities. Structural features respectively associated with these variables would be:

(a) concentration of authority: roles and bodies for decision-making at top levels of an organization but not at lower levels, so that binding decisions can only come from above.

(b) structuring of activities: existence of many specialized operational and management roles quite different from each other, having distinct responsibilities and each operating according to standardized, written rules, procedures and instructions.

(c) accountability: existence of information flows and mechanisms for monitoring and evaluating the performance of personnel having various responsibilities at different levels, with procedures for controls and sanctions.

(d) responsiveness, information flows and mechanisms for making changes in organizational structure and operation according to changes in context or goals.

Taiwan systems exemplifiy this latter variable, with well established procedures for changing the rules of water allocation and distribution in periods of water stress and passing control over water upward within the systems, a "default upward" system of management.[13] Interestingly, responsiveness in these systems is linked to increasing concentration of authority to handle the shortage.

The variable of responsiveness has been characterized in the literature in terms an organization's being well or poorly "joined." This depends on having a variety of communications between the main system and sub-systems at or near the maximum, compared with communication linkages that are weak or only occasional (Ashby, 1960: 205-214). In irrigation, instead of talking about communication between the system and sub-systems, one is concerned with communication between levels.

The extremes of this variable have been characterized as being (a) "organic," with much flexibility for change, innovation and adaptiveness, or (b) "mechanistic," with little flexibility (Burns and Stalker, 1982). This variable is also said to reflect the "degree of openness" in an organization. Organizations operating as "open" systems respond more readily to stimuli from their environment such as energy, information and other inputs, while "closed" ones are more self-contained, seeking to control all external exchanges.

Bureaucracies tend to function as mechanistic, closed systems, yet whether irrigation agencies should operate in that way goes back to issues raised in Chapter 1. Such a manner of functioning may be appropriate, where there is a reasonably complete knowledge base (Section 1.3.1) and the objectives and context are not too complex (Section 1.3.2). Where more complicated and changing demands are coming from the physical, social and political environment, discussed in Chapter 4, more organic, open systems that learn as they carry out tasks will be preferable. Complete flexibility is, of course, never something to be maximized. After all, one way of dealing with management problems is through <u>structuring</u>. Standardization and formalization can be introduced in such a way as to cope with certain constraints in the environment as in the <u>warabandi</u> system found in northern India and Pakistan (described by Reidinger, 1974, and Merrey, 1986).

Concentration of authority and structuring of activities refer to the <u>internal</u> processes of bureaucratic functioning, whereas accountability and responsiveness are more oriented to the <u>external</u> context. The four variables, however, are independent of one another. It is possible to combine high concentration of authority with operations that are more structural <u>or</u> less structured (specialized, standardized, formalized); with personnel being held closely accountable for performance <u>or</u> relatively autonomous; with a system management that is reasonably responsive <u>or</u> practically rigid. A high degree of structuring can go with accountability or autonomy, with responsive or rigid operation. Personnel held closely accountable can be working within a rigid structure or a responsive one, as could more or less autonomous managers and staff. Figure 2.4 makes these possibilities more evident.

Situation A (high concentration-low structuring) represents a very centralized bureaucracy working in an ad

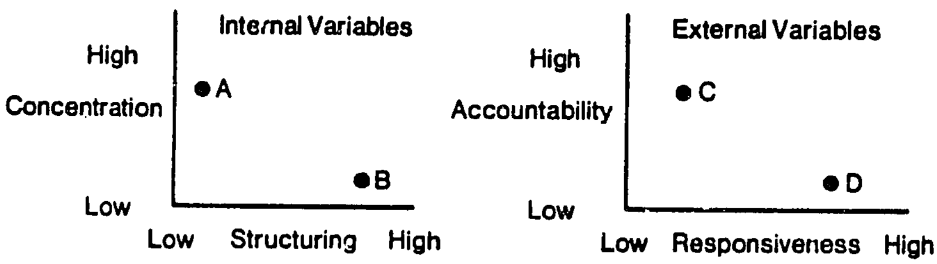

Figure 2.4: DIFFERENT COMBINATIONS OF STRUCTURAL VARIABLES

hoc, even arbitrary manner. This contrasts with Situation B (low concentration-high structuring) where responsibilities are extensively delegated, formally and in great detail. In Situation C (high accountability-low responsiveness), one has a bureaucracy operating with much control over all personnel, according to the dictates of top managers, not keyed to adapting to fluctuating circumstances. The converse situation, D (low accountability high responsiveness), functions with quite autonomous personnel modifying and adapting operations to meet system requirements. This would be possible with a high degree of self-management as discussed in Section 6.2.2.

These four variables characterize major dimensions along which irrigation management structures can vary. Concentration of authority and structuring tend to coincide with higher gradients, according to the analysis in the preceding section, while accountability and responsiveness correspond with lower gradients as do lesser degrees of concentration. Empirically, we find that bureaucracies with lower gradients have somewhat less structuring, but this does not appear to be a necessary relationship. Although standardization is usually associated with rigidity, fixed procedures can be established to promote responsiveness. Likewise, formalization can help to keep personnel accountable downwards as well as upwards.

User-managed systems -- types D and E in Figure 2.2 -- generally have less concentration and less structuring with more accountability and responsiveness than agency-managed ones -- A, B and C (Uphoff, 1986). What does this mean for improving the performance of the latter? It certainly highlights the importance of mechanisms for accountability and responsiveness. But the fact that user-managed systems have less concentration and structuring does not mean that agency-managed systems should necessarily try to do away with these. Rather than minimize these variables, the attempt should be to optimize them. Some concentration of authority and some specialization, standardization and formalization will always be needed in any bureaucracy.

Our purpose in this chapter has been to provide some systematic, sometimes graphic means for dealing with typological and structural variations that are found in the world of irrigation management. Since we are concerned with the performance of irrigation bureaucracies, whether called agencies, departments, bureaus or whatever, we are interested in system types C, B and A, in that order, though our conclusions should be relevant to bureaucracies assisting farmer-managed systems of D and E.

Systems vary not only physically and organizationally but also in terms of the goals they are to serve. As these are relevant to the planning, evaluation and improvement of management, we turn next to this subject of objectives and criteria.

ANNEX: OTHER VARIABLES BEARING ON MANAGEMENT

Some other variables are significant for management but are not so clearly structural. We discuss them in this annex to Chapter 2 for readers who have a special interest in organizational analysis and theory. One can consider, for example, the degree of administrative intensity. Price and Mueller (1986:27) define this variable as:

> . . . the extent to which an organization allocates resources to the management of its output. . . . An organization with a high degree of administrative intensity is sometimes said to have a relatively large "administrative apparatus" or "supportive component."

This variable can be operationalized as the ratio within a bureaucracy of administrative staff [A] to production staff [P], i.e., A/P. Span of control has also been used as a measure of administrative intensity, but Mueller and Price conclude it "does not seem to possess much validity" (1986: 35).

It is difficult to apply this variable to irrigation bureaucracies, perhaps because like much of organization theory it was developed and validated to account for relationships in industrial organizations. The reasons for why it does not seem to illuminate irrigation management are themselves instructive. In irrigated agriculture, there is no clear P (production staff) apart from farmers, who are not part of the bureaucratic structure. If one regards the irrigation bureaucracy itself as "producing" water, it is extremely difficult to separate staff into those who acquire, allocate, convey and distribute water from those who are responsible for running the organization. How does one categorize a superintending engineer or a maintenance worker, as A or as P? If one uses the measure proposed by Blau and Schoenherr (1971) -- the ratio of supervisory personnel to total personnel -- practically all technical staff are supervisors until one gets down to the lowest level of gatekeepers or ditchriders who accordingly would be the only "producers."

One could consider clerical, bookkeeping, transport and other such staff as a percentage of total personnel. But then one is dealing with support staff intensity rather than administrative intensity. It can be meaningful to consider such ratios as the total number of agency personnel per hundred water users or per hundred hectares. But this reflects the overall level of effort or investment being made to provide water to producers, not a variation in organizational structure. Moreover, it tells us nothing about the efficiency of that effort or the productivity of that investment.

Organizational coherence, according to Meyer (1972) the extent to which the dispersed parts of an organization are pursuing common ends cooperatively, seems relevant in irrigation management. If concentration of authority (at each level) is low and activities are only loosely structured, various sub-units could be acting independently in ways that are incompatible with irrigation efficiency, unless there is organizational coherence. This variable, however, is more a reflection of norms than structure. The structural features associated with accountability and responsiveness, described on page 30, should provide as much support for organizational coherence as can be built into the structure of an institution. Actually measuring a variable like organizational coherence is extremely difficult.

We are satisfied that the four structural variables identified and discussed in Section 2.3 are the most meaningful for comparing and assessing structural variation in irrigation bureaucracies. Although we have not presented specific measures of them, they are not abstract. They quite can be made concrete and can be associated with specific roles, activities and relationships.

Price and Mueller (1986) review the literature on a number of the variables treated in organization theory and cover several addressed in Section 2.3. Unfortunately, most are conceptualized for business enterprises or for government institutions in more developed countries, so their salience for our effort here is less than we anticipated when we eagerly started reading their book. Price and Mueller have interesting chapters on centralization (pp. 50-69), which corresponds to concentration of authority, and on the three components of structuring: complexity, defined as formal structural differentiation, i.e. specialization (pp. 100-105); standardization (pp. 237-242); and formalization (pp. 137-150).

Perhaps because industrial organizations are more concentrated spatially (and thus personnel are more easily supervised) and because there is less fluctuation in their conditions of production, accountability and responsiveness were not considered in the handbock of organizational measures. The "autonomy" that Price and Mueller analyzed (pp. 40-49) deals with an organization's relation to its environment and is thus not the converse of accountability as we consider it here, reflecting the autonomy of personnel.

Apart from these reservations and distinctions, we found Price and Mueller's discussions and conceptualizations useful in thinking about this subject. For readers interested in more formal and quantified approaches to this subject, Price and Mueller offer a rich compendium pulling together the findings of classic and recent literature on organization variables.

FOOTNOTES

[1]Visible structural features by themselves give different classifications than when "technologies" are also considered. Dolphins, for example, look like fish but are more related to mammals when one looks at their processes of reproduction, how they nurse their offspring, and how they maintain body temperature.

[2]Irrigation systems with one level of operation (no sub-divisions of the water supply) usually command about 100 acres (40 hectares) or less as does the lowest level of operation in a larger system. A two-level system (like the second level from the bottom of a larger system) usually has up to about 1000 acres (400 hectares), a three-level system (like the third level up) between 1000 and 10,000 acres (40 to 400 hectares), and so forth. Whether a system is in the lower or upper end of these ranges (orders of magnitude) depends mostly on size of landholding. Where units are smaller on average, the command area for any level of operation and organization tends toward the lower end of the range; with generally larger farming units, toward the upper end. See Uphoff (1986: 60-71).

[3]The convention of classifying "primary," "secondary" and "tertiary" levels of operation from above produces immensely different "primary" levels, with command areas ranging from 10 to a million acres. "Tertiary" levels can vary almost as much. So we have suggested terminology that proceeds "from below," to gain more commonality for is referred to by designations.

[4]One could have a typology based on technological alternatives for <u>distribution</u>, basically channel systems as distinguished from sprinkler or "drip" irrigation systems. Because the latter are still uncommon in LDCs, making such a breakdown would shed little light on how to improve management, lumping all non-drip, non-sprinker systems into one large category. <u>Acquisition</u> remains the more salient technological variable.

[5]In Uphoff (1986), we identified a third management category of "jointly-managed" irrigation systems, which covered a large proportion of systems since few systems are purely "agency-managed." Since we are concerned here with improving the contribution of irrigation bureaucracies, it

makes sense to combine these two categories into one, treating as a separate category (a), those systems that are essentially "user-managed." In such systems, irrigation bureaucracies have a limited role and a qualitatively different relationship with water users. Within the other, larger category (b), differences in agency responsibility are matters of degree along a continuum from "pure" to "joint" agency-management.

[6]Scale could be defined in terms of <u>size</u> of command area, <u>number</u> of water users, <u>distance</u> along which water is transferred, or <u>number</u> of division points in the flow. This latter indicator we consider most unambiguous and most meaningful.

[7]Where a main canal is very long, and its water is taken off by a large number of distributary channels, one may have a rather large system with only 3 or 4 levels of operation and organization. This is the case with the Upper Ganga system in India, part of which is managed by one of our workshop participants, S. K. Kumar. Such a system can present significant management problems of distributing water among the secondary channels off the main. Still, it qualifies our generalization about correlation between size and number of levels more than it modifies our proposition that number of levels critically determines management complexity. Patrolling and controlling a main canal, however long, is quite a different matter from regulating offtakes from myriad distributaries with their respective watercourses or field channels.

[8]If the control points in a large system are not just division structures but include storage facilities, such as multiple reservoirs within the system as often found in East Asia thanks to permissive topography, the effect is to create <u>de facto</u> a number of smaller systems within the larger one because of the possibilities for maintaining water "inventories" and for "buffering" supply. Even with river diversion schemes, if supply can be regulated independently for sub-systems, one can treat the latter as separate systems analytically and operationally. If such subdivision creates a number of medium-scale (3-4 level) systems, the possibilities for a larger user role in management are enhanced and the need for comprehensive agency responsibilities is reduced, as discussed in Section 8.1.1.

[9]A "paddy" category for irrigation systems would contain such immense internal variation as to have little meaning, and the "other" type would be only a residual category. Different topographies and irrigation requirements derived from evapotranspiration and rainfall patterns produce characteristic differences between the majority of South Asian and East Asian systems. In South Asia one more often finds larger, contiguous schemes with greater water requirements, i.e. less supply relative to demand. But certain physical types of systems are not unique to either geographic area.

[10]Carried out by the Industrial Administration Research Unit at the University of Aston in Birmingham, these are often referred to as "the Aston studies." They studied 46 organizations in the Birmingham area, including governmental departments, family firms, private companies, public service corporations, and public education institutions. All had over 250 employees and extensive interviews were conducted. From the organization theory literature, the researchers had extracted six major "dimensions" of organizational structure which they proceeded to measure and analyze. Since many of the dimensions proved to be highly related, they employed the statistical technique of factor analysis to determine what measures or scales were congruent with one another and which were independent of other measures or scales.

The Aston studies have been replicated in two further research undertakings, one by Child with a sample of 82 British firms, ranging from 150 to 6350 employees, none of which were branches or departments of the parent organization, and the other by Reimann studying 19 manufacturing firms in Ohio with more intensive data gathering. Both studies, again using factor analysis, confirmed the independent significance of the two variables we are using in our discussion below (Jackson and Morgan, 1977: 94-95).

[11]One of our Cornell colleagues, Randy Barker, who could not participate in the workshop because he was on an assignment in Nepal reported something very similar upon returning to campus. He was studying O&M requirements of irrigation systems in the terai (plains) of that country. Before the Irrigation Department there can make major repairs on flood-damaged channels or structures, it must submit specific requests with detailed cost estimates and get them approved. This takes time, and one or more seasons

of production are foregone before repairs get made. Knowing that some major repairs need to be made each year, a management structure exhibiting responsiveness would allocate sufficient money for this purpose each year, accepting justification of accounts for specific repairsafter the fact. Accountability could be ensured by appropriate physical and financial auditing procedures.

[12]These examples were contributed by participants in the workshop, Robert Wade and Gilbert Levine, who have had experience with these systems.

[13]See Chapter 1, footnote 11.

Chapter 3
ACTIVITIES AND OBJECTIVES OF IRRIGATION MANAGEMENT

Improving the performance of irrigation bureaucracies cannot be accomplished or evaluated in simple terms because the goals as well as the means of irrigation management are multiple. Moreover, as analyzed in Chapter 4, systems must operate in varied contexts that affect both the activities and objectives of management. In the preceding chapter we sketched the variety of irrigation system types that are to be managed by technical and administrative staff and/or by water users, and the ways in which the management structures of systems can vary.

Here we focus first on the *process* of irrigation management which is to be improved by specifying the *activities* involved (Section 3.1). Then we consider the *objectives* according to which performance can be assessed (Section 3.2) and some *criteria* that represent these goals (Section 3.3). Irrigation system management must invariably serve multiple and not always consistent ends. This is a fact of life for those who manage irrigation systems.

Restating the suggestion made at the end of Chapter 1, management is something to be optimized, not maximized. The costs of maximum management are unlikely to produce enough added benefits to justify an all-out effort by officials and water users, and such efforts anyway are not likely to be sustainable simply in human terms.[1] Tradeoffs must always be considered.

3.1 ACTIVITIES OF IRRIGATION MANAGEMENT

In previous analysis, three sets of four activities, twelve in all, were identified that encompass the things water users and/or agency personnel must do to run irrigation systems. The three sets of activities focus respectively on:

(1) the <u>water</u> which is delivered to crops,
(2) the <u>structures</u> that control water to (and from) fields, and
(3) the <u>organizations</u> which manage these structures and water (Uphoff, 1986).

These interacting sets of activities can be represented three-dimensionally as shown in Figure 3.1.

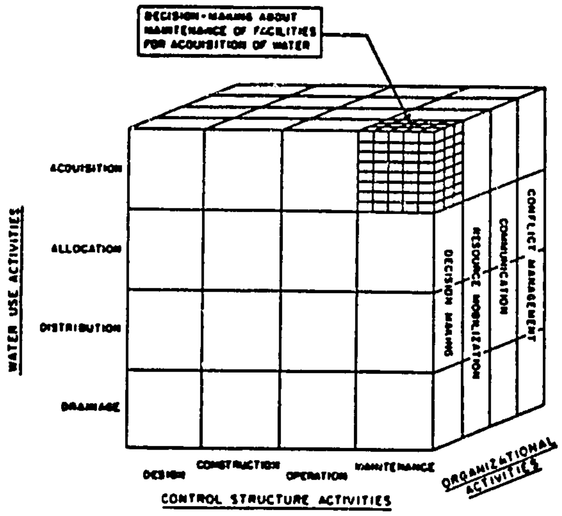

Figure 3.1: IRRIGATION MANAGEMENT ACTIVITIES IN THREE DIMENSIONS

For our purposes here, this framework can be simplified by grouping and reducing categories. This will make it easier to talk about performance. Activities that aim to manage irrigation water can be summarized in terms of either:

(a) <u>supply management</u> (acquisition and allocation), or

(b) <u>control management</u> (distribution and, if needed, drainage).

The first, dealing with supply, involves getting needed and appropriate <u>amounts</u> of water for a system and assigning <u>rights</u> thereto. The acquisition and allocation tasks of irrigation management are not identical, but they interact since allocation must match the amount available. With enough supply, allocation poses little or no problem, and difficulty in allocating rights to water derives mostly from shortages of supply. In contrast, the tasks of distribution and drainage are grouped together since they encompass control over water flow within the system.[2]

The activities focused on structures are conventionally grouped together as either design and construction, or as operation and maintenance. Indeed, the close connection between the latter two activities is symbolized by the standard shorthand abbreviation "O&M." Maintenance is essential for effective operation and commonly involves the same personnel and similar skills as operation. Design and construction are about as closely connected, often being assigned to the same personnel.

The two sets of activities focused on structures can be referred to simply as:

(a) creating structures (design and construction), or

(b) managing them (operation and maintenance).

Because this study focuses on improving the management of existing irrigation systems, we will concern ourselves only with the latter. Happily, this reduces the number of management variables we need to consider.

More complex are the activities that establish and maintain the organizations for irrigation management, whether these are bureaucratic institutions or membership associations of users. The main aspects of managing the organizations needed for irrigation can be categorized as dealing with:

(a) the variability needed for good irrigation management, involving decision-making and communication, and

(b) the costs associated with carrying out such management, particularly resource mobilization and conflict resolution.

The first category reflects how difficult it is to meet crop water requirements, according to certain soil conditions, climate, cropping patterns, and so forth, i.e., how much responsiveness, adjustment and adaptation are necessary, while the second addresses the amount of resources (time, money, effort) required. The two categories are correlated but involve different activities.

(a) variability in organizational management ranges from low to high, depending on whether the organizational activities of decision-making and communication can be handled in a routine manner, e.g., periodically, or must be frequent and changing to ensure an adequate, timely and reliable supply with favorable flow characteristics.[3]

(b) costs of management range similarly from minimal to great depending on whether there is little need, or much need for resource mobilization and conflict resolution.

Costs will be lower, for example, where there is little siltation and thus less need for maintenance expenditure. If siltation is heavy but regular, costs will be high but because the variability is low, little decision-making and communication will be required. An example of a high-cost situation would be where no social norms promote cooperation and accommodation among users, so much time and effort are required from officials to mediate disputes and regulate behavior.

Situations can be compared in terms of the total amount of effort needed or expended to cope with problems along one or more of these dimensions. Also, management efforts can be evaluated in terms of their success in dealing with the problems presented along that dimension. As indicated in Figure 3.1, all these variables interact.

Irrigation management can thus be assessed in terms of four main aspects:

(1) water supply management -- how much effort is required for acquisition and allocation? done with what success?

(2) water control management -- how much effort is required for distribution and drainage? done with what success?

(3) variability of management -- how much effort is required for decision-making and communication to operate and maintain the various structures so as to achieve adequacy, timeliness and reliability of supply and flow? with what success is it handled?

(4) costs of management -- how much effort is required to mobilize resources and resolve conflicts to operate and maintain structures? what success is achieved in terms of meeting and/or minimizing costs?

In principle, effort and success could be added up along these several dimensions to produce some summary measure of the amount and effectiveness of management. But we know of no adequate common denominators.

There has been some work done in organization theory on measurement of "administrative intensity." But as discussed in the annex to Chapter 2, it is not very revealing for the special tasks of irrigation management. One can try to judge the adequacy or efficiency of bureaucratic effort by calcula- ting and comparing ratios such as the number of field staff per 100 acres, or maintenance expenditure per mile of distribution channel. But such physical measures are ambiguous in terms of performance in irrigation management, and they cannot be added together.

It may be worth considering total recurrent expenditure per acre of command area as a rough summary indicator of management effort. But it is at best a proxy for many interacting variables. Composite indicators could be constructed by converting various physical and monetary measures into scales and combining them. But such indicators would be difficult to validate.

We think it best to proceed in a less aggregated manner, recognizing that the relative importance of different irrigation activities and outcomes will vary according to context and objectives. We want to help managers or evaluators clarify what kinds of irrigation management effort and success they are concerned with in particular situations, and to permit comparison of situations along one or more dimensions. The analytical framework presented here should give more tangible focus to discussions and assessments for improving irrigation management.

3.2 OBJECTIVES OF IRRIGATION MANAGEMENT

The specific objectives which an irrigation agency must deal with are likely to vary from country to country, from system to system, and over time, depending on the contextual factors analyzed in Chapter 4, and on the interactions among policy makers, water users and the agency. The objectives that national decision-makers seek to optimize are shaped by macro-economic considerations such as the rate of return on public resources invested in an irrigation system, minimization of the recurrent costs of operation and maintenance, year-to-year stability of production, etc. The priorities advocated within a government by Ministries of Agriculture, Trade, and Finance, for example, may not always be the same.

In addition, national objectives will include political considerations such as dealing with external pressures (e.g., to improve the balance of payments through export production) and domestic ones (e.g., from commercial agriculturalists to provide water for their high-value crops); leaders' tenure in office may depend on such considerations.[4] We have alluded in Chapter 1 to the fact that local politicians' interests can also figure into the objectives which governments give weight to.

The objectives of water users, on the other hand, are shaped more by micro considerations: the maximization of household benefits (e.g., adequate and reliable water deliveries to grow preferred crops) and the minimization of household costs (e.g., less time expended in weeding, or fewer water-borne diseases). In assessing costs and benefits, economic factors are important but they are not the only ones, in as much as political, health, status and other considerations also come into play for water users.[5]

The objectives of irrigation agency managers are "in the middle," as suggested in Chapter 1. The agency must support the objectives of national policy makers described above, and it is expected also to further those of irrigating households. In addition, managers will be concerned with maximizing benefits and minimizing costs both for their agency (e.g., getting larger budget allocations from the central government, or doing no more maintenance work than necessary) and for themselves (e.g., higher, more secure incomes, or fewer postings to places where facilities are inadequate). The latter considerations may seem inadmissible, but they are factors in practically all bureaucracies (Downs, 1967).

The demands placed on an irrigation agency are dynamic and complex, with some goals sought by national policy makers conflicting with those of irrigating households or with the personal aims of irrigation managers. In the workshop, an example of clashing objectives was given from the Dominican Republic, where the government stressed the total volume of rice produced whereas farmers, understandably, were more concerned with its profitability. When the price paid for rice fell too low, farmers left crops unharvested standing in the fields, to the consternation of officials. Fortunately, some goals are likely to be endorsed by all the major constituents, such as managing systems so that their productivity is not lost through salinization.

In previous analysis, major categories of irrigation management objectives were listed (Uphoff, 1986:15-18). It was pointed out there that (a) they are interrelated, and (b) rankings of objectives are likely to vary from system to system and over time. The major sets of objectives appear to be:

A. **Greater production and productivity** in irrigation projects, achieved through some combination of increases in:

   1. Yield,

   2. Area cultivated, and/or

   3. Cropping intensity.

B. **Improved water distribution**, which has two aspects:

   1. Greater _reliability_ and _predictability_ in the adequacy and timing of water deliveries. This is likely to contribute to A. through encouraging the use of HYVs and more efficient use of labor. From users' point of view, _convenience_ (minimum of hassle) is greatly valued.

   2. Greater _equity_ of distribution, especially between upstream and downstream areas or more generally among geographic regions. This can contribute to the realization of A. and can have secondary effects on employment and income for non-farm households.

C. **Reductions in conflicts:**

   1. Between the irrigation agency and water users so that optimum main system management can be implemented, unimpeded by ad hoc manipulations.

   2. Between upstream and downstream water users so that more coordinated and cooperative water use is possible.

D. **Greater resource mobilization:**

1. Contributions of labor and materials:

   a. for construction and rehabilitation,
   b. for operation of the system, and
   c. for maintenance of the system.

2. Contribution of funds (cost recovery) toward:

   a. capital costs, and/or
   b. recurrent costs.[6]

E. **Sustained system performance:**

1. By managing water and soil resources so that the long-term productivity of the system is maintained and the impacts of the system on the environment are positive, not negative.

2. By intensifying production within the carrying capacity of the system, generating more employment and sustaining more population at satisfactory levels of well-being, health and nutrition, increasing both the quantity and quality of life associated with irrigation. This should not be taken for granted (Merrey, 1987).

Greater production or productivity (A) is one of the broadest objectives of irrigation management and it has dominated assessments of irrigation performance in the past.[7] It is a goal that national policy makers, water users and agency managers are all likely to want to achieve, albeit from different macro, micro and project perspectives. The example given above from the Dominican Republic points out how conflicting the evaluations of "production" can be.

Increasing the reliability and predictability of adequate and timely water flows (B1) is an aspect of improved water distribution that national policy makers, irrigation managers and water users are likely to agree upon. They may not be as united on convenience, the aspect of distribution stressed by farmers, getting water with a minimum of "hassle" (Chambers, 1988: Chapter 7).

The other aspect, equitable distribution (B2), while endorsed by everyone in principle, may be very hard to achieve in practice. To begin with, equity is very hard to define. What is considered "fair" by one person may seem "unfair" to others who invoke other criteria, which depend on context and precedent. Equity in distribution can come into conflict with the interests of influential political actors and/or with the personal income-maximizing goals of system operators. Upstream water users have reason to oppose this objective if they see its achievement as depriving them of income.[8]

Reducing conflicts (C) may not be an objective that national policy makers and irrigation managers want to emphasize because it implies some deficiencies in management. But to acknowledge this as a goal is to recognize that irrigation systems are human systems. In fact, it is likely that if conflicts are reduced as an outcome of management, the whole irrigation enterprise will be more effective. Farmers consider this objective important enough, according to Chambers (1975), that they may accept even arbitrary judgments from managers or farmer representatives that reduce conflict so as to have greater certainty in their own water supply.

Resource mobilization (D) is an objective with which national policy makers and irrigation managers are often most concerned, especially under pressure from international donor agencies and when facing stringent financial conditions. National governments may publicly seek to maximize collections and to implement cost recovery schemes, but these outcomes are difficult to achieve. In fact, irrigation operation and maintenance are usually heavily subsidized from national coffers.[9]

Unless water deliveries are satisfactory (B1), water users will probably avoid paying the government irrigation fees if possible. Where service is reliable and adequate, several other conditions will affect cost recovery: whether the funds collected from users in a particular system are spent for O&M in that system rather than being siphoned into the central treasury; whether fee-paying farmers have some control over the expenditure of O&M funds so they are properly and efficiently used. In the Andhra Pradesh case, we found water users collecting funds within their own communities to make extra payments to managers for special allocations of water or to get government construction funds used so as to benefit their command area (Ramamurthy, 1986; Wade, 1984). To the extent such flows are not reported in any formal accounts of the resources devoted to irrigation, resource mobilization from water users is underestimated.

Finally, the goal of sustaining system performance (E) is gaining more attention from national policy makers and irrigation managers as numerous schemes built in the past face serious problems of soil erosion, waterlogging, system decay, and consequent declines in productivity.[10] This trend is more serious because of the worldwide tightening of funds and the availability of fewer good sites for new irrigation development in Third World countries. Declines can no longer be easily offset by expansion of irrigated area.

Unfortunately, the commitment of national policy makers to forestalling agroecological deterioration is often diminished by short-run perspectives owing to their brief tenure as leaders. That of irrigation managers may not be much greater. While water users may adopt longer-term perspectives when they own a system, attitudes toward preserving systems owned by the government are generally less responsible.

Where irrigation system management cannot achieve all of these goals, or cannot achieve them all fully because of physical, economic, political, social or other constraints, some ranking or weighing is needed. Managers should clarify for themselves how these different sets of objectives compare, so that decisions are made more explicitly with reference to some bundle of goals, even if a statement of objectives does not in itself determine subsequent decisions.

An ordering of aims has to be tailored with some knowledge of the context (Chapter 4) and of capabilities (Chapter 5) for system management. Consideration of these will complete our analytical treatment of the subject in Part I. But to complete our treatment of objectives, we need to discuss also criteria that can make them more operational.

3.3 CRITERIA OF MANAGEMENT PERFORMANCE

As Chambers (1986) points out, objectives refer to the purpose of an irrigation system, whereas criteria represent the performance of a system. The latter are intended to provide a basis for assessing how well a system is being managed. Once decision makers have in mind some set of goals for a particular irrigation setting, i.e., some combination of the objectives just enumerated, it should be possible to map out and evaluate management strategies for attaining them.

Increases in production or productivity (A) can be measured directly in terms of:

(1) increase in crop yields: change in output per unit of area (e.g. per hectare or acre)

(2) increase in area cultivated: additional number of hectares or acres receiving irrigation water and growing crops; more significant if achieved without increase in total water supply

(3) increase in cropping intensity: additional number of crop seasons, going from one to two or even three crops per year.

The concept of production is an absolute one, referring to total output, whereas productivity is a relative concept assessing output per unit of input. These measures represent only physical aspects of productivity, i.e., output with respect to area, water or time. They do not reflect any economic considerations of efficiency. For this, the value of production from irrigation must be measured with regard to some input:

(4) value of product per unit of land (area),

(5) value of product per unit of labor (worker hour, man-year),

(6) value of product per unit of capital (return on investment).

Where water is a constraining factor, the most significant measure will be:

(7) value of product per unit of water (per cubic meter, or per acre-foot).

A summary measure, not considering efficiency at all, would be:

(8) total value of production from irrigation.

This last indicator is often used but it is not very meaningful as a measure of management performance because it is too aggregated and is unreflective of costs.

Lenton (1984) has suggested that any aggregate analysis be refined by calculating productivity indices for various levels in a system -- the farm level, the outlet (field channel) level, the distributary, the branch canal, or the main canal. This is necessary to assess differences in management within systems. Making such assessments may appear to increase data requirements, but in fact, statistics for higher levels can only be reliable when they have been gathered first at lower levels in a system and are then aggregated. So the added effort for such indicators should not be great.

The quality of data needs always to meet criteria of acceptability. One of the sources of difficulty in managing many irrigation systems is the lack of valid information on either water distribution or water requirements. When measures were made for the Ford Foundation on four systems in India, the water actually being delivered to farmers was found to be only about half as much as the system managers thought was being made available.[11] Moreover crop water requirements, estimated from standard experiments, are often greater than allowed for given actual soil and climatic conditions. In Nepal, systems are commonly designed and operated with a norm of 1.5 liters/second/hectare, though percolation tests in some locations suggest requirements three or four times greater (Yoder, 1986). Without accurate data on such parameters as conveyance and percolation losses, systems cannot be operated or evaluated properly.

The most meaningful measures of management performance for given systems will be (a) over time, or (b) among sub-systems within them. Inter-system comparisons are likely to be invalid in one respect or another because of the complex differences in environments of irrigation, analyzed in the next chapter. National policy makers will want some aggregated figures such as output per acre or cropping intensity to work with. But these will be meaningful only for assessing the performance of whole regions or the whole country over time, comparing sets of irrigation systems with their previous levels of performance.

Water distribution (B) gets judged by many different criteria. We would focus on five dimensions:[12]

(1) adequacy: whether the amount of water delivered to fields is sufficient to meet crop water requirements (note that operationalizing this and

the next criterion, timeliness, subsumes the objective of reliability),

(2) timeliness: whether the water is delivered when crops require it,

(3) predictability: whether amounts and timing are regular or erratic, with information on water flow known in advance so water users can make best use of it and of complementary inputs (labor, fertilizer, weedicides, etc.),

(4) convenience: whether water is delivered with a minimum of effort from water users, often referred to as "hassle," measured in time or money,

(5) equity: whether water is distributed evenly within the command area, and among water users.

The characteristics of water supply interact so that the criterion of adequacy will not be met even if the amount of water is sufficient but water delivery is not timely. Similarly, the equity criterion cannot be satisfied if some users' water supply is inadequate.

Measuring adequacy is complicated in a specific agronomic sense, requiring tests of water availability in plants' root zones with different standards of adequacy for different crops. A simple indicator, based on field observations, called the Water Availability Index (WAI), has been developed in the Philippines and tested in Sri Lanka (Svendsen and Wijayaratna, 1982; Wijayaratna, 1986). This requires only that someone record on a daily basis whether fields have (a) flowing water, (b) standing water, (c) saturated soil, (d) dry soil, or (e) cracked soil. The index calculated from such simple data, requiring no instrumentation or laboratory analysis, has been shown in detailed production function analysis to represent water adequacy quite satisfactorily.

An even simpler index of adequacy developed at the same time, using farmer survey data, correlates quite highly with WAI and can be used as a proxy for water adequacy, the Water Problem Index (WPI) (Uphoff and Wickramasinghe, 1982). Farmers in the Gal Oya system were asked whether, for a specific season, they had (a) no water problems, (b) too much water, (c) too little water, or (d) unreliable water supply. Responses were combined into an index for specific command areas.

No <u>timeliness</u> indicators have been developed to our knowledge, but they could be constructed from either observation or interview data, as could <u>predictability</u> indicators. The WPI and WAI indicators incorporate timeliness and predictability in an approximate way.

Some very specific measures have been used for assessing <u>equity</u> of water distribution (B2), examining differentials in production or productivity: (1) between upstream and downstream areas, (2) between head-end and tail-end fields served by a common canal, or (3) among sub-systems within a command area. Measurable differences between head and tail areas in (a) yield, (b) percent of commanded area receiving irrigation water, (c) cropping intensity, or (d) value of production per unit of area, labor, capital or water can be used as indicators of spatial inequality in water distribution.

Any differentials should be known by system managers, water users, and policy makers even if there is disagreement as to what constitutes "fairness" in water distribution. Such a determination involves definition as much as measurement. Differences in soil quality, for example, rather than in water delivery may account for observed variations in yield. In such a situation, users and managers may agree that poorer, less water-retentive soils should receive an equal share. It can be argued, however, that such soils should get <u>less</u> water because they use it less efficiently, or that they should be given even <u>more</u> than proportional water to compensate for deficiencies in soil quality.

This gets into matters of policy or values. It could be proposed that equity in water distribution means giving all cultivators or all households an equal share of water regardless of the area they cultivate, to offset any inequalities in landholding size. The criteria for measuring "equity" must follow from its definition. It is important to establish for any irrigation system what the goal of equity entails, adopting then whatever measures are appropriate. One should also bear in mind that variables' measurability does not correlate always (or even often?) with their importance.

Reductions in conflict (C) either among water users or between them and irrigation managers can come from achieving the other objectives of improved management, rather than from managers' direct efforts to deal with the causes or manifestations of conflict. Conflict resolution is particularly difficult to measure because the best amelioration of disputes may be the least visible or may even be preemptive. A low level of conflict resolution may indicate either that there was little conflict anyway or that existing, often informal means were effective in abating it (Esman and Uphoff, 1984: 75-76).

While absolute levels of conflict resolution are difficult to evaluate, trends are less ambiguous. Measures that could be monitored would be (a) the number of complaints received by system managers from water users about the actions (or inactions) of agency staff or other water users, or (b) the number of hours irrigation managers spend in arbitrating conflicts among water users or between users and staff.[12]

In measuring resource mobilization (D), one is usually interested in the degree to which an irrigation system or systems can operate self-sufficiently, with no or little funding from outside. Government leaders may value managers' ability to attract foreign donor financing, and water users generally like to get outside funds from any source to improve system capacity and/or to reduce their own obligations. System managers commonly want, for a variety of reasons, to have more resources from any and all sources to work with.

The most common criteria for this area of performance are the <u>absolute</u> amount of resources mobilized within systems and the <u>relative</u> proportion of total O&M costs this represents (Repetto, 1986). One ought to be just as concerned with the <u>efficiency</u> with which resources are being used for O&M since getting more benefit from given resources or being able to operate with fewer resources is equivalent to acquiring new or additional resources. Resource-economizing criteria could be introduced in evaluating O&M but they are hardly utilized at present. <u>Resource savings are as significant as resource mobilization in management performance.</u>

Measures of interest would include (a) the amount of contributions of labor, materials or money from water users, and (b) the percentage these represent of total expenditure, broken down in terms of capital (investment) costs and recurrent (O&M) costs. These are best evaluated over time.

Much attention is being paid now in the literature to measuring <u>cost recovery</u>.[14] Costs and cost recovery are carefully monitored when projects are suppose to "pay their own way," as is currently the policy in the Philippines. This was the only country in Repetto's study (1986) where user contributions met or exceeded O&M requirements, though the Irrigation Associations in Taiwan also cover all of their O&M costs.[15] Reaching or approaching self-sufficiency through resource mobilization is much appreciated in evaluating irrigation management, as is ranking high on the number or proportion of farmers who pay the water charges levied on them.

Sustainable system performance (E) can be measured by looking at productivity (A) over a relatively long period of time. Have (1) yields, (2) area cultivated, (3) cropping intensities, and/or (4) value of production increased, been maintained or have they decreased? Operational measures could include:

(a) the rate of deterioration of the physical system, indicated by increases in the area experiencing waterlogging, salinity or erosion, or by changes in the water table,

(b) the cost and extent of rehabilitation and maintenance work required due to physical changes in the system.

Disappointing data on the latter measures might not represent poor system management so much as a difficult, unfavorable context for irrigation, with erosive soils in the watershed or antagonism among farmers interfering with efforts at preventive maintenance. One should not make judgments about management without considering the situations of the physical systems, the water users and the system managers. Recognizing this, we turn from looking at goals and measures to analyzing the ways in which the environments for irrigation vary, as these affect what can and should be attempted by an irrigation bureaucracy.

FOOTNOTES

[1]This can be seen from Levine's report (1987) on the Yunlin irrigation system in Taiwan, which in one year had only 50% of its normal supply in the reservoir. The managers of the system together with the farmers decided to make an all-out effort to maintain production by careful micro-management of the available water This meant that field staff and water users through their Irrigation Association had to apportion water very precisely. Gates were manned around the clock, and the farmer Chairman and the Chief Engineer of the Irrigation Association visited personally the staff who manned them, bringing tea and rice cakes and offering encouragement even at 2 or 3 in the morning. When asked if this was done to make sure that personnel were at their stations, the response was that "we wanted the staff to know that everyone was working very hard to make the effort successful -- even the Chairman and the Chief Engineer." With such efforts, 95% of "normal" output could be achieved with only half the usual water supply. But farmers and managers agreed that such a level of effort could not be sustained year after year.

[2]The classification here reflects different emphases since all four of these "water" activities can be seen either as "supply" activities or as ones involving "control."

[3]This analysis builds on the criteria of irrigation management performance treated in Annex 1 of Uphoff (1986: 161-164). The three main characteristics of <u>supply</u> are adequacy, timeliness and reliability, while those characterizing <u>flow</u> are its variability (steady vs. fluctuating), flexibility (adjustable vs. fixed) and predictability (regular vs. erratic). Note that variability of flow is not the same thing as variability in management requirements.

[4]The importance of international donor agencies recognizing the political rationality of national decision-makers in the Third World is explicated by Cohen et al. (1985). They suggest a methodology for undertaking research on "policy space" defined as "the area within which it is possible -- economically, politically, ideologically, administratively, culturally -- for a government to make effective decisions." (p. 1215)

[5]Our formulation of the objectives of water users is not limited to owners of land, though the discussion tends to suggest this "ideal-type" category. Agricultural laborers' interests, such as maximizing employment opportunities and the returns to labor from the method of production used, differ from landowners' and often get short shrift. Owner-operators may like to use water as a means of weed control whereas landless laborers would restrict such "overuse" so there will be more demand for weeding by hand.

[6]Several other objectives were considered in Uphoff (1986) under this heading of resource mobilization (acquiring information, and cost containment and quality control). But these were considered as objectives specifically with farmer participation, not of irrigation management generally, so here we have used fewer and simpler categories. The issue of recurrent cost recovery is a major one these days (e.g., Repetto, 1986; Small et al., 1986).

[7]Chambers (1988) characterizes this preoccupation as "production thinking."

[8]In completely user-managed systems, equity is often a prime objective and is achieved by adopting ingenious organizational or technical means (Uphoff, 1986). This can be attributed to the need to mobilize the support and resources of the whole irrigating community to acquire and maintain the supply of water. For this, all must be assured a fair (equal) share. Such a rationale for equity does not apply in agency-established systems, where users do not create the supply of water (a positive-sum situation) and instead find themselves in a zero-sum relationship with one another whenever there is shortage.

[9]A review of O&M costs in six Asian countries found that farmer payments covered these costs only in the Philippines (Repetto, 1986: 4-5). The average rate of O&M cost recovery for Indonesia, Korea, Nepal, Thailand and Bangladesh was about 50%. Payments covered between 8 and 13% of capital and recurrent costs combined. We do not necessarily concur with Repetto's conclusion, however, recommending "full cost recovery" without examining who are the real beneficiaries of irrigation. Consumers should usually be included in this category, especially where market prices for agricultural products are regulated, as they are in most countries. Repetto's analysis too readily

equates technical achievable levels of water use "efficiency" with economically efficient ones, surprising from an economist (p. 5).

[10]Tens of millions of hectares are affected by such problems. FAO has estimated that as much as half of the world's irrigated area has some diminution of yield due to salinization (Carruthers, 1983). The Indus basin of Pakistan has about 13.5 million hectares affected by some degree of waterlogging or salinity (Merrey, 1982: 83).

[11]These studies done by the University of Rourkee (Uttar Pradesh), the Agricultural Finance Corporation (Madhya Pradesh), Tamil Nadu Agricultural University (Tamil Nadu) and Indian Institute of Science (Karnataka) are yet to be published but have been reviewed by Gilbert Levine.

[12]In previous analysis, we suggested a more detailed analysis of water distribution variables (Uphoff, 1986: 125-127). Here we propose a more limited set for purposes of evaluation. The first three are identical to those Chambers (1987) arrived at from his studies of irrigation management. The fourth we added at his suggestion, and the fifth, he, we and practically everyone agree on.

[13]An unusual but meaningful measure suggested by farmers in the Gal Oya system (Sri Lanka) was the number of murders occurring over water. Farmers reported this declined to zero after formation of field channel organizations (Uphoff, 1987). They invited evaluators to consult local police records to verify that there had been killings previously but no more.

[14]See, for example, the summary analysis done for the Asian Development Bank by Small et al. (1986) on irrigation service fees in six Asian countries.

[15]For the period 1980 to 1985, the National Irrigation Administration collected under its jurisdiction 79% of its total O&M expenses for the systems from water users (Bagadion, 1987: 37-38). It is expected that the whole operation can become self-sufficient based on the development of associations of water users. One way of reducing the agency costs of O&M is to hand over complete responsibility for blocks of 2,500-3,000 hectares to the user associations, giving them the option of mobilizing resources in cash or in kind for necessary O&M.

Chapter 4

HOW CONTEXT AFFECTS OBJECTIVES AND PERFORMANCE

The contexts of irrigation management are complex, even for small systems. Before one can evaluate management, let alone think of improving it, there must be adequate understanding of agronomic, climatic, technical, economic, social and other factors that impinge on the achievement of objectives and indeed affect what is achievable through irrigation.

In the preceding chapter, we discussed management effort as a summary variable directed at (a) the supply of water or (b) at the control of water, involving (c) more or less need for variation in response to conditions, with (d) more or less cost, likewise depending on the circumstances. Which of these considerations is most important will be affected by context. For example, if water supply presents a constraint, all other aspects assume secondary importance, whereas with a high water table and poorly draining soils, water control to prevent loss of cultivable area through salinization may become the overriding concern.

As stated in Chapter 1, contextual factors can be grouped in half a dozen categories: (1) agro-ecological, (2) technical, (3) economic, (4) historical, (5) socio-cultural, and (6) political-legal. Their implications for improving irrigation management, along with some (but not all) of their interactions, will be considered in turn.

4.1 AGRO-ECOLOGICAL CONTEXT

The agro-ecological context of an irrigation system is of primary importance as it defines the ultimate limits of production potential and it often demands particular kinds of management effort. An irrigation bureaucracy may or may not be willing and able to provide the kind of management needed to cope with these environmental factors.

Agro-ecological factors affect both water supply and water demand, which in turn determine the emphasis to be placed among activities of water acquisition, allocation, distribution and application. Relative water supply (RWS) -- the ratio between how much water is or can be supplied and the crop's minimum water requirement under prevailing conditions -- sets constraints within which an agency must operate.[1] Together with technical factors discussed below, agro-ecological factors shape some of the objectives of irrigation management.

- **Acquisition** must have priority if adequacy of overall supply is the main problem.

- **Allocation** will need attention if there is water scarcity and assigning rights to potential users presents some difficulty.

- **Distribution** among channels and fields will receive priority if the timeliness and reliability of deliveries is the main problem, due to factors like cropping pattern or soils not being water retentive, creating need for control within channels.

- **Application** within fields demands priority if crops or soils are particularly vulnerable to wilting, salinity, waterlogging, etc. so there is special need for control at field level.[2]

Agro-ecological factors become important in the management of a system when they create special demands for, or interfere with, the delivery of good quality water in suitable quantities to the rootzone of the crops being grown in the system. Some of these factors are:

4.1.1 **Rainfall and Other Climatic Factors.** While all irrigation systems are constructed in areas where rainfall is expected to be insufficient to meet the needs of specific crops throughout the growing season, systems are usually designed based on assumptions of receiving certain amounts of precipitation before or during that time. This rainfall is expected (a) to raise the supply of water in rivers, reservoirs, aquifers or water tables and/or (b) to increase soil moisture directly.

Rainfall, however, usually varies in both timing and amount. When it is less than the expected amount, management effort must be increased to gain supply and/or control and also to deal with variation and cost. However, it is also true that more-than-expected rainfall can be rather a bane for managers than a boon. If there is adequate water supply in rivers, reservoirs or underground, having little or no rainfall is, ironically, the best condition from a management point of view.

When there is scarcity, acquisition efforts must be increased or some change made in allocation. Changing rights to water requires new patterns of distribution and possibly special efforts at conflict resolution. Users' dependence on system managers is greater under such conditions. With a surplus of water, the pressure on system operators to ensure supply is eased, or it is limited to providing water only at planting time and in periods of peak growth, as seen in the Mwea scheme in Kenya. Then control activities -- distribution, application and maybe drainage -- take on greater importance to prevent damage to the system and to preserve crops.

Where the timing and amount of rainfall is highly variable, managers must take initiative frequently to modify supply and control activities appropriately. In large systems, this is more important because rainfall varies not just in amount and time but also over space, falling in some parts of the command area and not others. With stable, predictable rainfall patterns, on the other hand, system managers face fewer difficulties with variation and cost. It is supply and control management that present problems if the stable, predictable amount is found to be low.

Apart from rainfall, climate influences the outcomes of irrigation through effects of: (a) solar radiation (affected by cloud cover), (b) temperature, (c) wind, and (d) relative humidity. The first two variables in particular increase the rate of plant growth, and all four affect evapo-transpiration (ET), plants' loss of water higher insolation, temperature and wind plus lower humidity will increase water demand in a system. The significance of these factors is heightened by the fact that their effects do not occur randomly or independently. In monsoon Asia, (a) and (b) are highest and (d) is lowest toward the end of the dry season, just when there is least supply of water in reservoirs and rivers.

Ideally, the supply and distribution features of a system are designed appropriately for the prevailing climatic conditions, so that the variation and cost of management needed to cope with climate are within an acceptable range. Climatic conditions present particular problems when:

(a) the climate and the type of crops grown are poorly matched, e.g., when heat-sensitive crops planted in very hot areas,

(b) marked changes in weather create unfavorable or unusual crop-growing conditions that require a response by those who manage the system e.g., if increased temperature and wind combine to increase ET and crop water requirements or if heavy typhoons or monsoons result in crop damage, or

(c) climatic conditions are conducive to the spread of human disease such as malaria or schistosomiasis and thus require certain operational procedures e.g. periodic releases of water to break the reproductive cycle of malaria-carrying mosquitos, not linked to irrigation water requirements.

Climatic conditions are not likely to be more important than rainfall or soils, but they should be considered along with other physical variables.

4.1.2 Soils. The characteristics of soils most relevant for irrigation management are:

(a) fertility. This not only influences the type of crop grown, but also the amount and type of inputs needed to obtain a good crop, which interacts with economic objectives.

(b) water retention. This, a function of soil texture and structure, plays a major role in determining the <u>frequency</u> of water applications needed in the particular system as well as amount. Retentive soils such as clays or loams allow greater flexibility in distribution and can buffer system operations, whereas poor retentive qualities (e.g. sands) require more attentive and active management. Highly retentive soils can also require such management to prevent water-logging.

(c) **infiltration and permeability.** The rate at which water moves through the soil profile will determine the rate of water application needed, and can place constraints on the scheduling of irrigations. Low infiltration can be very good for a crop such as rice but can pose problems for other crops. Highly permeable soils will affect water distribution if the canal network is unlined; resulting high water losses (if water is not reused) will affect the efficiency of the system. Unfavorable soil conditions may require expensive lining and frequent repair of canals which affects the economic benefits from irrigation.

(d) **soil variability.** Great variability in soils can occur even in small irrigation systems or within short distances.[3] It not only can affect productivity within the system but it can complicate equitable distribution of water where this is an objective of management, discussed in Chapter 3. The most common formula for water distribution is to divide it equally according to land area. But this gives unequal production outcomes where soil variability is great since sandy soils usually require more water to produce the same output. On the other hand, because the marginal productivity of water is lower in sandy soils, it can be argued that equity in water-short systems is better served by not giving so much water to these areas. Any adjustments made to accommodate diversity in soil quality will raise substantially the variation and cost of management.[4]

(e) **salinity or alkalinity.** Soils containing high concentrations of undesirable salts or with potential for elevated pH levels create distinct agricultural and management problems requiring special control measures. These occur more commonly in arid environments and can have drastic effects on production potential and the costs of maintenance.

4.1.3 **Topography.** Physical features of the land surface such as slope and relief have a profound influence on the design of irrigation systems and this can affect management requirements in turn. Due to differences in topographies, reservoirs are more common in East Asian countries than in much of South Asia, where river diversion schemes are more suited to the lay of the land. Significant from a management point of view, one finds more often in East Asia reservoirs connected in series that provide on-line water inventories and buffer stocks. These permit more flexible, responsive water distribution than in the Indian sub-continent.[5]

Topography affects whether managers are dealing with one large, more easily-managed contiguous command area or with many smaller pockets of cultivation, and whether water must be conveyed long or short distances from the source. In the Mwea system in Kenya, managers could adhere more satisfactorily to standardized systems for field units and water control because land there was very level. Other considerations are whether:

(a) slopes are so steep that they create serious erosion problems and make management activities more difficult,

(b) slopes are so flat that they adversely affect the distribution of water, slowing the flow and increasing operational and maintenance problems arising from siltation, or

(c) fields in the system are uneven so that the efficiency of water application is low unless there is land leveling.

Management challenges in mountain or hill irrigation systems are different from those in the lowlands.[6] In the former, special design and operating criteria are required to deal with differences in topography, and also usually soil structure. Drainage is not often a problem in hill irrigation, but keeping channels and control structures intact is, given the scouring power of rapidly running water and the greater instability of earth and slopes. Conversely with different topographic and soil characteristics in lowland irrigation, waterlogging and salinity can present serious dangers if natural drains are not functioning or sufficient. Drainage activities then need to be attended to.

4.1.4 Cropping Patterns.[7] The types of crops grown in a system must be taken into account when specifying objectives and strategies of management. If maximum productivity is the goal, operational procedures must be tailored to the needs of each crop. If equity is higher priority, a system of distribution like warabandi in northern India and Pakistan can be adopted which gives fixed amounts of water for each holding regardless of the extent or kind of cropping. Crop needs interact with rainfall, soil and other variables to present unique requirements, some of which are more demanding than others, for example, high-yielding varieties of rice or wheat compared to traditional ones.

As suggested in Chapter 2, a typology of irrigation systems could be constructed based on whether the crop being grown is rice or not. Most plants suffer when flooded and need water only intermittently. Rice, on the other hand, probably the major consumer of irrigation water, needs large and continuous volumes. Its yields decline dramatically when there is interruption in irrigation, while it tolerates (even benefits from) submergence, unlike most other plants. The response function of rice with respect to water rises (or falls off) very sharply. Yields of 5 tons/hectare are possible when water is ample compared to 1 ton/hectare if there is water "stress." Too much water therefore is no problem (some rice varieties developed for flooded conditions can grow in 10 feet or more of water); too little water is. The rules of the game for irrigation shift decidedly when moving into or out of rice production. This may even be done from season to season, as in irrigation systems that grow rice during the monsoon season and wheat during the dry winter season.

Whether the cropping pattern is (a) decided by individual farmers, or (b) imposed by the agency should be considered. If water users determine the kind and mix of crops, they can grow whatever optimizes their net income and spreads their labor requirements. This usually leads to more diverse cropping patterns, although market prices may encourage considerable similarity in what is grown and can produce fairly standard water demands if soils are relatively homogeneous. If agency preferences for cropping pattern prevail, more uniformity can be established in water deliveries, reducing the variation and possibly the costs of management. Whether or not there are net cost savings for system managers depends on how many resources must be expended on enforcement of such schedules

Sometimes the agency will dictate a certain pattern for the whole system, as in the huge Gezira scheme in Sudan where a strict rotation including long-staple cotton was decided upon by managers. A more flexible form of control is found in the Andhra Pradesh systems analyzed from India. There different zones within the command area are "localized" for certain crops, which respectively have different water requirements. The level of demand for water can thus be regulated by how much area is authorized for crops with high water consumption and how much for less water demanding crops (Ramamurthy and Coward, 1987). If a crop in question is an export crop, the management can enforce decisions more easily because it can control inputs and marketing better. This reduces the cost of regulating the cropping pattern.

The kind of cropping pattern found within a system can be analyzed along a continuum suggested by Lowdermilk et al. (1983):

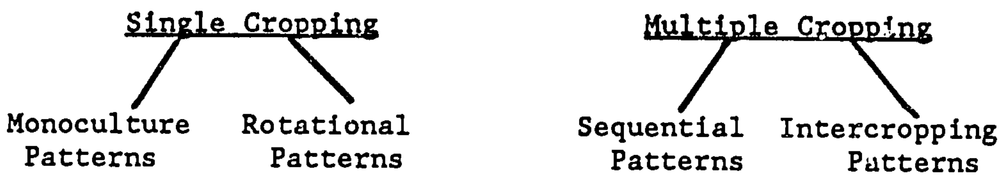

Figure 4.1: ALTERNATIVE IRRIGATED CROPPING PATTERNS

As one moves from left to right, the complexity of management becomes greater. With monoculture, water can be distributed in proportion to area over the entire command, assuming factors like rainfall and soils are equal. With rotational patterns, different distribution schedules are implemented in turn but still uniformly within the command. On the other hand, when multiple crops are grown concurrently, managers are usually expected to adjust water distribution to meet respective crop requirements. This requires more control and variation in management and also increases its cost.[8] Supply considerations enter in when insufficient water is available to meet all crop requirements. Then supply augmentation or a change in the cropping pattern is necessary.

Agro-ecological variations are elementary factors in any irrigation management setting. Clearly, one should not expect the same efficiency of water use, for example, where soils are more permeable or where topography makes long conveyance distances unavoidable. With highly variable rainfall, cost considerations might give way to having very responsive control. But other contextual factors are important too.

4.2 TECHNICAL CONSIDERATIONS

Within a given agro-ecological setting, irrigation systems are designed and built with certain technical specifications and capabilities. The nature and capacities of such systems are themselves part of the "context" of irrigation management. One can analyze these variables in terms of (a) source factors and (b) flow factors that derive from the technical features of the particular system.

4.2.1 Source Factors.

4.2.1.1 Type of Source. The first technical aspect concerns now irrigation water is acquired, as this affects its management.

(a) River Diversion. River flows depend on rainfall patterns and the hydrological characteristics of the watershed. To the extent these are variable, for example, in monsoon-fed rivers vs. snow-fed rivers (Andhra Pradesh in India vs. Punjab in Pakistan), the supply task becomes crucial. When flow is highly fluctuating, system managers need to be able to respond to water shortages. (Surpluses can usually be let flow downstream.) To deal with changing water supply, managers require clear operating procedures and rules for alternative conditions.

The acquisition structures most commonly used are diversion weirs or barrages, although sometimes pumps are used to acquire water from rivers. Where not very flexible or reliable, these technical means can restrict the options available to managers. For example, some river acquisition structures can divert only part of the flow even during shortages, while others have a tendency to wash away during flood flows.

Rivers as water sources for irrigation can raise special problems for managers, who must contend with competing users and multiple uses, such as for power generation or industrial enterprises. Considerable effort at coordination between upstream and downstream users may be required to ensure an adequate water supply of good quality for irrigation. Managers' problems of coordination and decision-making are compounded if the river crosses political or administrative jurisdictions as in our case studies from Andhra Pradesh, India and Sri Lanka.

(b) Reservoirs. This technology is supposed to reduce variability in water supply by storing water for an entire season. Reservoirs, referred to as "tanks" in south India and Sri Lanka, can vary in size from fairly small to extremely large, depending on rainfall, climate, soils and (most important) terrain. Sometimes their water supply can be augmented by diverting water from a river source or by pumping groundwater, but most often they rely solely on water from their catchment area. In most cases, managers of reservoir systems can concentrate their efforts on allocation and distribution, not supply. If large reservoirs supply drinking water and hydroelectric energy as well as irrigation water, multiple objectives have to be served in their management.

Even though the risks in cultivation can be reduced by storing water in reservoirs, there can still be season-to-season variation. Operating schedules for different years may have to shift depending on actual water levels in the reservoir; operating rules may be tightened to distribute a limited supply more widely or to ensure fairness in distribution. Also, reservoirs like Tungabhradra in India can silt up, so that more maintenance activities must be part of their management.

(c) Groundwater. Water from this source is generally reliable and more efficiently used because the areas irrigated are smaller as a rule and the economic cost of pumping gives an incentive for prudent use of the supply. The reliable operation of such a system is, of course, dependent on the existence of an infrastructure capable of repairing pumps as well as maintaining a steady supply of power or fuel. Because of greater reliability, the water has a higher value to cultivators, being used just when and in the amounts needed. When there are market prices for groundwater, farmers will pay as much as 20 to 30 times more for it than they will pay for less reliable (uncertain, often inadequate) surface supplies.

Although groundwater is usually a steady water source, managers have to be concerned about lowering of the water table and any long-term deterioration on the aquifer, which can become depleted or polluted beyond remediation. Equity in access to irrigation water may become an issue because private pumps and wells are expensive and often only the rich can afford them. Public facilities for groundwater have in general been not very efficient or even necessarily equitable in providing water (Howes, 1984; Pant and Rai, 1985). It is possible with appropriate institutional arrangements to make groundwater development serve the interests of the poor (Ghate, 1980; Nagabrahmam and Vengamaraju, 1987; Chambers, Saxena and Shah, 1988). Such issues mean that groundwater systems, though they often look simple to manage because they are smaller and offer more control over water supply, can present some special problems.

(d) Conjunctive Use. Many irrigation systems use more than a single source of water. Reservoirs and river diversion systems are often supplemented with groundwater. This results in a more reliable total supply since if the main system fails, the pump system can compensate. However, difficulties in coordinating sources of water supply make multiple sources no simple solution to management problems. Resource mobilization and conflict resolution are likely to be more difficult, which raises the costs of management with conjunctive use. Farmers who get water from pumps may be unwilling to pay for the upkeep of the canal system which raises the water table that makes their pumping easy. Some water users may suffer while others benefit from canal seepage losses that raise the water table. This can cause waterlogging for some while lowering operating expenses for tubewell owners.

(e) Re-use. Not all the water applied in fields is either utilized by plants or evaporates. Some runs off the fields in drainage channels or percolates through the soil to add to underground supplies. Water "losses" may be re-used either by diverting flows from drainage channels or by pumping where topography or technology permits re-use. These opportunities become especially important when water is scarce. Issues of water quality (Section 4.2.3) can be critical for this source, however, since re-used water may contain substantial amounts of dissolved chemicals. Also there are potential knotty allocative questions of who shall be entitled to such water -- who shall benefit from it? If otherwise disadvantaged tail-enders get the water, this enhances the objective of equity, but powerful users may capture this and complicate managers' decisions.[9]

4.2.1.2 Relative Water Supply. The amount of water available relative to the demand for water has a large influence on the way an irrigation bureaucracy operates. Even though the variables involved are difficult to measure, a concept of "relative water supply" (RWS) -- the ratio between supply and demand -- has been developed to focus on this relationship and to study empirically its implications for system management (Levine, 1982). The amount of pressure users will put on the staff controlling irrigation water is inversely related to RWS, and many actions by managers and users can be explained by levels or changes in RWS. During periods when RWS is expected to below, for example, users in some systems in the Philippines and Indonesia reduce their area irrigated rather than change operating practices, which would require more intensive management effort by system managers and water users (Oad, 1983; Valera, 1985). The bethma system used previously and sometimes still in Sri Lanka reflects the same behavioral principle for water management, not just the normative principle of equity.[10]

Studies have suggested that once RWS falls below about 1.5 (which means supply is less than 50% above the minimum in-field crop requirements), irrigation systems require more management effort than is acceptable and sustainable from users and managers. Then either special efforts will be made to increase supply above this threshold if possible, or different (or fewer) crops will be grown to require less water.[11]

Whenever possible, system operators will prefer to have a larger rather than a smaller relative water supply since this provides them some "slack" water resources to work with. RWS of 2.0 (twice as much water as absolutely needed) represents the equivalent of "50% efficiency" by standard engineering criteria. However, this should not be seen as "50% waste." Raising the level of "efficiency" (operating with a lower RWS) demands much more management effort, and depending on how the costs of management are calculated, it may not be an economically profitable strategy. The economic benefits from more intensive water allocation and distribution may not be commensurate with the added costs involved.

Operating with a lower relative supply necessarily increases management costs, which begin rising sharply as one approaches 1.0. More and more effort is required to eliminate smaller and smaller amounts of remaining "slack" in the system. This is not the same thing as "waste." Irrigation systems in the American West built and operated by the U.S. Bureau of Reclamation perform with a RWS of nearly 3.0 (their average "efficiency" is 37% -- RWS and effiency are the inverse of one another in gross terms). It has been judged too expensive and too difficult, given factors like existing water rights, to try to increase these USBR systems' efficiency.

The RWS concept is useful for thinking about irrigation management because it brings considerations of cost into evaluations in a way that standard notions of "efficiency" do not. Such a concept implies imply that 100% is not only desirable but attainable, and a realistic yardstick for measurement. RWS makes no such presumption, being an empirical number. It is however difficult to know exactly what is the "demand" to which "supply" is compared; whether this is a seasonal average or whether periods of minimum RWS are to be given special attention; whether it is to be measured at the field outlet or at higher levels.

If one makes certain assumptions about what is the agronomic water demand in a system, one can distinguish systems where RWS is (a) above 2.0, (b) between 1.5 and 2.0, (c) between 1.0 and 1.5, and (d) below 1.0. Above 2.0, management tasks can be handled in a fairly relaxed manner, whereas below 1.0 both the plants and the managers will experience "stress." Such figures as averages will generally mask considerable variation, so one cannot say that systems in the first category have no areas of crisis or stress where management could not be improved; nor will the latter category be everywhere very "efficient."

4.2.1.3 Water Quality. This depends on the source, particularly where water is being re-used and contains dissolved fertilizers, pesticides and other chemicals. Any problems of water quality add to management tasks. The most frequent problem is salinity, which arises if water is highly saline or the preferred crop is sensitive to salts. Where water is only moderately saline or a more resilient crop is grown, there is still the potential for soil salinization over time. Preventing salt accumulation in the root zone requires a net downward movement of water during the growing season, so managers must issue some excess of water for leaching where salinization could become a problem.

Another aspect of water quality is the silt content of the water. Where high, this increases maintenance requirements unless compensated for by operating procedures that involve more intensive management or by designing and building acquisition and distribution structures that reduce silt load, such as Tyrolean weirs and sedimentation traps. Water quality should not be taken for granted in irrigation management.

4.2.2. Flow Factors.

In dealing with flow, the technical design of a system needs first to be considered as it establishes biases in management -- what pattern of flow can be maintained easily or what cannot be provided; gradations in between are influenced by cost. Systems can be designed for flexibility or rigidity. Interestingly, in India the advice from the World Bank for some years has been to build in flexibility, so that systems could adapt to changing conditions over the next several decades. Recently the preference appears to have shifted to more rigidly designed systems, perhaps to minimize the possibilities for corruption that go along with discretionary management of flows. Within the context established by technical design, one needs to distinguish between the operational strategies that establish patterns of flow, and the physical structures that give control over flow.

Operational strategies can be differentiated in the same terms as technical design. A responsive strategy is capable of responding to changes in water supply or demand by changing the operating schedule. This requires a capacity to collect and respond to information and the availability of alternative operating procedures. A rigid system, on the other hand, does not respond at all to information and maintains the same operating schedule under all conditions. Each type of strategy requires different conditions and capacities to be operated effectively. We discuss these in terms of operational schedules and then look at the influence of physical structures.

4.2.2.1 Operational Schedules. These are the core of any distributional strategy and can be seen from the user's point of view as being on a continuum varying from fixed to flexible. A responsive strategy has a variety of possible schedules ranging from flexible to fixed, whereas a rigid strategy employs only one schedule, fixed and unvarying.

One can define a flexible schedule as one which can respond to the changing needs of water users. Actually or in effect it is the farmer who has control over how much water enters a field and when. The ultimate in flexibility is when the farmer can open up a valve or gate at any time to get any amount of water desired and it is received. This is known as a pure "demand" system.

A fixed schedule, on the other hand, is one where the farmer has no control over when and how much water is available. All decisions affecting distribution are made previously by the system managers. The classic example of this schedule is the warabandi system where rotational deliveries are rigidly set in advance and, at least in principle, adhered to (Reidinger, 1974). Between these two extremes there is a continuum of schedules. Two variables bear on it: response time, and water control.

(a) Response Time. How long does it take for the schedule to respond to a change in the distribution needs of a farmer? The most flexible schedule would react immediately whereas a fixed one would not respond at all. One could measure response time by observing what happens with a certain change. High responsiveness might be one day or less, medium would be 2 to 4 days, and low would be 5 days or more.

(b) Water Control. Another way of looking at the continuum would be in terms of who controls the water? In a fixed mode, control over quantity and timing is determined solely by the agency whereas in a flexible mode, control is in the water users' hands. One major problem with having control in their hands, however, is that a flexible schedule for head-end farmers may result in a very unpredictable (and inequitable) schedule for tail-end farmers.

A continuum of operational schedules will vary by rate, duration, and frequency of deliveries, with each of these dimensions of delivery being either fixed or varied. Table 4.2 below lists possible alternative schedules, varying from the most flexible at the top (Schedule 1) to the fully fixed at the bottom (Schedule 8).[12]

These alternative schedules have some correspondence with Relative Water Supply (Section 4.2.1.2) in that flexible schedules tend to go with a higher RWS, while fixed schedules are more suited to lower RWS. During times of water abundance, many systems abandon rotational schedules in favor of a *laissez faire* flexible schedule, whereas in times of water scarcity, there is a tendency to move toward more fixed rotations in water delivery.

SCHEDULE	FREQUENCY	RATE	DURATION
1	Varied	Varied	Varied
2	Varied	Varied	Fixed
3	Fixed	Varied	Varied
4	Varied	Fixed	Varied
5	Fixed	Varied	Fixed
6	Fixed	Fixed	Varied
7	Varied	Fixed	Fixed
8	Fixed	Fixed	Fixed

Figure 4.2: ALTERNATIVE IRRIGATION DELIVERY SCHEDULES

Alternative operational schedules are not inherently good or bad. A good one is effective for the conditions under which it must operate. Thus even if a "rigid" mode of operation may at first seem inefficient because it "wastes" water, the physical and social environment may be such that it can be operated more effectively than a flexible one.

4.2.2.2 Structures of Control. The possibilities for carrying out a strategy of control are limited by the physical structures in place in a system. In the short run, these must be treated as given, though they may be modified over the longer run at some expense. They represent one of the more malleable parts of the irrigation "context" if funds are available and the topography permits changes, though Horst (1987: 55) tells us that the potential for efficiency and flexibility often designed into systems is seldom used by managers, who likely continue operating by the original design.

(a) Canals. The type and density of canals in the system will determine what kinds of operational strategies are feasible as well as the maintenance requirements of the system. Two important factors are:

(i) Freeboard: the amount of carrying capacity that canals have over and above their designed capacity without serious problems of erosion, overtopping or breaching.

(ii) Lining: this will reduce conveyance losses in porous soils, making continuous flow delivery more feasible.

If channels have no or little freeboard, the flow in them cannot be increased beyond designed amounts, reducing flexibility of operation. Where soils are very permeable, unlined channels make rotational deliveries almost imperative if a system has any supply limitations. The efficiency of management must always be judged with regard to such constraints as may be created by channel design and construction.

(b) Division and Control Structures. Flows of water can be divided at various points either in a fixed or an adjustable manner. Proportional dividers used to make fixed divisions are the easiest to operate but they also limit the kind of operation that is possible. Modern systems tend to provide for flexibility of operation by having adjustable structures, whereas traditional systems with mostly fixed structures have more often achieved their flexibility by varying their operational rules.

The types of control structures used at bifurcation points include gates, weirs or orifices that are (i) fixed, (ii) open-or-closed, (iii) gradual, (iv) stepwise, or (v) automatic. Different combinations of these give different capabilities for affecting flow. The more variable the structures, the more flexible can be the delivery of water without changing the operating schedule. Structures on main canals will differ in operation, cost and construction from those on secondary canals and tertiaries. The latter structures should be easy for water users to understand and operate if they are to have a role in the management of distribution.[13]

(c) Measuring Structures. Few systems have enough such structures for managers to be able to know with any precision the amounts of water being delivered at various points within their system. Most systems can be operated reasonably well with approximate information on volumes. That most of the installed measuring structures are little used indicates that it is not necessary to have many exact measurements for adequate system management. But some basic and up-to-date information is important.

A variety of flumes and overflow weirs can be installed for measuring flows. They differ from one another in their reliability, their ease of use, and their cost. In many user-managed "traditional" systems, indigenously designed proportioning weirs are used to divide water reasonably exactly so that shares can be known and controlled even if amounts are not measured (Martin and Yoder, 1987).

Lacking measuring or proportioning structures can reduce the ability of system managers to make optimizing decisions about distribution and to enforce allocations. It can also limit users' basis for making effective claims for exact amounts or shares of water. Even where measuring structures are in place, they are of little value unless managers maintain a good system for training and supervision for collecting, evaluating and using the data from them. Even with the best efforts of technical personnel, measurements are likely to have errors of 10 to 20 percent. Structures need to be periodically checked and recalibrated to ensure even some degree of accuracy.

For gauging the adequacy of flows, systematic observation of fields and drains can determine quite well whether water is being delivered in excess of field requirements.

Where outflows in drainage channels are observed, adjustments in distribution can be made on this basis to increase water use efficiency. This requires some organization of staff and/or water user effort, but it can be done at reasonably low cost (Zolezzi, 1985).

4.2.3 **Drainage Factors.** To complete consideration of the technical context of irrigation management, one needs to remember that flows from the source may be in excess of crop requirements, at least in certain places, given soil and other conditions. When there is inadequate drainage, soil structure and aeration are adversely affected, and waterlogging can result over time. Some drainage will occur naturally and one hopes it is sufficient. But technical means can be employed to supplement natural drainage, or to take its place if necessary:

(a) surface ditches, to remove storm rainfall and to collect and dispose of surface irrigation run-off, and

(b) subsurface pipes or pumps, to control the water table which would otherwise rise to the surface and hinder production, and to improve the soil's internal drainage so that the free movement of air and water can occur.

Such technical means can enable system managers to deal simply and directly with drainage where soil structure and topography make it a problem. In the absence of such means (or even with them where large accumulations of water are serious), different physical structures and operational procedures will be necessary to control flows adequately and limit applications to what crops require.

Sometimes systems get planned without provision for drainage facilities, such as the Tungabhadra irrigation system in Andhra Pradesh, India, where it was expected that water users would install them when and where needed. Misunderstandings can arise in such circumstances, as water users are inclined to expect the agency to "complete" the design and construction work it initiated.

Drainage, it should be said, is not something to be maximized. Rather, the level of the water table should be monitored and "optimized." Especially where there is conjunctive use, a higher table has some advantages. A well-designed, well-functioning physical system will minimize the difficulties that system managers face within their technical context. This will enable them to devote more effort to problems arising from other contexts. As a matter of fact, managers invariably have at least some technical constraints. They need to learn how to work within and around those that they confront.

4.3 ECONOMIC CONTEXT

The agro-ecological and technical contexts of irrigation management are physical "givens" affecting the four aspects of management effort -- supply, control, variation and cost. They influence how much effort will be required for management under the circumstances. When we consider the economic context, other questions arise. How much is the management effort worth, and to whom? Who has incentive to make improvements or to cooperate in achieving them? Within this complex area for analysis, five aspects of a system's economic environment appear most salient.

4.3.1 Profitability of Irrigated Agriculture. To the extent that natural conditions are more favorable for crop growth under irrigation, it is more likely that a "surplus" of resources will be generated which benefit some combination of farmers, managers, the government, and the consuming public. Incomes are increased, more resources are available, more taxes can be generated, and more food can be bought at lower prices. Exactly who gets how much benefit, however, depends on things like government policies, relative prices, cropping patterns, etc., not just on "natural" productivity.

Where irrigated agriculture is a profitable enterprise for water users, they have more stake in the activity and are likely to be more willing to cooperate in intensified management that "pays." Also, managers can make a more credible claim on government resources for systems' operation and maintenance, and regimes will be more willing to invest in O&M. When, on the other hand, irrigation is a "marginal" enterprise economically, there will be more resistance on various fronts to allocating it more resources, though any improvements in management will always be welcomed, at least in principle.

The profitability of irrigated agriculture should not be taken for granted. Government-set prices in a country like Thailand, for example, have squeezed much of the benefit out of rice farming. Historically, it is not clear that irrigated production has been profitable for the majority of cultivators in Pakistan's Punjab (Merrey, 1987). Current studies in Nepal suggest that the operation and maintenance of some systems there, if farmers were to bear the full cost, would require as much as three-fourths of the value added from irrigation (Lohani, 1986). Under such circumstances, considering the uncompensated cost of family labor, it is not worth farmers' while to get more involved in irrigation unless the government assumes much of the financial responsibility for O&M. This may be cheaper, and politically more palatable, than raising the price paid to farmers to encourage production and increase their willingness to bear O&M costs, since raising the producer price boosts the price consumers must pay unless the government subsidizes the latter.

We are not here passing judgment on policy options, only calling attention to the fact that the profitability of irrigation affects the willingness of farmers and government to invest in its improvement.[14] Generally speaking, the importance of irrigation affects the efficiency with which it is practiced. In a country like Venezuela, where the agriculture sector has diminished in the wake of petroleum exploitation and industrial development, we find 70% of the newly-developed areas in irrigation projects not in production. Venezuela and its small rural population (25% of the total) do not need or benefit from irrigation as in some other countries.

4.3.2 Land Tenure. A different kind of consideration is who owns the land whose productivity is enhanced by irrigation? Where there is a high incidence of owner-operation, system managers are dealing with the principal beneficiaries of improvements and with persons who are in a position to act as decision-makers at their level of operation. Conversely, managers' communication and cooperation with water users will be attenuated when there is widespread tenancy, sharecropping, or some other arrangement such as hired labor working under an overseer.[15] Apart from considerations of efficiency in management, tenurial arrangements should be considered in irrigation management to appreciate what is its impact on equity. Are landless workers getting a justifiable return from their labor? How might they benefit more in terms of employment and income opportunities?

The size distribution of landholdings should be considered, whether there is much or little <u>variation</u> in farm size. When holdings are roughly the same size, management operations can be more uniform, and equitable distribution of water will be not only more tenable as an objective but also easier to achieve. Under conditions of relative similarity in landholding, it may be easier to achieve equity objectives than to maximize productivity as the latter requires more variation and maybe cost in irrigation management activities than the former.

4.3.3 **Labor Supply.** Irrigation is a relatively labor-intensive mode of production. It is most developed where population densities are fairly high, though the direction of causation is ambiguous since greater productivity with irrigation permits the land to support larger populations. In any case, the development and management of irrigation presents special problems when population density is low. The high cost of constructing irrigation in much of Africa, documented in Chapter 11, is attributable in part to the lack of abundant, cheap labor. But the effects carry forward into operation and maintenance. Agency costs will be higher (or certain tasks will go undone), and farm labor will be more expensive (or simply unavailable when needed), affecting the profitability of irrigated agriculture (Section 4.3.1).

Much of the success of Asian irrigation systems has depended on the availability of plentiful, cheap labor. In both Taiwan and South Korea, rapid industrial development drawing labor supply from rural to urban areas has created problems for irrigation management (Stavis, 1982; Wade, 1982c). The scarcity of labor in many rural areas of Africa is an underappreciated constraint on irrigation there (Tiffen, 1987: 300).

4.3.4 Commercialization. Where agricultural production is all or mostly for the market, water users usually invest more in inputs that require cash outlay or repayment. This makes them more vulnerable to any deficiencies in management of the irrigation system, since these compound the risks they already face from the market and from nature (drops in price, shifts in climate, pests, crop diseases, etc.). This should make them more demanding of good system management, especially if their entire livelihood depends on irrigated production and they have no other income alternatives. When producing for an export market, risks and dependency will be greater still.

Subsistence cultivators who rely on irrigation can of course feel similarly dependent, even desperate in certain straitened circumstances. But with "modernization" of production often comes a belief in the control of outcomes, represented by the system of irrigation. Subsistence cultivators are not more "backward" than commercialized farmers. But officials managing irrigation for subsistence farmers may have their shortcomings regarded as another one of many hazards, whereas with monetization of production, farmers' expectations change and heighten.

Another consequence of commercialization is that resource mobilization can be undertaken better in cash than in kind (Uphoff, 1986: 48-50). Mobilizing voluntary contributions of labor for maintenance and possibly certain operational duties will be more acceptable in a less commercialized economic setting.

4.3.5 **Financing Methods.** Still a further economic consideration is the means of financing irrigation activities. Water users are more willing to contribute to a system's operation and maintenance where they have made some initial investment, often in the form of labor, to create an irrigation system, thereby making it <u>their</u> property (Coward, 1983). Conversely, where government has financed the system entirely, users are more likely to accept, even to expect, officials to carry out the ongoing responsibilities of management.[15]

Who provides the resources for operation and maintenance? If the government does this, officials are in a stronger position to manage the system as they choose. On the other hand, if users are covering all or a significant part of recurrent costs through water charges or some other form of resource mobilization, officials are thereby more "dependent" on the users. Accountability to them, one of the structural variables discussed in Section 2.3, is more easily maintained.

An intermediate situation is where the government finances recurrent costs, but at an inadequate level. When service is poor, farmers may be expected or even required to pay, perhaps informally and maybe even illicitly, toward getting better performance. This can establish a kind of accountability, but usually not to the general community of farmers or in publicly discussable and correctable ways.[17] The sources of financing for an irrigation system's creation and its operation and maintenance, from the government or water users, are thus a very important factor impinging on the methods feasible for its management.

4.4 HISTORICAL CONTEXT

The history of an irrigation system's creation -- <u>who</u> planned and financed it -- is going to influence what options current managers have for decision-making and resource mobilization, in part because it affects _who_ is entitled or obliged to undertake these activities at different levels of the system. In this chapter so far, we have been looking at factors which are system-specific. Some historical influences arise from the course of development of an individual irrigation system. Past experience of the people involved, i.e., the managers and users, will influence their perceptions and expectations, their willingness to cooperate, invest, etc. But there are also broader factors -- historical along with social, cultural, political and legal parameters -- that impinge on the management of all irrigation systems within a country or region. These factors manifest themselves in specific wa... for given systems, but they should be understood as overarching influences.

The _evolution_ of irrigation in a particular country will shape the goals and orientations prevailing in the irrigation bureaucracy. If the current situation evolved out of indigenous irrigation by water users, willingness to involve them in self-management of schemes is likely to be stronger than if many or at least the major irrigation schemes have been built by government, in which case a dominant agency role in management will be presumed. The role will be even more dominant if irrigation development was done by a colonial government or entirely with foreign donor assistance. The kind of systems built are then also likely to be larger and more "advanced" in technical design, less amenable to user roles in management.

The _goals_ of irrigation held by policy-makers and the bureaucracy will be shaped by historical factors. If irrigation was established to minimize the effects of drought and famine, as in parts of India during British rule, not only the physical design of systems will be different than if food production and self-sufficiency were the original objectives. Management patterns will have been established, and literally "set in concrete" because of the kind of physical structures installed, to distribute water thinly over large areas rather than to maximize agricultural output. The pattern of staffing and its orientation toward management will reflect this objective of coping with drought and famine, being more disposed to mobilize personnel for handling crises than toward maintaining optimal day-to-day water deliveries.

Where irrigation was developed in Sri Lanka to deal with land tenure and overpopulation problems there, large irrigated schemes were established in the underpopulated dry zone, and all settler households received the same size land parcels (Farmer, 1957). System management activities got oriented to "equality" in the spread of water, more than to the maximization of production. This latter orientation of management is more likely where irrigation schemes have been developed to support the expansion of cash or export cropping, so that "efficiency" is a more salient concern in managers' thoughts and actions.

It is possible for goals to change over time, of course. The Mwea scheme in Kenya began essentially as a detention camp for Kikuyu tribesmen captured during the Mau Mau rebellion of 1953. Between 1958 and 1963, system managers began concentrating efforts on increasing agricultural production, and after 1963, various innovations were made in both the production and managerial systems to operate the system more efficiently and to expand the area cultivated (Chambers and Moris, 1973).[18] The Indian irrigation systems referred to above, established on an extensive basis to protect against drought and famine, are now being reoriented toward greater efficiency and productivity with more intensive management. The Command Area Development Authorities set up in most states are bureaucratic entities expected to integrate the work of irrigation, agricultural and other agencies in specific systems.

If an Irrigation Department has always been part of a Ministry of Agriculture, it is likely that staff will be more attuned to agricultural considerations in managing irrigation activities than where an irrigation agency has functioned autonomously or within some other ministry like Water Resources or Lands. With the latter history, an agency is likely to regard irrigation as essentially a hydraulic exercise and to be dominated by civil engineers rather than agricultural engineers. It will likely have few or no agronomists (or other agricultural specialists) on its staff and to have a more distant relation to farmers.

Another historical influence derives from the role that irrigation has played in the development of the agricultural sector as a whole. If the role was prominent, the agency responsible for this expansion will have higher status and more claim on resources than if it was a marginal contributor. Mexico's Ministry of Hydraulic Resources was instrumental in helping fulfill the promises of that country's revolution and this has given that agency a high degree of autonomy, according to Greenberg (1970: 43). Moreover, the opinions of the agency's professionals on budget and technical matters are treated with considerable respect because of the importance of irrigation there.[19]

"Traditions" are themselves always evolving, so one should not regard irrigation bureaucracies' orientations as entirely fixed. Organizational doctrine, discussed in the next chapter and then in Part II, reflects earlier goals and previous practices. By shaping professionals' self-images and their repertoire of management routines, what is called doctrine in institution-building theory is an important factor from the past which guides behavior in the present.

4.5 SOCIO-CULTURAL CONTEXT

Social and cultural factors affect both water users' behavior and values and those of the irrigation bureaucracy itself. We consider first their bearing on water users' contribution to management. Tasks of communication and coordination are more complex when residence patterns are dispersed rather than nucleated and do not correspond to the channel layout of the irrigation system, that is, when field neighbors are not village neighbors (Coward, 1979). Where residential patterns are those established in settlement schemes, system managers may have control over water users' living arrangements in addition to control over their water. This drastically changes the context of management, though not necessarily for the better, because then problems and resentments concerning residential matters get enmeshed with those from irrigation.

Social diversity within the cultivating community can present problems for irrigation management. If water users are heterogeneous in ethnic or cultural terms, or in economic or class terms, getting cooperation among them may be more difficult, and the management effort that must go into conflict resolution will likely be greater.[20] We found contradictory approaches to reducing social conflict in our cases. In Gal Oya, Sri Lanka, experience suggests conflict will be less if settlers brought into an irrigation scheme from different areas are located together homogeneously by place of origin. But in the Mwea system in Kenya, managers thought it better to mix up original clans when assigning houses and fields to new tenants.

While it is probably true that heterogeneous social situations are more likely to have conflict, we know that people who are homogeneous by most "objective" criteria can still find grounds for differentiation and dispute. An important cultural variable to be considered is what can be called propensity for conflict, or conversely, aversion to conflict (discussed with examples in Uphoff, 1986: 51-52). Some communities or populations have deserved reputations for being quarrelsome and they are regarded by system managers with despair. Other groups are known and appreciated for placing a high value on amicable accommodation of contending interests. More than different norms may be involved; some communities have effective roles and procedures for resolving conflict, while others do not.

Socio-cultural factors influence bureaucracies as they do communities. Bureaucracies have their own traditions and social mechanisms for dealing with internal conflict. Some bureaucracies are quite heterogeneous with regard to status and specialization. This shows up in the structuring variable discussed in Section 2.3 and also in greater organizational gradients discussed in Section 2.2. Social homogeneity in bureauracies has similar consequences as in communities for their smooth functioning. One can even consider the "settlement patterns" in bureaucracies which facilitate or impede communication and cooperation according to locational proximity. The variables that sociologists and anthropologists have analyzed should not be restricted to communities of water users but also can be focused on irrigation agencies.

Probably the most important cultural norm for us concerns interpersonal relations, whether egalitarian relations are valued and encouraged, or whether hierarchical, deferential ones prevail. Societies differ considerably among themselves (and over time) in this regard. Hierarchical norms create expectations among both agency staff and water users that subordinate the latter to the former, and junior staff to senior staff. They give any staff more "power" over water users to regulate irrigation behavior. But they also reduce the content and effectiveness of communication in both directions, contributing to gaps in knowledge and understanding on both sides of the management equation.

Hierarchical norms are especially important to consider within an irrigation bureaucracy; how superiors and subordinates relate to one another, and how much control and accountability there is within the organization. We will be looking at these relationships in the chapters that follow, and at how these relationships can be made more productive for achieving irrigation goals. Some changes can be made within agencies, but it would be a mistake to see hierarchical norms and behaviors in bureaucracies as very malleable. They arise from and are reinforced by the larger cultural context.

4.6 POLITICAL-LEGAL CONTEXT

For bureaucracies, their political-legal environment is usually more important than their cultural milieu. The most visible aspects thereof are the policies of government which set for the bureaucracy the objectives of irrigation management, discussed in Section 2.2. The orientation of political "masters" must be considered by irrigation system managers. For example, how much effort should they devote to regulating water use in head-end areas in order to have more water to give to downstream areas? Assessments will be affected, for example, by whether government leaders are stressing food self-sufficiency as a production goal, minimizing expenditures to reduce a budget deficit, or enhancing opportunities for the disadvantaged to create a more equitable society. The implementation of a cost recovery program would be quite different under each of these three policy conditions.

Colonial and early post-independence governments tended to emphasize the objective of control, but increasingly we find productivity and/or equity being stressed. Such changes in the orientation of bureaucracies are not easy to achieve, however, as discussed in Part II. That government can have a pervasive influence in the performance of irrigation systems is clear from the Mexican case, where a new presidential administration (called a sexenio) comes in every six years. In recent years a regular pattern in the growth and decline of production in irrigated areas has emerged according to the cycle of elections and new administrations. This is seen in Figure 4.3 on the next page, where triangles mark the change of government every six years.[21]

Something seldom written about but keenly perceived by irrigation managers as a variable is the extent of interference by politicians in management activities. There are many complaints about pressure for irregularities in water allocation or distribution, or about intervention in the operations of the agency, affecting staff transfers, promotions, etc.[22] Politicians may sometimes be correcting what they or some of their constituents see as deficient system management or inequitable distribution of irrigation benefits. Their involvement in irrigation management

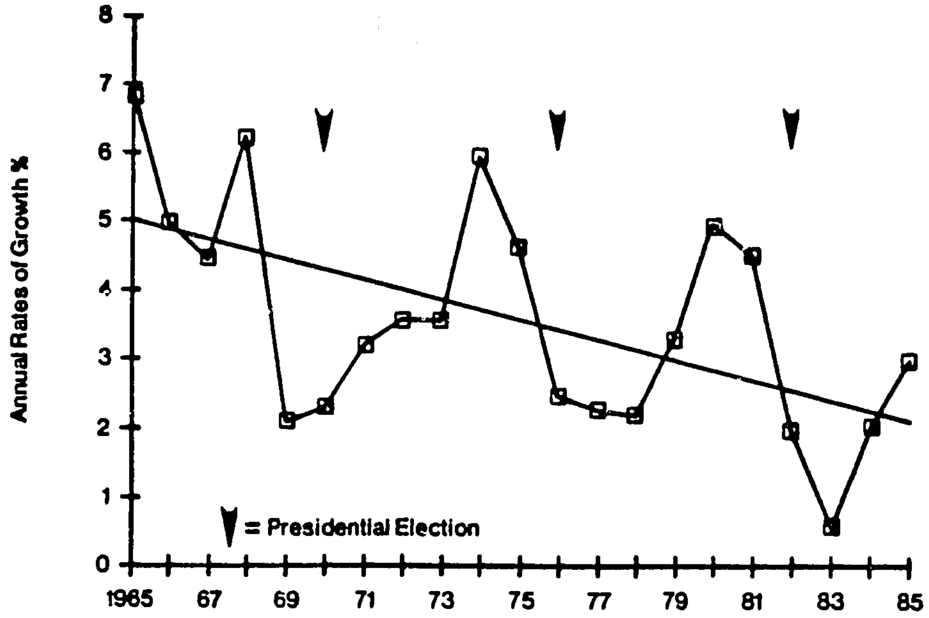

Figure 4.3: RATES OF PRODUCTION GROWTH IN MEXICAN IRRIGATION DISTRICTS

should not be justified or condemned universally therefore. Political interference may used to benefit certain privileged groups, or elected representatives may be looking after the legitimate needs of constituents who were ignored or victimized by the bureaucracy. What can be said is that some system managers must function in an environment where political intervention is frequent and overriding, whereas in other contexts, irrigation is carried out more according to set policies and technical criteria.

Even in the circumstance of non-interference, one may not always find technical or policy considerations determining operation. Possibly it will be responding to unsanctioned payments extracted from users for irrigation services, commonly referred to as "corruption." Where such practices and expectations are widespread, they constitute part of the context of irrigation management. They may be more or less of an impediment for improving performance depending on the kind of "bureaucratic culture" prevailing in the agency, discussed in Chapter 9.

What gets referred to as "the political climate" may be so inhospitable that irrigation management is difficult if not impossible. One can only wonder how irrigation is faring in Iraq, Iran and Lebanon these days with warfare distracting and distorting what it has not destroyed. Civil unrest makes work in parts of Nicaragua, Peru and Sri Lanka untenable, though the situation could be different in a few years and other countries could be embroiled in similar debilitating strife. At our workshop it was reported that production in the Indian Punjab in 1986 was at record levels despite the violence prevailing there, partly because agricultural production is one of the few available and assured economic activities and labor supply is plentiful. Certain countries have situations that are so authoritarian or corrupt that relations between agencies and the public must be less than productive. One should not assume that irrigation management can function without regard to the broader external political environment.

An important factor is the extent of water users' influence, whether individually or collectively they are able to affect management decisions. This depends partly on the importance of farming sectors in the political-economic strategy of the regime, whether top decision-makers wish to or need to pay attention to farmers' interests. Where water users have little social status and political influence, they can be ignored by officials, possibly attended to only where illicit financial transactions come into play.

To the extent that water users are organized and able to make their collective voice heard, this will add to their influence. This will be greater if farmers have electoral significance as a bloc. In some societies, farmers are economically, socially and politically put into the role of "clients" subordinate to rural or urban elite "patrons" (Scott, 1972). Their influence will then be felt only through the latter, who if themselves dependent on irrigation may pressure for better management. They may do this, however, mostly for themselves, as seen in our Pakistan and India cases (Merrey, 1982; Wade, 1984a). If there is much intra-elite competition, more weight and benefit can accrue to farmers themselves.

Finally, the legal situation needs to be assessed. What are the operative laws, codes or regulations governing water use and management? Three general situations can be found: (a) where there is a well-defined legal framework and institutions backing it up with enforcement; (b) no clear framework or policy, admitting of high variation in what happens, or (c) dualistic legal systems with basically Western and indigenous laws coexisting.[23]

There is usually some legislation which assigns rights and duties to the irrigation agency and/or to water users, but most laws tend to give rights to the former and duties to the latter (Uphoff, 1986: 135-136). Possibly water user associations will be authorized or even required by law, given wide or very narrow scope of operation.

One key consideration is whether the legal framework gives the irrigation bureaucracy effective authority for enforcing laws and regulations against water users violating them. In some countries, laws are on the books but the complexity, slackness or slowness of enforcement makes them practically a dead letter. In a minority of situations, one finds agencies clearly empowered to back up their decisions credibly. This greatly changes the context of irrigation management. The same applies if water user associations have definite authority to enforce their decisions, mobilize resources, etc. We consider in Section 6.3.1 the role of modifications in the legal framework for improving irrigation management.

Other facets of the context of irrigation management could be considered, but these are the ones we have found most likely to be salient in our review of the literature and case studies. Before turning to an analysis of irrigation bureaucracies as such, we list in summary form the variables within the environment of such bureaucracies that most warrant consideration.

Agroecological Context:
- Rainfall and other Climatic Factors
- Soils
- Topography
- Cropping Patterns

Technical Context
- Source Factors (Type of Source, Relative Water Supply, and Water Quality)
- Flow Factors (Patterns of Flow, and Structures of Control)
- Drainage Factors

Economic Context
- Profitability of Irrigated Agriculture
- Land Tenure Arrangements
- Labor Supply
- Commercialization
- Financing Methods

Historical Context
- Evolution of Irrigation
- Goals of Irrigation
- Origins of Agency
- Importance of Irrigation

Socio-Cultural Context
- Residence Patterns (Nuclear-Dispersed)
- Group diversity (Heterogeneity or Homogeneity)
- Propensity for Conflict (or Conflict Aversion)
- Social Relations (Hierarchical or Egalitarian)

Political-Legal Context
- Policies of Government
- Interference by Politicians
- Water Users' Influence
- Legal Authority

FOOTNOTES

[1]"Relative water supply" is discussed below in Section 4.4.2. It has been developed and analyzed as a variable affecting irrigation management behavior by Gilbert Levine and several colleagues and students at Cornell University. See Levine (1982) for statement of the concept and its operationalization; also Oad (1985) and Yoder (1986).

[2]Application is treated here as the fourth water-focused activity because if the supply of water at field level is adequately controlled, problems of drainage (the fourth water activity analyzed in Uphoff, 1986) should not arise. Application of water at field level and its removal are obviously linked.

[3]In the Gal Oya system of Sri Lanka, Zolezzi (1986) found within the command area of a single distributary channel four-fold differences in soil water availability (3.9% to 15.4%) due to differences in soil characteristics. The Irrigation Department was in principle distributing water uniformly to all areas of the system on the assumption (belief) that the soils all had the same water retention qualities, expecting (mistakenly) a uniform subsurface pan to have been built up after 30 years of cultivation. In practice, of course, some adjustments had to be and were being made.

[4]Not to make such an accommodation can reduce the social benefits of irrigation. In the Mwea scheme in Kenya, for example, system managers restricted their assistance to the fertile, water-retentive black clay soils used for cash crop production, leaving less good red soils for farmers' subsistence cultivation. While this simplified management tasks, it meant that the scheme underperformed in meeting subsistence needs (Chambers and Moris, 1974).

[5]At our workshop, Robert Wade speculated that topographical differences might explain different modes of organization for irrigation management -- autonomous Irrigation Associations in Taiwan and large centralized bureaucracies in India.

[6]In Nepal, a distinction is usually made between "hill" (hillside or mountain) irrigation and "terai"(plains or lowland) irrigation. But Pradhan's field studies (1986)

suggest also a third kind of topographical situation, "valley" irrigation. This is intermediate between the other two types in terms of size of command area and slope to be dealt with.

[7]Cropping patterns could be classified either under this or the next section, which distinguishes "man-made" from "natural" physical conditions. Crops are "natural" but their patterns are man-made. We consider cropping patterns along with agroecological factors because of the close association of plants with water and soil. This section may be seen as bridging into the next one.

[8]As noted above, in the warabandi system of water distribution used in northern India and Pakistan, no account is taken of differences in cropping patterns within the command. Fixed amounts of water are delivered according to a set schedule and farmers can decide how they wish to make use of that water. From a management point of view such systems are operated as if they were monocropped.

[9]In our first field visit to the Gal Oya Left Bank scheme in Sri Lanka, very poor farmers on a tail-end distributary told us of being deprived of what little water they could get by merchants and other influential persons who were cultivating drainage areas illegally and had extended field channels to serve their encroachments directly. When drainage water was inadequate, they sent their employees (thugs) at night to close the field channel offtakes serving authorized farmers in order to send all water to the tail. When the farmers tried to block such water theft, they got beaten up. The police also turned a deaf ear to complaints. This anomalous situation of powerful "super-tail-enders" was subsequently cleared up by physical and organizational rehabilitation of the system.

[10]In traditional Sri Lankan irrigation management, whether farmer-managed or government-managed, when water supply in the reservoir at the start of the dry cropping season was below a certain level, head-end farmers would cultivate only part of their plots and farmers in middle and tail sections of the command area would be permitted to cultivate the remainder in order that all could plant some crop with assured water supply. On the bethma system, see Leach (1961).

[11]Reference to "minimum plant requirements" is figurative, not literal. As discussed in Section 4.1.4, one should think in terms of plants' response functions with respect to water. For rice, the response curve is sharp and dramatic (S-shaped), enough so that one can speak in effect of "requirements" to prevent crop failure (drastic falloff in yield). For most other plants, with more sloping response curves, yields are more roughly proportional to water inputs. In such cases the optimum water-yield combination depends on cost of inputs and value of outputs. The notion of "crop requirements," common in the literature and in common discourse, is more appropriate as an engineering design criterion than as an agronomic or economic cutoff point.

[12]This analysis is an adaptation from that suggested by Replogle and Merriam (1980).

[13]In the most "modern" systems, with computer assistance, one increasingly finds automated gates regulated according to downstream levels of flow -- "dynamic regulation" (Rodier and Rousset, 1987; Tardieu, 1987). It has certain advantages for system managers but then places full responsibility on them because water users can have no role, apart from blaming the managers for any breakdown.

[14]The question of whether water users should pay the "full cost" of O&M, as currently advocated by some donor agencies, is very complicated. The beneficiaries from irrigation include, besides farmers, the large number of consumers and the government. The latter are, respectively, the major source and the main receiver of taxes, from which any cost-sharing of O&M must come. Businessmen, merchants and contractors also benefit but are not considered liable for sharing the capital or recurrent costs of irrigation.

[15]In an extreme case like Mwea in Kenya, where the government remained the owner of all the land in this irrigated settlement scheme, it could use cultivators' insecurity of tenure as a means of ensuring "discipline" and "cooperation" from them.

[16]See Coward and Uphoff (1986) and Small et al. (1986). Many systems have been built largely with external sources of finance. Foreign donors often pressure an agency to follow their directives on things like cost recovery, management practices, etc. While such strictures

may strengthen the hand of the bureaucracy in certain ways, they may also contribute to users feeling and taking less responsibility.

[17]There are cases reported in India where water users in a system collectively pool their funds to pay official managers to ensure water deliveries (Meinzen-Dick, 1984; Wade, 1982). Illicit linkages between users and managers may contribute to some collective accountability, but this is an exception to the rule.

[18]It is not clear that this "legacy" of Mwea's initial years has been totally forgotten or eliminated. The way farmers were regimented in Mwea when it was established is more understandable once one knows that their predecessors were indeed prisoners of war. This observation was confirmed in our discussion with a senior manager of the National Irrigation Authority of Kenya who visited Cornell in April 1987.

[19]Greenberg (1970: 60). In Sri Lanka, the restoration of ancient reservoirs and reopening the dry zone for cultivation beginning about 1900 put the Irrigation Department there in a very exalted position. In the 1930s farmers addressed the Irrigation Overseer with the worshipful Sinhala title used for addressing Buddhist monks meaning "Your Reverence"; an Irrigation Engineer was called "Great Reverence" and the Director of Irrigation "God-like Reverence." "Such were the attitudes of the people at the time I joined the Irrigation Department in 1934," reminisce G. M. Dissanayake, a former Deputy Director of Irrigation (Irrigation Department, 1975: 60). Such status has of course now diminished, not just because the agency has less impressive and crucial work to do, but also because the public is more educated, and democratic values have become more widespread.

[20]Or it may simply complicate management without any particular problem of conflict. The Deputy Director of Irrigation managing the Gal Oya scheme in Sri Lanka (S. Senthinathan) reported at our workshop on a problem he encountered when, to save water, he interrupted the delivery of water for land preparation during the five days of Sinhalese New Year, when the Buddhist majority of farmers take time off for festivities. Muslim farmers in the tail-end areas strongly objected and asked that flows be resumed since they had not stopped their fieldwork.

[21]This figure was prepared and provided by one of our workshop participants, Enrique Palacios-Velez, formerly general director of Water Resources Administration for the Secretaria de Recursos Hidraulicos in Mexico.

[22]While this subject is seldom written about, there is some documentation of it in Wade (1982a and 1984) and Greenberg (1970) with regard to our Indian and Mexican cases.

[23]Such dualism has been formalized in Thailand with separate legal acts pertaining to "peoples' irrigation systems," mostly small-scale indigenous systems found in the north and northeast, and "royal irrigation systems" managed by the government. Indonesia is an example of such co-existence developing more through practice.

Chapter 5

HOW TO ANALYZE IRRIGATION BUREAUCRACIES

Any analysis of the structure and functioning of irrigation bureaucracies should be better for having thought about the various types of irrigation systems and management structures to be found (Chapter 2) and also about the objectives and contexts of irrigation (Chapters 3 and 4). We do not intend to propose any universal solutions for improving irrigation bureaucracy as an abstraction. Any changes to be effective must have a good fit with the characteristics of the socio-technical system itself, with the objectives and context of the system as these are understood by the relevant actors, and with the social and psychological dynamics of the bureaucracy involved.

In this chapter, we highlight features of bureaucratic structure and orientation which are both focuses and means for introducing changes in the way an agency operates. We look also at various activities and capacities as well as linkages involved in producing irrigation results. This will prepare us for dealing in Part II with strategies for improving bureaucratic performance in the irrigation sector.

We will not distinguish in our discussion whether the "agency" in question is an Irrigation Department, perhaps part of a larger ministry, or a ministry itself, an autonomous authority, or some other kind of bureaucratic entity. We want to get away from purely nominal differences and thereby to focus on structural and operational features that are more significant. Indeed, irrigation activities in a country may be handled by several different entities, dividing responsibilities among themselves according to different criteria:

(a) by area, with geographically defined jurisdictions,

(b) by function, with different agencies responsible for O&M and for design and construction, with possibly even a division of responsibility between operation and maintenance,

(c) by type of system as analyzed in Chapter 2, with one or more agencies responsible for operating state-managed systems while others work with user-managed systems, or responsible for different sizes of systems (large-scale vs. small-scale),

(d) by source or technology, with different agencies handling surface water systems and groundwater (pump) systems.

These principles can be illustrated in the case of Sri Lanka. There a newly-created Mahaweli Authority handles the development of hundreds of thousands of acres in a large complex of command areas served by a major river system, while the Irrigation Department continues to be responsible for all other "major" schemes, defined as those over 200 acres. The Department of Agrarian Services under the Ministry of Agriculture deals with "minor" schemes, those under 200 acres in extent. The Mahaweli Authority itself is divided into two sections, a Mahaweli Engineering and Construction Authority which handles the design and building of new systems, and a Mahaweli Economic Authority which brings in settler households and works with them to meet their economic, agricultural and other needs, including water supply. MEA handles irrigation management through engineers and technical staff at different levels, but its staff includes also other disciplines to help establish productive communities based on irrigated agriculture. This has been a relatively bureaucratic operation, with even the efforts to provide for farmer participation proving less than satisfactory (Lundqvist, 1986). In the past there have been other authorities, such as the Gal Oya Development Board which established the Gal Oya system and then became the River Valleys Development Board to cover other new systems as well. Some of its responsibilities were later transferred to the Irrigation Department, while others now rest with the Mahaweli Authority.

This example may seem complicated, but countries often have a number of agencies involved in the irrigation sector. Having a division of responsibility between "large" and "small" systems is often confused by spurious precision. Any command area definition is arbitrary. A cutoff in Sri Lanka at 200 acres leaves a large number of small-scale (one or two level) systems serving 200 to 1,000 acres poorly attended to because the Irrigation Department is preoccupied with "major" schemes, those having thousands of acres (three or more levels). In Indian states, systems below 5,000 acres are usually regarded as "minor" systems, but even then, medium-scale systems (5,000 to 25,000 acres) often get neglected by the bureaucracy which has its hands full just managing "major" schemes.

There can also be confusion over jurisdiction between agency-managed and user-managed systems. Because user-management is often not legally recognized, the nominal responsibility of government agencies can appear to be greater than it actually is. Clear assignment of responsibility has been made in Thailand, where separate laws govern the operation and maintenance of systems under the Royal Irrigation Department and those identified as "people's systems."[1] Our concern here is with whichever bureaucracies are responsible for operation and maintenance in irrigation systems of any type.

5.1 STRUCTURE OF AGENCY

There are various ways in which an agency can be structured. The factors we would emphasize are the levels of organization, the allocation of personnel within the agency, and formal divisions of responsibility supplemented by informal relations among staff at the various levels.

5.1.1 Levels of Organization. The number of levels of agency organization is determined at least in part by the area extent of its responsibility, just as the number of levels of operation in an irrigation system reflects the size of its command area. Authority and information in an agency flow downward and get subdivided in a manner not unlike that for water in a system. However, institutional "gravity" is not as advantageous as physical gravity for water because information must move also in the opposite direction, and upward flow is difficult.

Operating the agency at the center is equivalent to "main system management" for water, handling the tasks of decision-making, resource mobilization, communication and conflict resolution at the highest level of the system. Organizational structure is subdivided in a series of levels down to the lowest operating level for the bureaucracy. The first intermediate level is likely to correspond to the first administrative subdivision of government authority below the center, variously called states, regions, provinces, or departements in Francophone countries. Below this come units often called districts at the next lower level, and then units such as sub-districts, divisions, or cercles below that. (See Figure 5.1 on the next page for an example of such organization from Pakistan.)

A major consideration is whether all levels of organization correspond to administrative subdivisions, and if not, where they diverge. Since irrigation is an activity clearly delimited in spatial terms, there are likely to be management problems when administrative rather than hydraulic boundaries are used to organize staff operations. At the first level below the center, this may present no difficulties. But at some level it causes problems because irrigation systems overlap administrative units. Because of differences in climate and topography, some administrative units will have large irrigated areas to manage while others will have little or no irrigation. Boundaries for the administration of irrigation activities should be (but are not always) aligned with hydraulic realities.

Some irrigation management problems come from unfortunate assignments of geographic responsibilities. In the Gal Oya scheme in Sri Lanka, the head and middle areas were administered by one office and the tail areas by a different office. While the remedy for such problems is reasonably obvious, this does not make the changes easy. Existing boundaries are reinforced by historic patterns of communication, interest articulation and political influence, and some resistance is likely to be encountered for any proposed realignment.

The number of levels at which there is authorized decision-making and separate budgeting processes and accountability is to some extent discretionary. In the Sri Lanka case, below the national level and the range level, there is the project level, managed by an engineer. Within each project, there is some number of offices and jurisdictions for the lowest level of professional staff, the Technical Assistant, who supervises O&M within an area of about 5,000 acres. This unit is further subdivided into Work Supervisor (Irrigation Overseer) areas of about 2,500 acres each, and then into Patrol Laborer areas of about 500 acres each. Note that the principle of organization shifts from being administrative at higher levels, to being hydraulic at the project level, to being operational at the lowest levels, where boundaries are set according to staff jurisdictions of responsibility.

A larger and more complicated structure of organization is shown for a province (state) in Pakistan in Figure 5.1. This has many more levels for personnel, budgeting and other activities of decision-making, resource mobilization, etc. than found in Sri Lanka. The diagram does not show the national level because it has only policy and budget allocation responsibilities, not for operation and maintenance.[2]

As suggested in Chapter 2, the more levels of organization there are in a bureaucracy, the greater is the organizational distance between the top level of the

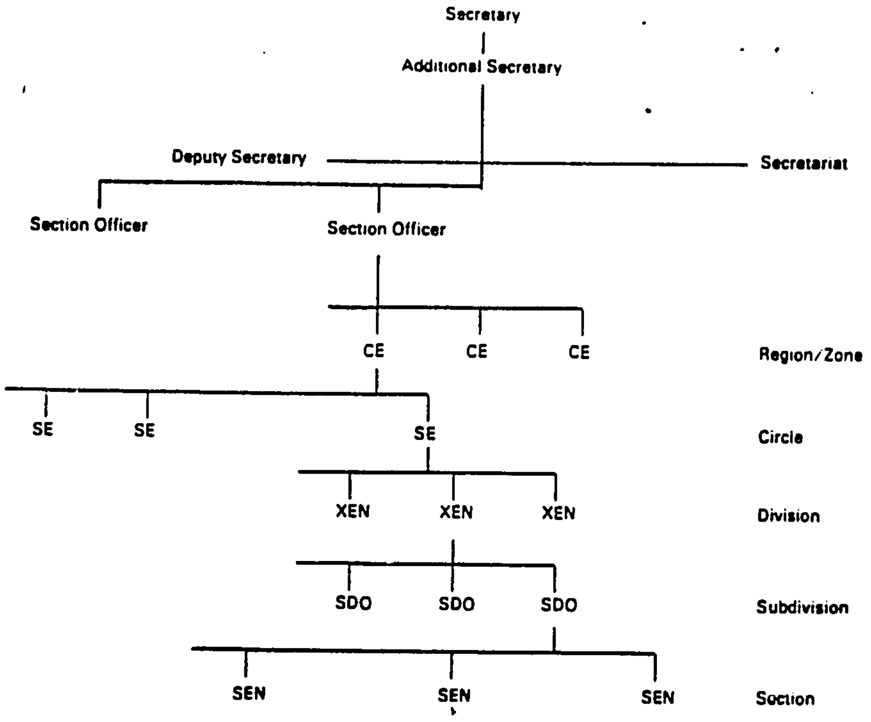

Figure 5.1: ORGANIZATIONAL DIAGRAM OF AN IRRIGATION DEPARTMENT FOR A PROVINCE IN PAKISTAN

agency and the bottom of the management structure, the field level. To the extent that communication and cooperation between levels is greater, this reduces the angle between levels, and the organizational gradient is less steep. But the number of levels presents a fixed factor affecting communication and cooperation in any system.

Any reduction in the number of levels will increase the span of control which administrators at one level must cope with in dealing with all subordinate levels, i.e., they will be responsible for supervising more subordinate units and will have more units reporting to them. Since there are limits on the time and attention that decision-makers can devote to the needs and initiatives of those with whom they work, a reduction in distance by having fewer levels will be partly offset by a resulting steeper angle when spans of control are extended. This does not mean that the span of control should be minimal, which would require having a greater number of levels, but rather that the tradeoffs must be weighed. Organizational gradient is something to be optimized, not minimized, with a view to achieving organizational objectives.

5.1.2 **Allocation of Personnel.** The structure of a bureaucratic organization, apart from symbolic depiction as in Figure 5.1, is most tangibly expressed in the assignment and location of its staff. The number and qualifications of personnel working at different levels is an essential feature of agency structure. We have all heard some organizations described as "top-heavy." This means that of all the staff with operational responsibilities, a disproportionate number are allocated to higher levels.

The variable of administrative intensity, discussed in Chapter 2 as the ratio of administrative personnel to production staff, does not necessarily represent a positive feature for any bureaucracy. Such intensity can occur at any level. A high proportion of "non-production" personnel, however they are defined for irrigation bureaucracies, e.g. clerks, messengers, bookkeepers, etc., may be located at middle or lower levels of the organization.[3]

Within the category of "production-oriented" irrigation personnel, various distinctions get made. In most of South Asia, one finds a distinction between "officers" and "staff"; in the Mwea scheme in Kenya, classifications were made among "senior," "junior" and "subordinate" staff; the Mexican bureaucracy for irrigation has distinguished between "confidence" and "base" workers according to their responsibilities and the basis of their appointment.

The shape of organizational pyramids as sketched in Figure 2.4 will roughly reflect the number of personnel allocated among the different levels of organization. One would want to know, in addition to numbers, the allocation of personnel by professional status among and within levels. For example, how far down in the structure does one find professional engineers? Are all engineers with higher education and professional qualifications assigned to the upper levels, with only less formally qualified engineers running the system at lower levels? This reflects an important qualitative dimension of organizational structure.

Further, one would want to know something about the segmentation of personnel: the extent to which identifiable cadres are maintained within the bureaucracy. This can be by level or function. In many countries, the public service is organized so that top positions are filled by persons without a technical specialization who constitute an administrative cadre, supported at middle levels by personnel in an executive class, while the lowest ranks are staffed with employees in a clerical or manual service. In South Asia, for example, a sharp distinction is drawn between "gazetted" and "non-gazetted" staff in terms of their levels of formal qualifications. Irrigation agencies are likely to draw heavily on a separate technical cadre recruited on the basis of specialized educational qualifications or technical knowledge gained from experience.

Whether the top bureaucratic leadership of an irrigation agency is drawn from the administrative or technical service is an important matter because it affects how the rest of the technical personnel fit into the organization. Are engineers collectively managing the agency according to their best technical judgments (within policy guidelines, to be sure), or are they carrying out directives sent from above and outside their technical cadre, placing responsibility elsewhere? Tensions if not outright competition and conflict between administrative and technical personnel are common in segmented bureaucratic agencies, and irrigation departments will not be immune from such sources of internal difficulty.

This structural feature affects the mobility of personnel, whether staff can be and are moved freely across areas of responsibility or are tracked narrowly along certain lines within specializations. It also influences the amount of upward mobility of personnel, which in turn affects morale, a factor influenced by structure but not a structural factor as such. Can persons entering the agency at one level and in one cadre move up and into another set of responsibilities based on experience and merit? This question gets answered in different ways in different agencies. If a sharp dividing line exists between "gazetted" and "non-gazetted" personnel, for example, staff appointed in the latter category can never move up into positions of responsibility.

A final concern is the stability of personnel assignments within the agency: how much transfer and turnover one finds. One can speak of a relatively stable or unstable staff structure depending on the average length of tenure in positions, which affects the amount of institutional memory available. One of the most frequent sources of substandard bureaucratic performance is lack of personnel stability. Then people are not in their positions long enough to develop the needed knowledge and skill base or to feel some commitment to achieving results because they expect to be transferred soon, either at their own initiative or against their will.[4] A review of World Bank experience concluded that a major determinant of irrigation project success was the length of time the professional staff stayed with the same project. In the most successful projects, top staff spent their entire careers in the same scheme.[5]

Complete stability can lead to stagnation or demoralization, or both, so it is not necessarily the ideal to be sought. Personnel policies should aim at a structure with some personnel mobility, both horizontal and vertical. The optimum will be some combination of staff change and stability, with more of the latter than the former.

5.1.3 Divisions of Responsibility. Given a number of levels of organization with staff assigned to each of them, a third structural concern is how responsibilities are divided or shared. This reflects the degree of decentralization but also the relationship between technical and administrative duties. These can be organized so as to require specialization in each area or to be manageable by generalists, possibly technical personnel with administrative training and/or experience. The consequence of much specialization is to have an agency which is more "bureaucratized" according to the analysis of Max Weber (1947), which stressed division of labor as a distinctive feature of this mode of organization.

Some specialization is inevitable and desirable, but a high degree tends toward immobility more than efficiency, as the different divisions of the bureaucracy become more separated. Processing papers for staff appointments or for releasing funds, for example, can be under the control of certain auxiliary staff who have authority in such matters, or more clearly at the direction of personnel who have substantive knowledge and responsibility. The latter, of course, may feel a particular aversion toward "administration" and "paper-shuffling," preferring to engage themselves with technical tasks. But the consequence is to put many decisions affecting technical performance in the hands of non-technical personnel. In the case of Mexico, it is reported that technical staff appreciate the delegation of many "administration" tasks to non-technicians (political appointees) as this helps insulate them from certain practices and decisions they would not like to be associated with (Greenberg, 1970). There will invariably be some specialization in any organization, so this variable is always a matter of degree.

Decentralization can be a matter of kind as well as degree, the main distinction being between deconcentration and devolution of authority. Both represent movements away from "concentration of authority," a structural variable discussed in Section 2.3, but in different ways. The first represents a delegation of authority to lower-levels within a governmental structure, moving powers of decision-making from the central (national) level to one or more sub-national levels. Authority still remains under the purview and ultimate control of the center. With devolution, on the other hand, authority is transferred to decision-makers not part of the bureaucracy and accountable to local populations (Uphoff, 1986a: 221-227).

The latter alternative is found with participatory strategies of irrigation management where water user associations or other local organizations have responsibility for a range of decisions, for resource mobilization to support operation and maintenance, for communication and coordination, and for conflict resolution (Uphoff, 1986). Having such organizations contributing to irrigation management expands not the structure of the bureaucracy, since they are formally outside it, but rather the overall structure of irrigation management as treated in Section 2.2.

Most often in the past, decentralization in irrigation management has meant not devolution but deconcentration. This involved either (a) giving staff at lower levels of the system more authority, funds and information to take and implement decisions about operation and maintenance, or (b) assigning staff from higher to lower levels to carry out management activities "closer" to the field. In the first instance, there would be no change in the structure of personnel but the resource shifts would represent a structural modification. In the second instance, change could be measured in terms of new staffing ratios by level and by function.

5.1.4 **Informal Structure.** In Section 2.3, we proposed "structuring of organization" as a key variable with three correlated aspects. The first of these, specialization, has been discussed as producing different structural arrangements than where staff are working mostly in generalist capacities. The second is taken up in Section 5.2.2.4. The third, formalization, is often hard to recognize because its absence means reliance on informal roles and procedures for decision-making, mobilizing resources, etc., which by definition are hard to identify and measure. To the extent that the tasks of management get handled through informal roles and relationships, there exists within the agency a practically invisible internal structure which, although it affects performance in many ways, may be virtually unknown by outside observers.

Informal roles and relationships exist in every bureaucracy. No institution can operate entirely "by the book." One study for the World Bank on the Mahaweli scheme in Sri Lanka notes: "Proposals for management improvement will fail if they do not take account of informal interests and the patterns of incentives and pressures they create" (Heaver, 1982). In virtually every organization, personal connections and favors are vital for getting needed exceptions made and urgent business expedited. Things accomplished on such bases should not necessarily be judged invalid or illicit, though there is always a feeling that such relationships are illegitimate for being idiosyncratic or irregular.[6]

There are important matters of degree to consider. In some bureaucracies, the formal procedures and channels are so slow, unresponsive or unreliable that quite a system of informal linkages must compensate for them. Then the divisions of responsibility shown in an organization's chart do not give a good guide to its real workings. When assessing any bureaucracy, one needs to know the relative importance of informal roles and relationships compared to formal ones. A full-blown structure of interactions covering decision-making, resource allocations, communication and conflict resolution can exist informally alongside formal channels and obligations. These may be integrated into a network of relationships from top to bottom of the organization or they may be focused in sub-organizational groups such as analyzed by Leonard (1977:43-80) in his study of the Kenya extension service.

Anybody seeking to improve the performance of an irrigation bureaucracy must be attuned to the existence and influence of such an "invisible" structure. This does not mean ignoring the formal one but rather examining both formal and informal capacities where the latter have become more than means of dealing with small "normal" failures of the formal system. Examining the extent and functions of the informal structure of an agency will tell us much about the defects and deficiencies of its more visible formal counterpart.

5.2 AGENCY ORIENTATION

Paralleling these structural features are a number of normative and behavioral factors which emanate from the individuals involved more than from the situation they find themselves in. In social science terms, a "structural" explanation ignores individual differences and deals with general influences such as the incentives assumed to affect the typical or average person, having predictable effects, no matter what are the persons' individual beliefs or capabilities.[7] Normative and behavioral explanations, on the other hand, employ factors like values or habituation that influence an individual's performance independently of the situation. This distinction is important because the means of affecting collective performance differ depending on which explanation is invoked for any deficiencies -- whether these are seen as rooted in the situation that individuals find themselves in or in the attitudes and capabilities of the individuals themselves.

Attitudes and capabilities of individuals establish orientations that shape performance within a bureaucracy, though it should be clear that factors within a bureaucracy likewise help to shape those attitudes and capabilities. Such orientations can be analyzed with regard to irrigation management particularly under two headings:

(a) the doctrine that animates and directs individual efforts within the organization, and

(b) the professionalism that derives from staff training and background.

In both respects one is dealing with shared ideas and values that have an impact on individual and collective performance, over and above the influence that various structural factors such as discussed above can have.

5.2.1. Doctrine. One of the most interesting concepts in the "institution building" literature (e.g. Eaton, 1972) points to the importance of an organization's doctrine: the set of principles, objectives, strategies, self-images, etc. which define the organization to its members and to outsiders. Doctrine, a concept extrapolated from military experience, helps to coordinate planning and action through shared ideas and expectations. A military organization will prepare itself for the kind of attack it expects most probable, e.g. whether over land or by sea; it will put more effort into recruitment and equipment of infantry or of cavalry, or into building battleships or submarines; it creates expectations that officers will lead their troops into battle or command from a distance; all personnel will understand that there is never to be any retreat, or none until certain conditions are met.[8]

Any bureaucracy needs some consensus on what are the most likely problems its staff must deal with, what are the most effective solutions, what are preferred methods of action, the operative decision rules, etc. Strategic and tactical principles backed by shared beliefs in their efficacy are necessary to maintain what was referred to on page 36 as organizational coherence. Not every necessary action can be anticipated and specified in advance from above; much must be left to the discretion of personnel at all levels. A shared doctrine which conveys uniform expectations about what others will do and one's own best course of action reduces greatly the need for communication and explicit coordination.

Once doctrine is established, it also creates certain inertia within an organization, as people conform to received expectations rather than take initiative to revise their assumptions and routines (Hedberg, 1981; Miller; 1982). Doctrine thus has some costs as well as benefits. We will be dealing with it more fully in Chapter 8 as a factor for improving performance in an irrigation bureaucracy. Here we consider four aspects of doctrine that orient irrigation personnel, particularly in the upper echelons.

5.2.1.1 Preferred Activities. In principle, all activities that create and sustain the physical structures supplying water for irrigation are equally important:

design, construction, operation, and maintenance. In practice, there is a strong bias in most engineering cadres in favor of design and construction. These are the most prestigious activities, the ones that earn reputations. After all, who ever became famous for good O&M? It is thought that anybody can handle this, whereas "the best and brightest" do design and construction. The "queen bees" of the profession create the physical systems which the "worker bees" then operate and maintain. Such status preconceptions are unfortunately reinforced in most irrigation systems by the patterns of material reward, licit or illicit, that favor persons handling design and construction.[9]

Where operation and maintenance are not valued activities, irrigation system management is bound to suffer. Improving them becomes more difficult because top talent will be reluctant to take on these responsibilities, if only because accepting O&M tasks suggests one is not good enough or did not have enough clout to be assigned to design and construction, the preferred activities. This problem is so common and so widely recognized that no more need be said about it.

What kind of performance deserves and gets respect? What should one hope to accomplish with one's life? The program of professional education through which engineers come understandably emphasizes technical accomplishments as the most commendable. Administrative and managerial tasks are often seen as best performed by those who cannot become first-rate engineers.[10] Such an orientation can have similar effects as the one just described. Administrative responsibilities get taken on reluctantly and maybe not by the most capable and most motivated. Investing time and thought in making improvements is not seen as "worthy." There is accordingly less likelihood of engineer-administrators working to devise and introduce innovations in bureaucratic practice.

5.2.1.2 Locus of Control. The prevailing doctrine on this matter, whether control should reside more at headquarters or with staff in the field, is not the same for all agencies. Whichever view is taken will affect the presumptions according to which irrigation systems are managed.

In the initial period of irrigation development, it is often self-evident that engineers in the field must have control over resources for design and construction and authority to make necessary adaptations in plans. Decision-makers at the center cannot know much about field ituations and operations because of poor communication and transportation, so considerable delegation of authority occurs at least de facto. This can foster a belief that an irrigation organization should proceed with control based at field levels, and such an orientation could carry over into O&M activities.

Some agencies continue with this premise of operation, whereas others accept the more "modern" view that all activities should be determined by the best expertise available and the best policy that can be articulated from the center. With better means of communication and transportation has often come more centralization of authority, if only to be responsive to the priorities and directives of political leadership. Also, political democratization has contributed to a shift in doctrine to favor central control in the name of accountability; an elected government should exercise control over bureaucratic operations in the name of the public.

There are arguments to be made in favor of either position. We are not proposing one over the other but call attention to this aspect of organizational doctrine, which affects how irrigation systems will be managed: whether there is a presumption that central decisions should override local ones, or vice versa. The latter view has many advantages for responsive operation and maintenance, provided that the staff are themselves oriented toward public service and productivity objectives.

5.2.1.3 **Social Relations.** To what extent do hierarchical or fraternal relations predominate within the organization? We discussed this in Section 4.5 in terms of the socio-cultural context of irrigation systems management. But this variable applies specifically to the values and practices within the bureaucracy itself. The standard bureaucratic orientation is for superiors to maintain considerable social distance from subordinates. Countervailing this can be the professional norm that all persons with similar training and qualifications should treat each other equally. Some differences in status and respect can be accepted based on professional competence and accomplishments, but they should in this latter view not be due solely to bureaucratic position. The values prevailing in the social environment outside the bureaucracy may coincide with and reinforce norms either of a hierarchical or fraternal nature. Or there can be hierarchical organization within an egalitarian society, or vice versa. If internal and external normative orientations are contradictory, this makes for tension and incoherence within organizational doctrine.

Hierarchical norms within a bureaucracy should not be seen as simply archaic or negative. They can reflect the principle that expertise (reflected in promotions) and experience (consolidated in years of seniority) are important and should be deferred to. In fact egalitarian norms within the cadre of engineers, in the absence of strong attachment to performance criteria, can contribute to unresponsive and even irresponsible behavior on the part of senior staff, who value the judgment of their technical peers more than the needs and opinions of water users or even political representatives. On the other hand, hierarchy can be used promote a service orientation and even participatory objectives.[11]

These comments have introduced the concept of organizational "doctrine," which will be taken up again in Chapters 7 and 8. It should be understood that any organization will have some doctrine that guides the activities of its members, whether they are conscious of this or not. Indeed, organizational doctrine is usually tacit, though its elements will be regularly conveyed in word and deed. By discussing it, we want to make doctrine more tangible so that it can be enlisted in support of improved bureaucratic performance. Once identified, obstructive elements in an agency's doctrine can be confronted, and more constructive ones can be introduced.

5.2.2. **Professionalism.** Another crucial factor affecting bureaucratic performance is the degree and kind of professionalism to be found in agencies in the irrigation sector. How much esprit de corps is there? How much self-confidence? To the extent that staff think of their work as "just a job" rather than as a respectable vocation, one they are committed to and take pride in, operation and maintenance will be performed more routinely and less satisfactorily.

On the other hand, professionalism can be conceived and practiced in ways that have certain undesirable consequences, such as when it is used to maintain extreme hierarchy. Some forms of professionalism make staff more remote from the public and defensive in response to any criticism. The values and practices deriving from professionalism, like those associated with doctrine, can have either positive or negative impacts on performance.

5.2.2.1 **Qualifications and Training.** One factor is the extent and kind of formal training that has been given to staff at different levels (this is discussed by Chambers in Section 10.3..1). The more of the staff that have had professional or "technical" education, the more inclined they will be to work according to technical standards and objectives compared to those instructions that have come through regular bureaucratic channels.[12] If certain, usually higher, levels of the organization are staffed with professionally-trained persons and other levels, usually lower, are not, this creates a cleavage within the agency and exaggerates any tendency toward hierarchical relations that may exist.

The kind of training is important, since engineering cadres can have different kinds of professional orientation. The most likely is toward civil engineering, stressing structures and hydraulics -- the capture, conveyance and distribution of water according to some scientifically based plan. Less likely is toward agricultural engineering which stresses soils and crops -- the timely application of water to meet agro-environmental requirements. The least likely is toward systems engineering, which encompasses the first two orientations but stresses the factors of productivity and sustainability -- the interaction between people and physical factors in a socio-technical process of irrigation.[13]

Engineering professionals can have any one or a combination of these orientations, depending in the first instance upon their educational background. Did they come through a civil engineering or an agricultural engineering course, or possibly a more interdisciplinary curriculum including subjects like operations research and organization theory? The whole pattern of system management can vary depending on whether the top cadres are drawn mostly from civil engineering or agricultural engineering or some other profession.

5.2.2.2 **Career Paths.** How do engineers get to top positions of administrative leadership in the agency? As discussed already, most enter the service after completing higher education in some branch of engineering as professionally qualified engineers. Some in the engineering cadre may have entered the agency with less technical qualifications but may have been promoted based on years of experience and supplementary study. Usually the latter will have somewhat different status, different pay and some ceiling on the responsibilities to which they can be aspire. The more of the latter kind of engineers have made it into the professional ranks, the more the practical experience that can be found there.[14]

The pattern of experiences which professionally-qualified engineers gain in the course of their agency career is itself important and can vary. Some agencies assign junior engineers to field responsibilities as soon as appointed, with the idea that young engineers should "get experience" right away. Their subsequent postings may make them more and more remote from the field, but at least they have had some field exposure and experience. In other agencies, young engineers start out in office assignments, not being given field responsibilities until they are more mature. Being given responsibilities may then be regarded as a mark of trust, something desirable, rather than as something forced on beginners who lack the status and seniority to be elsewhere, and who will seek to escape from the field as soon as possible. Different patterns of career development for the engineering cadre will affect both enthusiasm and skills for handling the operation and maintenance of systems.

5.2.2.3 Autonomy. One of the hallmarks of any profession is having a certain identity which gives its members a degree of autonomy. Professionals are expected to be to some extent self-directed, drawing on their expertise and guided by commitments based on professional standards and values. Such expertise and commitments are beneficial for the broader community. At the same time, there is a question of how much autonomy is desirable. Technical criteria which engineering professionals are apt to use, for example, are more appropriate for determining means than ends -- how to achieve a desired objective, but not what constitutes a desirable goal.

Professional autonomy for irrigation bureaucracies can occur (a) generally in terms of their being members of a bureaucracy vis-a-vis the rest of society, or (b) specifically based on their technical expertise. Bureaucrats are expected, according to Weber's analysis, to act upon their best professional judgments since they have been selected for their respective claims of competence. The extreme of bureaucratic autonomy was the Mandarin tradition in China where the civil service had great discretion and independence in the conduct of government business.

Efforts have been made in most countries to establish a different relationship between the bureaucracy and the public, e.g. designating the civil service as the "public service," though this can be a purely nominal change. One still hears recriminations, especially in ex-colonial countries, that the bureaucrats are not civil servants but civil masters. To the extent that there is a pervasivetradition of civil service autonomy in a country, government irrigation agencies will be more aloof and powerful vis-a-vis water users.

Added to this will be whatever claims the irrigation agency wishes to make, based on being a specialized technical department, for independence from outside control, either from politicians or the public. To be sure, if these outside influences are particularized ones, favoring special interests rather than broadly beneficial irrigation objectives, professional or bureaucratic ability to resist outside pressures can be seen as desirable.

5.2.2.4 Standardization. The second aspect of "structuring" in organizations (discussed in Section 2.3) is closely linked to professionalism. "Right" ways to do things are established on technical and/or ethical grounds within any profession. All members are expected to perform their tasks accordingly. When the professional norms are appropriate, the uniformity achieved is of great benefit; when incorrect or not apt, they constitute real barriers to improved performance.[15]

In this and other ways, we see that professionalism in irrigation bureaucracies has potential for both positive and negative effects. The line between esprit and arrogance can be vague; people welcome the first as much as they reject the latter. Relationships among individuals are rooted in values and ideas such as promoted and perpetuated by a profession. Values and ideas are affected by the structure of an organization but they also can transcend that structure. They contribute to outcomes that are better or worse than the structure alone would have produced.

This is why we have considered both the structure (5.1) and the orientation (5.2) of agencies as each bears on bureaucratic performance. We move on to an analysis of activities -- what irrigation agencies do (5.3) -- and of their capacities for performing them (5.4), looking finally at their various linkages (5.5) since agencies do not and cannot operate in an organizational vacuum.

5.3 AGENCY ACTIVITIES

Given the structure and staff of an agency, what are the responsibilities it has to perform? We listed in Chapter 3 the generic activities involved in irrigation management. But these activities which focused on irrigation water, control structures and organizational functions do not encompass the full range of activities associated with irrigation management if agricultural, land tenure and other responsibilities are also undertaken by an agency. So we include the latter too. Irrigation agencies can vary in their responsibilities along three dimensions of concentration:

(IA) All responsibilities in the irrigation sector may be assigned to a single agency, in which case it has to handle the full range of activities, from acquisition to drainage, from design to maintenance, and from decision-making to conflict resolution, or

(IIB) alternatively, they may be divided among several agencies.

(IIA) A broad definition of "irrigation" may be accepted so that the irrigation agency handles all associated agricultural and other responsibilities, or

(IIB) it can be concerned exclusively with water activities, with other responsibilities taken care of by the extension service, banks, land registration office, etc.

(IIIA) The agency may discharge all responsibilities itself without any user participation, or

(IIIB) local institutions such as water user associations or local government bodies may share in carrying out the different activities.

Different kinds of concentration are possible. A single irrigation agency (IA) can work with a narrow definition of its responsibility (IIB) and with water user associations (IIIB). Or one of several irrigation agencies in a country (IB) can have broad responsibilities (IIA) and share few of them with water users (IIIA), e.g., the Mahaweli Economic Authority in Sri Lanka as discussed above. Obviously, an agency with a concentration profile of IA-IIA-IIIA would have more activities than one with IB-IIB-IIIB. For readers who like to visualize such relationships, Figure 5.2 on the next page shows how the three dimensions relate.

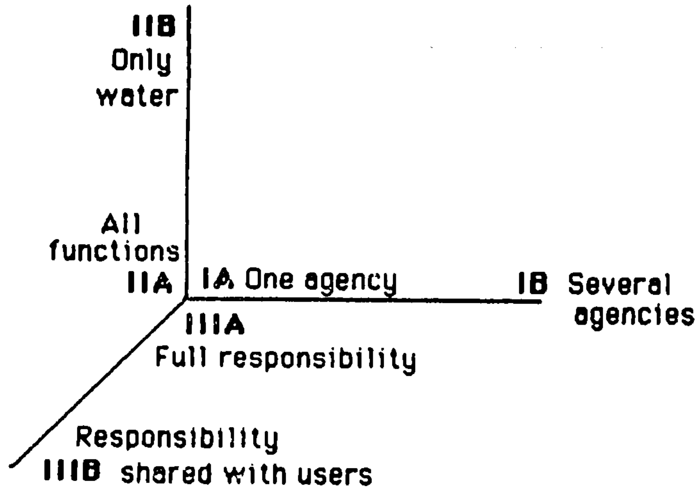

Figure 5.2: ALTERNATIVE PATTERNS OF AGENCY RESPONSIBILITY

A hegemonic agency (IA) can be either comprehensive (IIA) or specialized in water activities (IIB). If agencies are organized on a regional basis, the combinacion IB-IIA can result, as in the case of the Muda Agricultural Development Authority in Malaysia, though IB-IIB is also a possible profile for regional agencies. IB agencies can be organized along functional rather than geographic lines, with one organization given responsibility for all design and construction while another handles all operation and maintenance once the irrigation systems have been built. In Sri Lanka, the Mahaweli Engineering and Construction Authority has no O&M responsibilities, as these are taken care of by the Mahaweli Economic Authority. Sharing of responsibilities with farmers (IIIB) or not (IIIA) is possible with any of the above patterns of concentration, though we have not found any agencies with the profile IB-IIB-IIIB, however feasible this may be in principle.

A specific enumeration of possible agency activities would include the following, noted in Chapter 2:

A1 water acquisition
A2 water allocation (assignment of rights)
A3 water distribution
A4 water removal (drainage)

B1 design of structures (weirs, canals, gates, etc.),
B2 construction of these structures
B3 operation of these structures
B4 maintenance of these structures

C1 decision-making about the above
C2 resource mobilization for the above
C3 communication concerning the above
C4 conflict resolution in connection with the above.

The last set, C1-C4, must be undertaken to some extent within all agencies, but one needs to distinguish among them when analyzing what an agency's staff at different levels have responsibility for.

Beyond these, there are a number of activities associated with the agricultural aspects of irrigation:

D1 planning, coordination and monitoring of cropping
D2 provision of technical advice (extension)
D3 provision of agricultural inputs (fertilizer, seeds, credit, etc.)
D4 disposition of crop (marketing, storage, transport, etc.).

Other activities like agricultural research, crop insurance, grading of crop, etc. may be undertaken. A still broader set of activities would include:

E1 assignment and enforcement of land tenure rights
E2 settlement/resettlement services to farm households

E1 may be connected with maintenance responsibilities B4, preserving agency rights-of-way so that encroachers do not interfere with access to channels and other facilities. Or it may entail comprehensive land tenure responsibilities within the irrigation system, regulating grazing and use of other reserved areas, and can even extend to the watershed catchment area. E2 can be limited in time to an initial period or may extend indefinitely with broad community development responsibilities including education, health and recreation. The agency managing the Rahad scheme in Sudan, for example, even encompasses some local government functions (Benedict et al., 1981).

An analysis of agency activities should go beyond enumeration of the things for which the particular agency has responsibility, to identify what things are handled by agency staff at different levels, discussed in Section 5.1.1 above. Concern with O&M, for example, may be found only at the scheme level and below, with higher levels of agency leadership paying these activities no heed beyond approving budget allocations and staff requirements. Of course, at least <u>some</u> decision-making (C1) and resource mobilization (C2) for operation (B3) and maintenance (B4) must occur at higher levels. But they can be minimal and perfunctory, with real management of O&M, e.g., discretionary decisions about budget and staff allocation for these activities, handled at one or more levels below.

Where a water charge is levied to mobilize resources for O&M, this may be decided on at high levels but then actually carried out at the scheme level. In IIA systems, irrigation agency personnel do the collection in cash or in kind, while in IIB systems, this activity is undertaken by revenue officials or other government staff. In IIIB systems. such collection would be handled by water user associations or the local government.

When analyzing activities at different levels, one should specify exactly <u>what</u> is done within the various categories (A1-E2) by <u>which</u> staff at that particular level. At the scheme level, water distribution activities (A3) will entail scheduling when the main gate is to be opened and closed and then carrying this out, whereas staff at the lowest level may have no role in scheduling, only opening and closing watercourse turnouts as directed.

Organizational activities (C1-C4) should be examined with regard to all other activities. Who makes decisions (C1) and at what level concerning each activity in question? Where decisions are made at a level above where they are to be carried out, one wants to know who ensures communication (C3) in both directions to inform decision-makers and those affected by the decisions. Also, <u>who</u> is responsible for resolving any conflicts (C4) that may arise in connection with activities such as water acquisition, allocation, distribution or drainage? If resources for channel maintenance are mobilized (C2) at the <u>same</u> level where they will be used, the main management problems are their sufficiency and the efficiency of their use. However, when resources are mobilized from <u>another</u> level, specific responsibilities for decision-making (C1), communication (C3) and conflict resolution (C4) need to be assigned to handle the inter-level relations in channel maintenance.

These examples show how interwoven are the activities of management. The framework mapped out here actually simplifies activity analysis by proposing a set of inclusive categories to be considered. It should help managers and analysts avoid overlooking certain kinds of activities, calling attention to inter-level as well as to within-level tasks.

When doing an analysis of irrigation management by a particular agency, it is important to know what things ought to be done by its staff at particular levels but are not. The reasons for omissions should be identified -- whether they are due to lapses in management planning and supervision, to inadequate information, to limitations of staff and budget the agency faces, or constraints imposed by contextual factors analyzed in Chapter 4.

5.4 AGENCY CAPACITIES

Considering what an irrigation agency should or might do but does not leads to an evaluation of performance. Having looked at its activities, the next question is: What things does the agency do well and what not so well? Assessment of agency capacities is essential before making improvements in performance, but as we have said, it needs to be done with reference to types of systems (Chapter 2), objectives (Chapter 3), context (Chapter 4), and the specific agency structure, staffing and activities considered in this chapter.

Any agency will have some deficiencies in performance. These should not be allowed to overshadow agency strengths; any efforts to remedy shortcoming should build on these strengths or at least not compromise them. Agency staff need to appreciate, and to know that others appreciate, what they are doing well. So an assessment should identify agency capacities and not just incapacities.

In the business management literature, something called SWOT has been described, assessing Strengths, Weaknesses, Opportunities, and Threats. When analyzing agencies' contexts in Chapter 2, we addressed the latter two, opportunities and threats. In this section, we are concerned with strengths and weaknesses. Examples of strengths would be continuous efforts to try to rationalize operational procedures, or to keep water use to a minimum.

Alternative means for assessing agency performance include:

(a) external evaluation by some group of specialists from outside the agency who would carry out their assessment based on interviews, documentation, and observation. Personnel at all levels of the agency would be tapped as sources of information and assessment, but also other persons who deal with the agency as administrators for another agency, who have some responsibility for irrigation (such as government ministers or secretaries) and of course those who receive its services (water users).

(b) self-evaluation by some group selected from within the agency. Its sources of information would be essentially the same as for (a). Being intimately familiar with the agency's functioning, such a group should be able to be more penetrating in its assessment. Whether the analysis would be beneficial or not would depend on how it was perceived and responded to by colleagues, superiors and subordinates.

(c) user evaluation by a group representing water users. They might draw exclusively on the assessments of receivers of agency services, or if given supporting staff and resources they could undertake an assessment similar to (a).

(d) joint evaluation by a mixed group including outside specialists, agency personnel, and water users. This is in our view the most promising.

These require both time and effort, and while they are likely to be worthwhile on a periodic basis, they are no substitute for a further alternative which is less demanding in terms of resources and therefore possible to conduct more often, on a continuing basis:

(e) management evaluation by those persons with management responsibilities who do an informal internal self-assessment of performance, looking at the factors discussed thus far and at linkages, discussed below.

In addition to identifying where the agency has shortcomings, assessments should diagnose the reasons for them. These can be analyzed in terms of (a) resource, (b) structural, and (c) contextual constraints.

5.4.1 Resource Constraints. These are more readily identified and dealt with than other constraints because resources are finite and divisible. They are most often thought of in economic terms, but several kinds are needed for irrigation management, not just the first listed here:

(a) budget -- limitations in financial resources according to the:

(i) amount of funds available,

(ii) timing of funds' availability (may not be available when needed, e.g. because budget is given in quarterly installments).

(iii) uses to which available resources can be put (see d)

(b) personnel -- staff limitations in terms of:

(i) amount available, overall shortage of staff,

(ii) skills available, limited technical competence, or limited managerial capabilities,

(iii) deployment, unable to assign staff where needed,

(iv) supervision, unable to monitor and discipline staff to achieve desired levels of performance (see d)

(c) information -- suboptimal decision-making and implementation due to:

(i) inadequacy, of information, sufficient or correct data not collected,

(ii) no analysis, of information, adequate use not made of available data,

(iii) poor communication, information not getting to those who need it, due to lack of:

(a) channels of communication -- established routes for passing information,

(b) facilities for communication -- e.g. telephones, vehicles, typewriters, photocopying machines.

(d) authority -- decision-makers are unable to make effective decisions for various reasons:

(i) lack of flexibility and discretion in handling budget and personnel -- e.g., in reallocation of funds, redefinition of responsibilities, scheduling of work, exercising disciplinary powers, etc.

(ii) lack of enforcement powers -- unable to invoke sanctions such as dismissal of personnel, imposing fines, or withholding water from water users who break rules.

(iii) lack of status and legitimacy accorded decision-makers, reducing effectiveness of authority even if the legal basis for authority grants discretion and nominal enforcement powers; insufficiency of status and legitimacy may emanate from own agency staff, other agencies, or water users.

Not all of these resource constraints can be easily remedied, but they are at least specific and may be found at any or all levels of the agency. One can have sufficient information at lower levels but not at higher levels, or existing information may not be reaching the right persons because of poor communication infrastructure. These four kinds of resource constraints interact, but are distinguishable.

5.4.2 **Structural Constraints**. Structural problems can be related to resource limitations, such as too little communication between levels. But more complicated processes of change are involved than getting an increase in budget, winning Public Service Commission approval to upgrade certain positions, or instituting new reporting procedures. Structural relationships were considered in Section 2.3 and in the first section of this chapter, so we will not elaborate on them further here. We simply state that when diagnosing inadequate agency capacity, one should look beyond resource constraints as such and pinpoint any basic problems that involve the kinds of reorganization and reorientation to be discussed in Part II.

5.4.3 **Contextual Constraints**. Many agency shortcomings can be attributed to the kinds of factors analyzed in Chapter 4. There may be an absolute shortage of water supply because of changed weather conditions, or the water table may be going down due to factors beyond managers' control. The government's price policy may give farmers little incentive to invest much effort in their part of operation and maintenance responsibilities. Much staff time may be tied up in conflict resolution because cultural and legal traditions make water users inclined to take all disputes into court.

Improving the performance of an irrigation bureaucracy which is hemmed in by such constraints in the environment will require different strategies than those for enhancing managers' resources or making structural adjustments, which are essentially intra-agency matters. To be sure, resource or structural initiatives may have to be part of an agency's strategy to cope with adverse contextual influences. Creating all-round capacities for irrigation bureaucracies to deal with their many tasks will usually involve addressing all three kinds of constraints.

5.5 AGENCY LINKAGES

Before getting into consideration of strategies in the following chapters, we need to introduce some analysis of the linkages which an agency has (or could have) with other agencies and sets of persons that interact with it. This area of concern has been addressed in organization theory and specifically in the literature on institution building, which is discussed in Chapter 8 for what it can contribute to strategies of agency strengthening. Other agencies and actors present both constraints and opportunities for improving irrigation management.

As noted already, the agency whose performance is being assessed is unlikely to be the only actor in the irrigation sector. Some combination of the following linkages, involving the exchange of information and other resources such as funds, personnel and authority, should be examined:

(a) with other agencies in the irrigation sector, where the agency under consideration is not the only one (e.g. in Sri Lanka, the Mahaweli Authority vs. the Irrigation Department)

(b) with other agencies in the agricultural sector, such as the Ministry of Agriculture, the agricultural extension service, rural banks, and the statistical office that gathers data,

(c) with other government agencies such as the Ministry of Finance which approves budgets, the Auditor-General who monitors expenditure, or the Interior Ministry if district-level coordination is handled by its representative at that level.

Linkages, as the last example suggests, can occur at many levels and across levels. The national office of an Irrigation Department may need to interact with a District Commissioner not under its authority if he controls budget submissions and personnel transfers within his district. Linkages can be competitive rather than cooperative, as reported in the Mexican case where the irrigation agency (SRH) often comes into conflict with the Federal Electricity Commission (Greenberg, 1970:47). An agency will come into competition with other agencies more often if carrying out functions beyond those of irrigation, i.e., if it is a type IIA agency as defined in Section 5.3.

Linkages extending outside the bureaucratic structure can include connections with:

(c) non-governmental organizations (NGOs) involved in the irrigation or agricultural sector if they provide services to the agency or to water users; examples could include private voluntary organizations assisting in the resettlement of households in new irrigation schemes,

(d) donor agencies where they are assisting in irrigation or agricultural development,

(e) water users, individually or more effectively through their own organizations where these exist, and

(f) politicians, at national, regional and/or local levels.

The latter category is often the most problematic. It can be a source of desired and needed political support but possibly also of difficult, costly demands. Agency leaders may have particularly good connections to politicians if, for example, they have the same educational or ethnic backgrounds. By cooperating, each can make the other more popular and effective in their respective roles. Financial transactions may flow in either or both directions, in the form of budget allocations and various unsanctioned payments. It is a fact that "linkage" between officials and politicians has a significant effect on the way irrigation systems are operated if persons in authority evaluate system performance less on the basis of water flows and more on the basis of cash flows (Wade, 1982a: Greenberg, 1970).

The strength and possible mutual benefit of all linkages should be examined when trying to assess the capacity and performance of an irrigation agency. What does the agency (or groups within the agency) get from each external source in terms of authority, prestige, information, financial resources, technological inputs, perquisites, political support, etc.? What is provided in return? One should ask also, who is more in control of the amount and direction of flow? The value of resources flowing in both directions need not be the same.

Linkages are treated extensively in the "institution building" literature, considered in Chapter 8. They are sometimes called "interorganizational relationships" (IRs) in the literature on "organizational assessment." The variables it uses to characterize differences in networks of interorganizational relationships are similar to the ones we found useful for describing differences in the structures of organizations in Chapter 2: centralization, formalization, complexity, and intensity. Empirical tests of these relationships have led to the development of almost three dozen measures of interorganizational relationships. We would not recommend such a sophisticated system for evaluation of linkages in irrigation bureaucracies' networks, but the operationalization of indicators by Van de Ven and Ferry (1980) could be adapted for agencies in our sector of interest.[16]

A concern with linkages directs attention from within an agency outward to its human and institutional environment. This is a focus we want to amplify. But in developing strategies for improving irrigation agency performance, we start with more inward-looking means in Chapters 6 and 7. This is not to ignore outward-looking efforts, but to begin by increasing the productivity of resources and structures within an institution. We take up the external dimensions of capacity-building in Section 8.2 when approaching our subject from the "institution building" perspective. This emphasizes linkages as key factors in the analysis and improvement of organizational performance.

FOOTNOTES

[1]The applicable laws are the Royal Irrigation Act (1942, amended 1975) and the People's Irrigation Act (1938, amended 1983). The latter was enacted to provide some system regulation for the small-scale schemes developed by users particularly in the northeastern part of Thailand.

[2]This diagram is from Wolf (1986: 5). The provincial irrigation bureaucracy it represents is larger than most national irrigation bureaucracies.

[3]If these employees are contributing to communication or to resource mobilization, they are as much a part of irrigation management as other personnel. This exemplifies the problem noted in Chapter 2 of classifying irrigation bureaucracy personnel as either "productive" or "administrative" for purposes of assessing "administration intensity."

[4]Frequent transfers may be prompted not by personnel rules but by political and pecuniary interests of higher-ups to gain more power or financial advantages, as found in our Indian and Mexican case studies (Wade, 1982; Greenberg, 1970: 63).

[5]See study by retired World Bank irrigation advisor, Fred Hotes (1983). In our workshop, the participating engineers strongly endorsed this source of improved system performance. Kumar and Senthinathan themselves exemplified this, having remained in their respective areas of responsibility longer than the "norm" for their departments.

[6]While much that gets done "informally" may be quite normal and acceptable, bureaucratic institutions such as described in Mexico can become taken over by "alternative" relationships that follow political allegiances and alliances (Greenberg, 1970). These can systematically deflect activities from open, stated purposes, though in the Mexican case, the high status of technicians and the degree of "specialization" which delegates certain responsibilities to engineers only places limits on political derogation of irrigation management activities.

[7]Such predictions are always probabilistic, greater than zero but usually considerably less than 1.0 (100% certainty). This is because so many influences are involved, including unavoidable individual differences that express factors considered here as "behavioral" or "normative."

[8]The doctrine in the Mwea irrigation system in Kenya was literally a military one, described by Chambers and Moris (1973) as "authoritarian, hierarchical, disciplined." In keeping with the military style, senior managers were called Officers-in-Charge and field assistants were designated as Non-Commissioned Officers, who had been "recruited from within the ranks."

[9]Where water is scarce, as in the Andhra Pradesh irrigation systems studied by Wade and by Ramamurthy, it must be said that operation and maintenance responsibilities can be rewarding in financial terms, though not legitimately. This does not mean that the systems will be managed efficiently and responsively. Such situations create incentives for system managers to perform their O&M tasks more poorly so as to make illicit payments more necessary for farmers to get any share of the unreliable water supply.

[10]The same orientation, it should be said, prevails among academics who look upon those of their colleagues who are willing to accept administrative responsibilities as persons who are not, could not be, or are no longer, productive scholars. This can be a self-fulfilling prophesy, to the detriment of the way universities and colleges get administered.

[11]We have noted previously the apparent paradox that bottom-up participatory situations may require considerable top-down initiative and leadership (Esman and Uphoff, 1984: 253-255).

[12]This will make more likely a "technological" bureaucratic culture as discussed by John D. Montgomery in Chapter 9.

[13]This discussion draws on some of the theorizing about the developmental paths of irrigation bureaucracies by our colleague Gilbert Levine. He has called attention to the apparent evolution of irrigation departments' orientation from initially concentrating on structures and

water when civil engineering is the dominant concern, to taking soils and crops into account when agricultural engineering gets brought into departments, eventually to considering people as part of the irrigation system when still more disciplines get integrated into management.

Levine suggests that departments go through stages and that it is difficult for departments to "skip stages," moving from the first to the third without passing through the second. This presumes that a department was dominated by civil engineers at the outset when its main task was to capture and convey water to get the irrigation process started. Where a department began as part of a Ministry of Agriculture or with agricultural engineers in control, a different pattern of professional orientation would presumably occur.

[14]In Sri Lanka, such experienced persons carry the diminishing designation of "Non-Professionally Qualified Engineers," unfortunately.

[15]One implication of "standardization" as part of professional training and orientation is the presumption that the same solutions can be applied everywhere. Irrigation systems get designed according to standard criteria or specifications, such as all field channels having one cusec capacity. Operation then tends to follow similar set rules even though when design is standardized, operation should be varied to correspond to variations in soil characteristics, actual command area, etc. Engineers should not expect to be able to transfer from one system to another and yet operate each in just the same manner.

[16]Van de Ven and Ferry started with thirty-three variables, most of them measured by Likert-type response scales, used with 147 public agencies in Texas. The measures were then grouped, by using factor analysis, into ten composite variables: resource flows, resource dependence, frequency of communication, quality of communication, formalization of inter-agency agreements, consensus, domain similarity, agency and personnel awareness, and perceived effectiveness of the relationship. The results of this analysis and the specific form of inter-organizational relationship measures are given in Van de Ven and Ferry (1980: 319-346).

PART II

STRATEGIES FOR IMPROVING BUREAUCRATIC PERFORMANCE

Chapter 6

IMPROVEMENTS IN MANAGEMENT STRUCTURE AND STYLE

The avenues for improving performance of irrigation bureaucracies are several. Some are based largely on theory, drawing from the literature on private and public sector management -- from organization theory, learning theory, communication theory, and so forth -- while other approaches have been derived from observation and experimentation, sometimes from positive, more often from negative experience. Irrigation management is an ideal place for the realms of theory and practice to meet. It would be desirable if these crisscrossed to form a conceptual grid, as if theoretical avenues ran north to south, and practical ones went from east to west. Unfortunately, these respective analyses usually operate on such different levels that there has been little intersection.

In this and the next two chapters, we will at least begin the task of bringing theory and practice closer together. First, we examine a number of management approaches that could be applied in the irrigation sector. Then in Chapter 7, we explore the elements of what can be characterized as bureaucratic reorientation, which involves structural and behavioral changes in agencies to achieve better performance of institutional tasks. After that, in Chapter 8, we consider two approaches with particular applicability to irrigation management, socio-technical analysis and what has been called institution building. Beyond this, in Part III we present suggestions and comments from critical observers of irrigation management in different parts of the world, followed by our own conclusions.

6.1 CHANGING CENTRALIZED MANAGEMENT

One way to improve the performance of irrigation bureaucracy is to focus on the way top managers -- agency directors, bureau chiefs, chairmen of authorities, department heads and others -- carry out their responsibilities. A corresponding focus, examined in Section 6.2, is on the management style and practices that prevail throughout the bureaucracy. Under each focus, we have identified two approaches that have promise, though they have not been systematically applied in the irrigation sector. We begin with what could be done to improve central management.

6.1.1 **Management by Objectives.** The classic mode of management is for top decision-makers to determine by themselves what shall be done, and how, and to instruct subordinates to carry out a plan of work decided from above. This is the concept according to which most irrigation bureaucracies are organized and run. A modification of this method of management, first developed in the private sector for industrial activities, is called "MBO" for "management by objectives."[1] It has been transferable to the public sector and has been used for accelerating rural development in Kenya, under the designation PIMS (programming and implementation management system) described by Chambers (1974). This version of MBO can be made relevant for irrigation management in LDCs (Bottrall, 1981: 184-187). Fairchild and Nobe (1985: 381-409) describe a variant called "management by results," which is being introduced in Pakistan with the Command Water Management Project.

With MBO, organizational effectiveness is assessed by judging whether the organization has accomplished certain tasks that have been specified after consultation with its personnel. These are tasks judged appropriate and necessary to the organization for a particular time period, and they are expressed in specific and quantifiable, ascertainable terms (Campbell, 1977). For example, managers can specify at the beginning of a season the targets to be achieved in terms of x tons of production per hectare, y hectares irrigated in the lower portion of the command area, or z rupees or pesos collected from water users for maintenance. Such targets can be set for any level or unit of management. The question is whether these are appropriate, whether they represent better performance and whether their achievement is more than a matter of appearances.

Determining targets with MBO is not to be done just by managers. Rather it involves a simple but systematic process of consultation. In the PIMS version, there is a planning meeting (usually annual) within each administrative unit where all the staff meet with their managers for one or more days of discussion about the goals and tasks of the unit. In irrigation, it would be appropriate to hold planning meetings at each level as discussed in Chapter 2. Present and past experiences should be considered for what guidance they can give. What is achievable and what not? Which methods of operation have been successful and which not?

On the basis of such discussions, taking into account the ideas and reservations expressed by the staff, an annual plan for the unit is prepared, discussed and approved. Formal approval rests with managers, but to the extent it represents a consensus plan, all will have given their assent to it. It becomes "their" plan, not just that of top management, since it was built around objectives and performance targets they understand and concur with. It also specifies means and schedules that everyone has agreed are reasonable and likely to produce results.[2]

The assignment of responsibilities is spelled out so that everyone knows what is expected of him or her and knows also what others are committed to do as their part of the bargain. This in itself creates certain pressure for each individual to perform because everyone knows that others are expecting certain things to be accomplished. One can be more effective in one's own work because one can count on others doing certain things as and when agreed.

This management methodology is more than a planning exercise. It is followed by periodic review meetings of representatives of the different sub-units who assess (perhaps monthly) the implementation and progress of the plan. Whereas planning under MBO is done with the largest feasible group, monitoring and evaluation are done by smaller working groups. Reasons why the collective effort may be falling short of expected levels are analyzed, and remedial actions are agreed upon. Tasks may be redefined or reassigned, and schedules may be revised. Some objectives may be dropped as unrealistic or as less important than previously thought. New activities are added if necessary for achieving agreed-upon objectives.

After each progress review meeting, an action report is prepared and circulated so that everyone knows the plan's status and any modifications being made in it. The action report makes clear assignments or changes of responsibility. Major changes or redirections are not often made within the year's cycle of planning and implementation, but these can be introduced since the process proceeds under the direction of top managers.

In some ways, this approach could be classified as "participatory management," discussed next. However, the MBO methodology was devised to develop better, more realistic goals for managers and to generate better information "from below" with which they could guide the organization. That it also generates commitment among staff to fulfill organizational objectives is an added benefit perhaps ultimately more important. In fact, MBO can be carried out in a quasi-military manner, and the system itself is one established from above. "Democratic" relationships are not required, and participation is valued more as a means than intrinsically for its own sake. This is said not to criticize MBO as a management approach. It can represent quite an improvement over less consultative methodologies. Its applicability to irrigation management should need no elaboration. Its main limitation is that it is quite time and staff-intensive, at least in the planning stages.

6.1.2. **Participatory Management.** This represents a style more than a system of management, emanating nevertheless from top levels. In contrast to a concentrated, structured approach like MBO, it aims to become more pervasive and diffused. In place of the "authoritarian" management style prescribed in conventional bureaucratic descriptions, this approach would have managers work continuously in a more consultative, democratic manner, not just during several planning and review exercises (Alford, 1969; Meade, 1971).

Coincidentally, the most detailed empirical study we found evaluating the effectiveness of alternative management styles for improving bureaucratic performance in a developing country comes also from Kenya, from where we have Chambers' report on a modified MBO system. Leonard (1977) evaluated the Kenyan agricultural extension service using the best available hypotheses from the organization theory literature. Among the propositions he tested was whether a more "democratic" style of management would be more successful than an "authoritarian" style which provided for no participation by extension workers in the running of the agency.

Work output of subordinates according to objective measures of Visit Effort was found to be higher when supervisors operated in a more participatory manner, that is, when they turned their "authority" into "leadership," voluntarily accepted and supported by staff members (Leonard, 1977: 81-98). There is no reason to expect that the tasks of agricultural extension and irrigation are different enough that similar results would not obtain in management of the latter.[3]

One objection could be that in some or even many LDCs, colonial legacies and cultural norms support hierarchical relationships, as discussed in Chapter 4, perhaps making egalitarian patterns of interaction unattainable. It is sometimes said that subordinates will not respect a superior who does not order them around, or that asking for subordinates' suggestions will be taken as a sign of weakness or indecision. Some political cultures such as described for the Mexican irrigation bureaucracy seem to place a positive value on "power" (Greenberg, 1970). The same argument is sometimes made with regard to India and Pakistan. If this is correct, managers willing to engage their staff more directly and openly in the processes of administration, not just treating them as pawns to be moved about at someone else's will, could face socio-cultural impediments. What will be feasible and effective must be established in particular contexts based on experimentation, though it should be kept in mind that a critical mass of agency leadership can alter organizational culture, discussed in Section 7.2.2.

The participatory management approach has been associated particularly with the work of the Institute for Social Research (Likert, 1961 and 1967). Superior-subordinate relationships have been found to be most productive when infused with mutual trust, confidence and consultation. Communication is to be frequent and flowing in all directions, accurate and listened to. Subordinates are to be involved in decisions related to their work, and goals are to be set with group participation (this is similar to MBO). Elements in a participatory management approach include the following:

(a) presentation of management roles as functioning more for facilitation than for control of organization activities,

(b) encouragement of suggestions, giving subordinates recognition for useful ones so as to encourage more of them,

(c) sharing credit for accomplishments widely and distributing blame fairly; this reverses the usual managerial tendency to take all credit for successes and to blame all faults on subordinates, and

(d) engaging staff in group and self-diagnoses of shortcomings at individual and at organization levels of performance.

It also involves some delegation of responsibility as discussed in the next section. Such approaches to management do not relieve directors of their responsibility for achieving organizational goals by active personnel, financial and other forms of administration. They do change the terms on which directors and their staff interact. Such a style of management, it is believed, would enlist more of the efforts and ideas of subordinates than an authoritarian one. The most persuasive empirical support found for this proposition in an LDC context is Leonard's study from Kenya cited above. But considerable evidence in its favor can be found in the literature on experience in the U.S. and Europe.[4] The kind and amount of professional development needed to sustain such an approach in LDC settings are not well documented.

6.2 DECENTRALIZED MANAGEMENT

Central managers, rather than hold all responsibilities for decision-making, resource mobilization, communication and conflict resolution in their hands, can delegate some responsibility to staff at lower levels.[5] Such options can go along with the kinds of management changes discussed in Section 6.1 rather than be treated as alternatives. There has been interest in the business management literature for some years in more decentralized approaches, associated with studies like McGregor (1960), and Bennis et al. (1976). To get higher performance by mobilizing more ideas and efforts from within the bureaucracy, a degree of decentralized management can be introduced either through delegating responsibility to groups or to individuals.

6.2.1 **Team Management.** Recognizing that the achievement of most organizational goals in irrigation requires multidisciplinary perspectives, one mode of decentralization has been to delegate considerable responsibility to <u>teams</u> operating at one or more levels below the top, making management a collective responsibility. The groups should be <u>inter-disciplinary</u> and often inter-level, made up of persons not all at the same level of authority. Bringing together people with different levels of responsibility facilitates vertical as well as horizontal flow of ideas and may be as crucial for the productivity effects as getting together people at the same level.

This approach has been identified with "the art of Japanese management" (e.g. Ouchi, 1981; Pascale and Athos, 1981), but it was developed by American management analysts in the 1930s and 1940s. Curiously, their work found more enthusiastic reception in Japan after World War II than in the U.S., where managers at the time felt no apparent need to innovate (Whyte, 1987). This historical observation deflates the objection that such managerial creations as "quality circles" or "work planning groups" depend for their success on an East Asian social setting. While some of the Japanese business successes probably have had cultural sources, the management principles prevailing there are not uniquely rooted in that country's normative milieu and can have relevance elsewhere.

A key element in this approach is an emphasis on problem-solving as the driving force of management. Problem identification can come from any level of the organization, as can proposed remedies. Managers' task in such a decentralized mode is not to do all the problem identifying and solving themselves, but to superintend a process which will carry out these activities successfully. It may be top managers who notice problems, shortfalls, potential disruptions, etc. But rather than try to deal with these by themselves, they enlist the ideas and efforts of groups at appropriate levels. The groups, themselves usually multi-level, are to come up with appropriate actions, often experimental rather than final. The process of group interaction is seen as more likely to produce innovations than if one individual takes the burden of handling all problems on himself.

The idea of team management was introduced into development administration by Albert Mayer in his experimentation with "community development" initiatives in Etawah District of Uttar Pradesh in India in the 1930s and 1940s (Heginbotham, 1975). Mayer saw "the implicit authority structure of the team submerged as the contributions, energy and enthusiasm of the individual members surged forward to give the unit initiative, ideas and capacities that go far beyond what would be produced by an authoritarian structure."[6] The same principles and results have been observed in efforts to improve irrigation management in the

Gal Oya scheme in Sri Lanka. The Institutional Organizers assigned to help set up water user associations and to improve cooperation between farmers and engineers were deployed in teams with considerable responsibility given to them for determining work schedules, deploying and redeploying efforts, group problem-solving, etc. (Uphoff, 1985a and 1987a).

Experience in Gal Oya was quite consistent with evidence from the business management literature, analyzed by Kerr and Slocum (1981). It finds teams or work groups more likely to be effective:

(1) when the group is highly cohesive, so that transgressions by individual members are likely to lead to effective sanctions;

(2) when members must cooperate with one another to perform successfully;

(3) when a group's task is such that the group can fairly easily regulate its members' work methods, assign members to tasks, and provide feedback about members' performance;

(4) when a flexible role structure exists, permitting multi-skilled members to exchange roles; and

(5) when a group contains relatively few members.

All of these lessons applied to the highly motivated and effective performance of the organizers in Gal Oya. With appropriate modification, these principles could be applied to the operation of technical staff working at different levels of an irrigation system, especially if combined with a management reform like MBO.

A new Integrated Management System (INMAS) has been introduced in Sri Lanka for operating major irrigation systems. It was not based on the Japanese example or on any explicit theories of management. But the scheme was consistent with what has just been discussed. As originally proposed, each irrigation system would have an interdisciplinary Project Management Team made up of representatives of all the relevant government departments serving that system. The team would also include some number of farmer-representatives.

One of the officials, likely but not necessarily the Irrigation Department's engineer-in-charge, would serve as Project Manager and would chair the team, while farmer-representatives would chair Sub-Project Committees which included government field staff. These committees, plus farmer committees at distributary and field channel levels advised by various government staff, would have responsibility for planning and implementation of operations and maintenance at all levels of the system. They could function in a manner like the MBO approach described above. "Team management" according to this system would extend down to the field channel level.[7]

Wherever the team approach aims to cross departmental lines, it is faced with predictable problems of getting cooperation and coordination (addressed in Section 7.1.2). Getting engineers, agriculturalists and professionals of other disciplines to work together can be difficult enough even if there are no competing departmental loyalties and interests. Possibly staff with desired disciplinary knowledge will simply not be available to the irrigation agency, as reported in Peru. There agronomists are available but civil engineers for a variety of reasons are difficult to engage within the agency. So too are the lawyers, economists, public health specialists, hydraulic specialists, and others who would contribute to more integrated analysis and solution of irrigation problems.

A more intrinsically difficult constraint to overcome for team management is the nature of the manager's job. As analyzed by Mintzberg (1975) based on observations of what managers actually <u>do</u> with their time, there are at least ten different <u>roles</u>. Several persons cannot divide up these roles "unless they can very carefully reintegrate them." (1975:59)[8]

This objection calls to mind the wisdom of an edict attributed to Mao Zedong, "Each solution creates its own problems." Team management is intended to correct shortcomings of highly centralized, non-participatory management, but it is not without difficulties itself. That this approach has won considerable support outside the irrigation sector, in private industry where the "bottom line" of profit gives some objective measure of productivity, suggests it is worth experimenting with. If introduced, it needs to be backed with enough delegation of responsibility and to be supported for enough time that the persons involved in this new approach get a fair chance to make the innovation work under the particular circumstances if it can.

6.2.2 Self-Management. This approach to improving management takes decentralization all the way to the individual staff member and stresses personal responsibility and initiative. It parallels the alternative of participatory style in central management (6.1.2) much as decentralized team management (6.2.1) can expand upon the centrally-directed strategy of MBO (6.1.1). None of these four alternatives should be seen as mutually exclusive, and introducing a greater degree of self-management can reinforce each of the first three approaches discussed.

Various understandings of what constitutes "self-management" can be found in the literature. We will not consider here some of the more radical or idealistic versions of self-management. Because irrigation entails so much interdependence, having agency personnel set their own standards and evaluation criteria and administer their own rewards does not seem very operable.[9] More structured, goal-centered versions such as described by Campbell (1977) might be tried, however. This means working out performance criteria based on the job description for each staff member, who would then be given considerable flexibility to determine how to go about meeting these objectives. Such an approach is, of course, more feasible where goals and criteria can be specified quite clearly.

In the literature, self-management is found to be more effective: (a) where organizations require judgment rather than just routine performance from their staff, since capacity for judgment is not activated or developed if people operate simply according to fixed criteria, and (b) where control systems operating solely on the basis of formal rewards and punishments produce sub-optimal results. Simply setting criteria or targets for staff is often counterproductive. These are likely to discourage initiative and adaptability in the use of resources, performance characteristics which self-management encourages.[10]

It is difficult to specify all of the actions required to achieve an intended result, especially if the context of management requires considerable modification of activities from time to time. Then one wants adaptability (the fourth variable discussed in Section 2.3) built into the system. To get this, system managers need to give considerable autonomy to lower level staff with regard to means, while accountability (the third variable in Section 2.3) maintaining with regard to the achievement of ends. With a self-management approach, subordinates are given functional rather than formal objectives, and they are expected to use their experience and ideas to produce results, according to which they will be evaluated.

Few if any accomplishments in organizations are single-handed efforts, so there can be some difficulty in setting and evaluating goals for individual performance. However, working with and through other individuals is the name of the game in all management. This is the challenge which each person in a bureaucracy, at any level, must accept. Self-management must presume interdependence, but it focuses on what individuals can achieve within their respective spheres of responsibility, seeking to engage more fully their enthusiasm, their sense of commitment, their creative talents, their persistence, since these are needed at all levels of organization.

The criteria for assessing individual performance will of course differ depending on the level of responsibility. A senior irrigation manager might evaluate himself and be evaluated on criteria such as increases in output per hectare or per unit of water for the whole scheme, improvements in reliability, predictability and equity of water distribution from the main canal, or percent of O&M costs generated from within the system. A ditchtender, on the other hand, would look at and have his performance assessed in terms of output per hectare or per unit of water for those tertiary channels for which he is responsible, water distribution along those tertiaries, or the amount of resources mobilized for O&M from farmers in the area under his supervision. This latter may constitute a kind of measure of user satisfaction with his water distribution performance.[11]

6.2.3 **Assessing Alternative Approaches.** In our consideration of team management and self-management, we have discussed mostly performance-enhancing effects reported in the literature. Some performance-inhibiting effects have also been identified with these decentralized alternatives. It has long been known that work groups, particularly informal ones, can establish norms that constrain output, minimizing individuals' need for exertion or risk-taking and often protecting their least capable or least energetic members, contrary to the desire of superiors.[12] Similarly, self-management can be taken advantage of by some staff members who are able to deceive superiors and operate according only to their own, not organizational objectives. Subordinates can usually find ways to meet formal requirements so as to absolve themselves of responsibility for system malfunctions.

We must recognize, as in all human endeavors, that no approach is without limitations or potential misuse, recalling Mao's observation cited at the end of Section 6.2.1. If managers face informal group constraints on employee performance, the most promising management reform is probably to establish formal groups with delegated management responsibilities. Whereas informally, persons may justify to themselves and to others their not contributing as fully as possible to achievement of organizational goals, this is harder to sustain in public when objectives are openly discussed and set and when performance is collectively evaluated.

Getting individuals to accept responsibility may be handled by this means of decentralization to groups, mobilizing peer reinforcement in a positive direction. But much also depends on management style and on the kind of expectations created from above in an organization. Persons tend to respond to others' expectations, and if they are expected to be lazy or irresponsible, the likelihood of such behavior is increased. It has been found over and over in management that expectations of high or low performance tend to be fulfilled. Decentralized management by itself is thus not a solution for all organizational deficiencies, but it represents a promising avenue for improving performance of bureaucratic operations.

6.3 INTERNAL REORGANIZATION

A number of actions can be undertaken to improve irrigation management in terms of specific capacities for control and direction. These are different from the broader initiatives discussed in the next chapter, to reorient the bureaucracy through structural and normative changes. Here we are interested in actions that can be added or increased to improve upon the present functioning of the organization. We review them under several headings: legal changes; financial changes; personnel changes; facilities for transportation and communication; and monitoring and evaluation.

6.3.1 **Legal Changes.** Commonly, irrigation bureaucracies have to operate under the general laws and regulations of the government even when the tasks they must perform are different from those of other departments.

Then some changes in the legal framework for irrigation management to tailor it to the particular requirements of the sector and its institutions are appropriate.

One area of special concern is conflict resolution, when disputes arise over water distribution. Since flowing water is not a fixed asset, and since the value of water is bounded by the natural limits of the growing season, decisions are needed very quickly. The complicated procedures of the court system and the slow pace at which judicial findings are handed down make the regular legal avenues for conflict resolution and enforcement of administrative decisions often unworkable for irrigation.

This had led some governments to institute special water courts, empowered by law to make swift and summary judgments about water distribution, adherence to schedules, payment of water charges, etc.[13] It has been suggested that farmers themselves approve such procedures because of their need to have some certain knowledge about water availability (Chambers, 1975). Even if a summary ruling might go against them, this is deemed preferable to having unresolved disputes or claims interfering with the reliable operation of the irrigation system.

Irrigation agency staff are frequently deterred from enforcing rules because this can tie them up in interminable court proceedings and prevent them from carrying out their duties in the field. Staff may think it better to put up with some disruption of water deliveries than to have to leave them unattended. Thus, giving staff some legal authority to make and enforce rulings can be justified, taking into account the special technical nature of irrigation. Where there are functioning water user associations (situation IIIB analyzed in Section 5.3), such authority might be better given to WUAs, thereby relieving officials of onerous duties.[14]

Our purpose here is not to prescribe a set of legal changes. Rather we want to identify this area as one where changes often should be initiated for improving bureaucratic performance. Sometimes the codes that exist to regulate irrigation activities are quite out of date, for example. In that case, revisions to take account of contemporary conditions are needed.

6.3.2 Financial Changes. Having a reliable and adequate flow of funds is as essential for irrigation bureaucracies as a similar flow of water is for farmers. Most bureaucracies in LDCs suffer from frequent interruptions in funding and confront numerous constraints on how money can be spent that interfere with the achievement of goals (Caiden and Wildavsky, 1974). Reforms that reduce the impediments of "red tape" are needed but they would not be unique for irrigation bureaucracies.

Irrigation bureaucracies run into particular problems of financial management in matching funds with the annual cycle of work. Budgets are commonly divided into equal periods for disbursement according to the calendar, but irrigation activity, both for farmers and for managers, fluctuates greatly during the year, having to respond to changes in climate and in the cycle of the seasons. Construction activities must be carried out during certain periods when weather conditions permit, and maintenance work such as repair of structures and desilting of channels can only be done when the system is not in operation. Unfortunately, funds may not be available then. Their flow is often not even regular throughout the year as planned, which would be better than the random "non-seasonality" which is found.

It is true that funds for maintenance are often insufficient, but the shortage is doubly painful when allocated funds are not available when needed. For the first part of the fiscal year, few or no funds may flow because the budget is not yet finalized. Then for months there may be no more money because funds have supposedly run out or cutbacks have had to be imposed. (Some of the disorder may be no accident, as treasury officials "save" money by bogging down timely authorization of funds in dilatory paperwork.) An equally lamentable situation occurs when funds become available only shortly before the end of a fiscal year, or just before a donor-assisted project ends, and then are spent unnecessarily or hastily, with the result that the work accomplished is low priority or substandard.

One of the things that could improve irrigation performance in a number of countries would be to institutionalize procedures for timely funding of operation and maintenance activities, adjusting authorizations and transfers to seasonal variations in the level of necessary expenditure. Also, giving agencies authority to carry over funds from one budget year to the next, within some reasonable limit, would contribute to more rational use of scarce budgetary resources. Such changes would increase the value of the limited funds that can be made available.

In some countries, with acute fiscal problems, anything approaching economic rationality may appear remote. The rate of inflation recently in Peru has made budgetary allocations, when requested, when made and when received, into fabrications. The month in which the budget is released to the agency makes a substantial difference in the value of the appropriation. Where an agency is operating within a "seige" economy, it may be necessary to re-think what are the minimum tasks of O&M that can be performed without (much) money. Perhaps the technologies and the priorities according to which the agency works can be modified to manage within these financial circumstances.

Because irrigation work takes place over large areas, not just in one or a few offices, financial controls also present frequent impediments. Usually the problem is that accounting procedures are very burdensome, requiring written approval before any expenditures are made and documenting them in detail for auditors. The dispersed nature of irrigation does create opportunities for abuses. But the systems put in place to control misdeeds can create obstacles to the effective discharge of responsibilities without curbing the misuse of resources, since practically any system can be circumvented by persons intent on doing so. The result is that the productivity of all staff is diminished. The more requirements are put into financial systems to prevent abuses, the more time gets drained away from useful work.[15]

This is not to suggest that all controls should be abolished. If there is not some concern for accountability, concern for the efficiency with which resources are used invariably declines. Rather, controls should be subjected to some test of "cost-effectiveness." This is not done now because of the official premise that misuse of funds must be prevented <u>at all costs</u>! This premise becomes indeed a costly one, causing a continuous loss of managers' time and a waste of resources. Accepting some modest level of "corruption" may be difficult to do officially, but it is done to some extent in practically all bureaucratic systems.

The subject of "corruption" is often sidestepped because it is not supposed to exist. Our workshop discussions on this subject were lively but not conclusive. From figures collected by Wade (1982b), it was calculated that illicit payments to an Executive Engineer in an Indian system in the mid-1970s brought his salary level to about what he could earn if he were to emigrate to the Middle East. Suggestions for raising engineers' and technicians' salaries to reduce the temptations or necessities of getting "side-payments" met with the objection that there is no evidence higher salaries mean less corruption. (At least no such evidence can be found in the U.S.) Some system of bonus payments for good agricultural production seems attractive, except it cannot be effective in a water-short system. Illicit payments may create an obligation to provide water, but they also create incentives to keep service poor and unpredictable.

The question of how "functional" and therefore how "tolerable" corruption can be is an old one, much debated in political science and economics. On balance, more arguments were voiced for combating corruption than for accepting it as a necessary and on balance benign fact of life in irrigation management. But this did not mean there is agreement on an assured strategy for reducing it.[16]

It is possible to have too few financial controls. In Mexico, the irrigation bureaucracy has great power politically and administratively partly due to its ties to the ruling party (Greenberg, 1970). Introducing more regularized budgeting and auditing procedures was thought by technical personnel there to represent a needed reform, to enable them to perform their jobs more properly. But Mexico represents an unusual case in this regard. More often the need is for rethinking and possibly reducing (though not eliminating) controls so that they produce benefits greater than their costs in administrative terms.

6.3.3 **Personnel Changes.** For a variety of reasons, the use of staff time and effort can be as "irrational" as some of the uses of funds, just discussed. An example would be a personnel rule that requires all government employees to "sign in" every morning and "sign out" at the end of each work day. This can make sense in a regular office situation, but for irrigation management it can be quite foolish. If field staff live near their place of work (which is desirable) and if the irrigation office is some distance away (and especially if transportation facilities are poor as is often the case), staff can spend 3-4 hours a day just travelling back and forth, from home to office to field to office to home. Some of these hours are at government expense during which time staff are rendering no service to the agency or to water users. Requiring such an obviously wasteful use of time cannot help affecting, in an undesirable way, employees' attitudes toward how they use the <u>rest</u> of their time on the job.

As with financial regulations and controls, the answer is not to do away with all personnel rules and requirements. But where appropriate and possible, modifications in the general rules and requirements should be made to reflect the special circumstances of irrigation. Where water user associations exist, they may be requested to verify staff time and work in the field. This is the kind of responsibility undertaken by farmer organizations in the Philippines when Quantity and Quality Control Committees were established to monitor and certify inputs in connection with NIA's modernization of communal irrigation systems (Bagadion and F. Korten, 1985).

One of the improvements which can be made at fairly low cost is to work out fairly specific <u>job descriptions</u> for personnel, coupled with reasonably detailed operational manuals. These often simply do not exist. Bottrall (1981: 182-187), endorsing Chambers' suggestion of "the primacy of procedures," recommends this as one of the priority areas for improving irrigation management. This might seem to go against some of the advice in the literature on public administration, which favors "organic" models of administration over "mechanical" ones (e.g. Burns and Stalker, 1962). But Leonard (1977: 217-223) gives empirically-based reasons for having in LDC contexts <u>more</u> rather than less "structuring" of bureaucratic organizations, the second variable analyzed in Section 2.3.

A "structured" organization with formal job descriptions need not be an authoritarian or rigid one, as these descriptions can be arrived at through consultative, participatory procedures.[17] We accept Leonard's argument, reinforced by Bottrall's study of four national irrigation agencies for the World Bank (1981), that greater specification of responsibilities, criteria of performance, persons to whom one reports, etc. is appropriate. This should help all personnel know and perform their tasks better, so that the benefits outweigh disadvantages. For such specifications to have real effect, however, they should be reinforced by the structure of rewards (and penalties) associated with the position.

One long-standing issue of personnel policy is whether to recruit and assign "locals" or "outsiders" to irrigation management tasks. The classic approach, influenced by colonial policies and experience, has been to choose the latter, partly to reduce the probabilities of favoritism and corruption but also to keep staff from having too "comfortable" positions in which sloth and indifference could prevail over sense of duty. Indian irrigation administration follows this policy, transferring personnel frequently for these reasons. In the South Korean case, on the other hand, preference is for "locals." Indeed, the Farm Land Improvement Associations there, like the Taiwanese Irrigation Associations, hire part-time farmers to discharge various operational duties. Accountability is maintained, perhaps not perfectly but probably more effectively than in other situations, by requiring the village headman, to whom any complaints could have been brought, to endorse all reappointments (Wade, 1982c). Job descriptions should establish both to whom staff are responsible and how accountability will be institutionalized, such as by approving promotion, reappointments, etc.

6.3.4 Transportation and Communication Facilities. One of the frequent complaints and constraints in irrigation management is lack of facilities, particularly for transportation and communication, vehicles and fuel, telephones, etc. These days it is more likely that an agency will have reasonably modern and adequate computer facilities than that its phones and jeeps will be sufficient and in good operating condition. Getting equipment and supplies for an agency can be inordinately difficult and time-consuming. Usually, complicated government procedures are involved, with various requirements for specifications, inventories, tendering, and procurement.

As in the previous sections, we recognize that the "red tape" required cannot be simply eliminated. But where enough of managers' time gets consumed on a continuous basis to meet these requirements or in fighting for needed budget allocations for facilities, some investment of managerial effort in improving the <u>system</u> of material support will be justified.

Communication improvement and maintenance is one of the simplest but most often neglected areas where management could be strengthened. From users' point of view, <u>knowledge about</u> water is almost as important as the water itself. One of the challenges of irrigation management is how to reduce the "hassle" which aggravates users and staff alike and which is often due to inadequate communication. One of the areas where Indian irrigation management has made the most progress, at least in some systems, is in institutionalizing communication means. The Upper Ganga system was offered in our workshop discussions as a case in point. When the schedule of deliveries is worked out, it is printed in the local language and distributed in the villages as well as being displayed at all Irrigation Department offices. Most offices have a telegraph connection which farmers can use free of charge to send a cable if not getting their supply of water as announced, or if they have too much water and want a gate closed. Keeping telegraph service in working order is an added burden for the department, and at any one time, as many as half the connections may be out of service. Certainly it is not enough to get the facilities installed; they must be maintained. The same applies to vehicles. Communication and transportation occupy particularly strategic positions in irrigation management and thus deserve special attention and effort from managers.

6.3.5 **Monitoring and Evaluation.** One of the most recent but most widely accepted structural innovations for improving irrigation bureaucracies' performance is building into them some institutional capacity for monitoring and evaluation (M&E). Donors are often quite willing to fund M&E units or offices, to provide computers or consultants on management information systems. Irrigation agencies have usually accepted such assistance quite freely, especially if it comes with "hardware," to have some evidence that they possess "state-of-the-art" management capacity. After a first wave of fairly superficial donor aid given and received, more serious efforts to devise workable M&E systems are underway (e.g., Bottrall, 1981; Lenton, 1985; Staub and Koppel, 1986; ADB, 1987).

Monitoring and evaluation systems will not be equally appropriate and cost-effective for improving all irrigation schemes. The larger the scheme, the more elaborate must be the efforts to keep track of and assess its performance, whereas in small ones, information on water deliveries, agricultural inputs, yields, etc. is more easily obtained and also more comprehensible. Where a system is operating very unsatisfactorily, M&E will not be much help. There something more like a rapid appraisal (Chambers and Carruthers, 1986) will be useful, to be followed by measures that improve performance, the results of which can then be usefully monitored and evaluated. This means that M&E systems will not be the most appropriate point of entry for improvement of all irrigation schemes. This was suggested graphically during our workshop by Robert Chambers who sketched the relationships shown in Figure 6.1.

Although monitoring and evaluation is readily accepted in principle, it has not been very often put effectively into practice. There is frequently staff resistance to instituting a system that might embarrass them by revealing shortcomings or possibly irregularities. Even with acceptance and good will, having data collected and getting

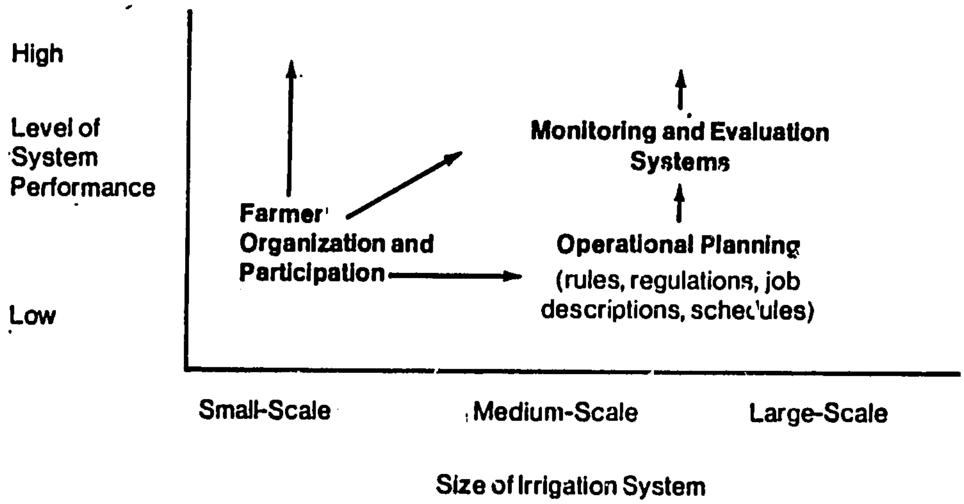

Figure 6.1: ENTRY POINTS FOR IMPROVING IRRIGATION MANAGEMENT

it processed and analyzed does not mean it will improve management decisions. Much time and effort are required for getting reliable numbers flowing in to managers. Measurement particularly of water flows presents major difficulties. We noted in Section 4.2.2.2 the problems of maintaining correct calibration of measuring structures.

Few irrigation agencies have enough staff and logistical support to do recalibration even on an annual basis, which may not be frequent enough for really accurate information.[18] Equally important, quality time and effort are needed for putting data into meaningful form so they can be properly understood and interpreted by the technical or administrative staff. The data must also be made available in a timely way or their value greatly diminishes.

In fact, one seldom sees sufficient quantity, let alone quality of resources being devoted to monitoring and evaluation in systems to have a significant impact on performance, in large part because the demand from managerial levels for such information is not yet great. As noted above, there is a natural apprehension about having systematic and quantified evaluation of performance, an aversion not unique to the irrigation sector!

The introduction of M&E can make substantial contributions to irrigation system performance, though having the structural capacity to gather data is not by itself sufficient. In the Sri Lankan case of Gal Oya, a flow monitoring program, complete with a computerized model, contributed to much improved water efficiency. Dry season issues have been lowered from 8 to 9 acre-feet per acre to 5 to 5.5 acre-feet, and wet season duties from 5 down to 2.5 acre-feet.

But these changes were accomplished not just through M&E. There was in Gal Oya, an extensive physical rehabilitation and the establishment of active farmer organizations, supported by a considerable reorientation in the thinking of the engineering staff managing the system (Uphoff, 1987). Institutions for having communication and cooperation between farmers and agency staff at their "interface," as discussed in the next chapter, were essential for changing water use practices and maintaining irrigation discipline. The monitoring system was an important element of the new management system which included water users. But by itself, without physical system improvements, farmer organization, reorientation of system managers, and interfacing institutions, it would have contributed little or nothing to better performance. One of the most significant contributions of the computerized M&E system in Gal Oya, according to the report of the Deputy Director of Irrigation responsible for the system, has been its raising the sense of "professionalism" among technical staff, boosting their morale and pride.[19]

The various changes in structure and style of management discussed in this chapter will be more or less valid depending on the particular characteristics of the system in question, on the objectives to be met and on the context of operation and maintenance. To some extent these changes represent different kinds of "tinkering." More profound changes in the orientation of system management may be judged appropriate, even necessary. More systemic measures are examined in the next chapter.

FOOTNOTES

[1]For discussions on MBO in its usual First World setting, see Odiorne (1965), Humble (1970), or Carroll and Tosi (1973).

[2]Heaver (1982: 42) says participative planning creates incentives for implementation, "since officials are likely to be committed to targets that they believe to be realistic and have set. For this reasons, participative goal-setting should be extended to the lowest levels of the hierarchy. Bottom-up rather than top-down targeting is not only realistic, but essential to motivation."

[3]Leonard found that the supervisor who is relatively nonauthoritarian and the one who is popular with his subordinates is able to capture the support of his work group and get more Visit Effort from it (1977: 98). An analysis of post-project evaluations of 52 USAID-funded development projects by Finsterbusch and Van Wicklin (1987) found a negative (-.31) correlation between overall project effectiveness and "authoritarian management style" as scored from the documentation on project administration. Other relevant findings were that centralization within the ministry responsible for implementation correlated -.22, and centralization of project implementation correlated -.39 with overall effectiveness. The degree of discretion available to key personnel correlated positively, .44.

[4]See, for example, the organizational development literature reviewed in Beer (1980), Burke (1982), and Brown and Covey (1987). The origins of this literature go back to the classic works on new approaches to management by Barnard (1938), and Roethlisberger and Dickson (1939). On this, see the historical review by our colleague, William F. Whyte (1987).

[5]For a review of the literature and empirical work relating to decentralization in business organizations, see Jennergren (1981). A classic definition of decentralization comes from Simon et al. (1954): "An administrative organization is . . . decentralized to the extent that discretion and authority to make important decisions are delegated by top management to lower levels of executive authority." This definition unfortunately treats "discretion" as something distinct from authority, when it is more an aspect of authority.

[6]Prof. Arthur Goldsmith, in commenting on our draft, noted that some of the success achieved in the Etawah project has been attributed to the presence of irrigation in that district. Perhaps one of the reasons why the "community development" model did not work as well in other places in India was the absence of irrigation elsewhere which would hold back agricultural advancement, Goldsmith suggests.

[7]This organizational model was patterned in the first instance after the decentralized, participatory structure of management introduced by an engineer in charge of the Minipe irrigation scheme (de Silva, 1985). Unfortunately, the way the INMAS program was implemented compromised some of the advantages possible from adopting a team approach. A new cadre of Project Managers (PMs) was recruited from among applicants at large, who could come from any government department. Project Managers thus were not selected from <u>within</u> each irrigation system's management team as originally conceived. Also there was no longer to be <u>rotation</u> of the PM responsibility within each team, as originally proposed. From a management theory point of view, much of the benefit of the initial plan was thereby lost, and INMAS became in practice more of a centralized than a decentralized management innovation. Often engineers handling technical aspects of system management declined to cooperate with non-engineers placed in charge of the inter-departmental teams supposed to run the system under INMAS plans. (This experience is similar to that with the Command Area Development Authorities in India.) Initial progress has been uneven. Where good working relations developed within the team, and where farmer participation were welcomed and institutionalized, recognizable improvements in system management have been made at very little additional cost to government.

[8]The roles are <u>interpersonal</u>: figurehead, leader, liaison; <u>informational</u>: monitor, disseminator, spokesman; <u>decisional</u>: entrepreneur, disturbance handler, resource allocator, and negotiator. "The real difficulty lies in the informational roles. Unless there can be full sharing of managerial information, and as I pointed out earlier it is primarily [two-thirds to fourth-fifths] verbal, team management breaks down. A single managerial job cannot be arbitrarily split, for example, into internal and external roles, for information from both sources must be brought to bear on the same decisions." (Mintzberg, 1975: 59)

[9]Drastic innovation is proposed by Thoresen and Mahoney (1974), for example. Luthans and Davis (1979) discuss the experience of a number of business organizations that have tried to install systems of self-management along these lines, with some promising results.

[10]Efforts to get greater work output from subordinates by setting targets from above can lead to gross distortions. This is seen coincidentally from two studies we have cited already, both done in North Arcot District of Tamil Nadu state of India. Heginbotham (1975) has shown how the Ministry of Agriculture in that state went about its task of extending high-yielding varieties of rice in that district in the 1970s with no semblance of self-management by its staff (see especially pp. 163-165). A few years later, it was found that the actual area under new varieties was only one-third the officially-reported figure (Farmer et al., 1977: 96). Superiors had for a number of years been setting higher and higher "targets" which subordinates then reported as fulfilled, whether this was true or not (usually not). Next year's target was then set even higher. MBO could have or at least reduced errors by enlisting more conscientious thought and action from lower-level staff, who were trying to meet formal requirements because these were stressed by higher level officials and used to evaluate staff performance. (Contributing to the problem was that more fertilizer was also allocated when targets were set higher.)

[11]This can be a kind of "referendum" on ditchtender performance. In the Indian user-managed system Meinzen-Dick (1984) studied in Tamil Nadu, at the end of each season ditchtenders have to collect personally from the farmers in the area they serve the payment due to the tank association, some part of which constitutes the ditch-tenders' salary.

[12]The literature on negative effects of small work group norms started with Frederick Taylor, the founder of the "scientific management" school of thought. See Leonard (1977:43-63) for discussion of these issues with regard to improving bureaucratic performance in an African context.

[13]The oldest and best documented examples of water courts are Valencia, Spain (see Glick, 1970; also Maass and Anderson, 1978). Legal frameworks for water courts as well as for water user associations in a number of countries are described in Radosevich (1977).

[14]The argument in the preceding paragraph suggests that water users do not favor participatory institutions because these might not handle disputes quickly or authoritatively. This view of farmers' preferences is contradicted by data from Sri Lanka (Uphoff, Wickramasinghe and Wijayaratna, 1988), though farmers there do believe that their water user associations should be given some statutory authority that strengthens enforcement powers behind what are in the first instance consensual decisions.

[15]A General Motors manager in the U.S. has been quoted as saying: "Our control systems are designed under the apparent assumption that 90 percent of the people are lazy ne'er-do-wells, just waiting to lie, cheat, steal, or otherwise screw us. We demoralize 95 percent of the work force who do act as adults by designing systems to cover our tails against the 5 percent who really are bad actors." (Peters and Waterman, 1982: 57-58)

[16]Arguments against accepting corruption in irrigation management were summarized at the workshop by Robert Chambers as: (1) corruption encourages poor maintenance work; (2) it encourages treasuries to allocate fewer funds to maintenance because they assume the funds will be wasted; (3) countering it or participating in it absorbs a lot of managers' time; (4) its institutionalization, through manipulation of staff transfers, introduces a lack of stability (or the wrong kind of stability) in postings; (5) farmers may pay and not get better water service anyway; (6) rumor mongering and misinformation are encouraged to induce payment from farmers; (7) uncertainty about water deliveries reduces willingness of farmers' to invest in inputs for high-yielding varieties; (8) farmers must spend a lot of time in hassling to get their water; and (9) the institutionalized beneficiaries of the system may be politicians rather than technical personnel anyway.

[17]Leonard says that evidence for a connection between "mechanistic" structures and "authoritarian" management came from a particular study of Scottish businesses (Burns and Stalker, 1962). "In other environments, however, organizations may have settled into informal patterns even more authoritarian, narrow and rigid than a planned and formally established mechanistic structure can be. . . . systematic accountability may entail dangers of rigidity or red tape in the provision of services, but it also reduces the likelihood of arbitrary or incompetent disregard for the interests of clients." (1977:219-220)

[18]Gil Levine reported to the workshop that in the Yun Lin system in Taiwan, gauges are recalibrated every six months or more often. During meetings with twelve groups of Executive Engineers in India, he asked how often measuring structures were recalibrated in their systems and the answer was never. None of the more than 100 engineers had ever seen a non-original calibration chart. Robert Wade pointed out that the Andhra Pradesh irrigation department, with responsibility for 3 million acres, has only one gauge testing division with 250 staff (one per 12,000 acres), of whom only 5 are engineers (one per 600,000 acres). Most of their time must be spent on the diplomatically and economically sensitive measurement of inter-state flows. Gauges below the 36th mile of a 300-mile canal Wade studied in Andhra Pradesh had never been recalibrated. In such a situation, measurement cannot be improved without more staff and logistical support.

[19]Only a minicomputer is used. Rainfall and water issues at various points in the Left Bank system are monitored, at first on a weekly basis and now daily. Offtakes only from the main canals are recorded, not from distributaries as there is not enough manpower. The model for estimating seasonal requirements is based on 75% of normal rainfall and on actual outflows from the reservoir. As there were no ET, percolation or channel loss data, these had to be estimated for the model. Initial calculations of system requirements were so much higher than the system was actually operating with that this, paradoxically, forced engineers to go into the field to take actual measurements to refine the model so it would approximate real relationships. The outputs of the model are used as guidelines, as checks on actual issues and deliveries, not as exact norms for operation. It is still important to observe the drains within the system to see where excess deliveries are being made. Main flow and offtake levels are observed twice daily, by ditchtenders travelling on bicycle, who phone them in to the district headquarters. The data are fed into the computer and any suggested adjustments in gate settings are fed back to ditchtenders, who wait at a phone until the model has been run, in a matter of minutes. Having such "systematic" knowledge has boosted the enthusiasm of senior and junior engineers and has also made ditchtenders attend to their duties better. On the model, see Vlotman and Jabir (1985).

Chapter 7

APPROACHES TO AGENCY REORIENTATION

The attitudes and expectations that irrigation personnel at all levels bring to their tasks can be as important as the structures and resources with which they work. No clear division can be made between (a) the organizational structures of an agency, and (b) the values and behavior of its personnel because they influence each other. One can, however, distinguish between (a) the frameworks within which people function -- the organizational structures and resource flows considered in previous chapters, and (b) the orientations which persons individually and collectively bring to and express in their work. The latter are examined in this chapter, though we start in Section 7.1 by looking at how frameworks can influence orientations.

The concept of bureaucratic reorientation can be said to have been "discovered" in the irrigation sector, since it was formulated based on experience with irrigation bureaucracies in the Philippines and Sri Lanka (D. Korten and Uphoff, 1981). The National Irrigation Administration in the Philippines was at the time fairly well along in a process of changing its structures and philosophies of operation to work more cooperatively and effectively with water user associations, whereas the latter country was just embarking on such a process. Forming farmer organizations was planned as part of a rehabilitation project for the Gal Oya irrigation system, as engineers and the project designers both blamed farmers for most of the deficiencies in the operation and maintenance of that system. Cornell faculty together with colleagues at the Agrarian Research and Training Institute in Sri Lanka accepted the challenge to set up farmer organizations along the lines of the successful water user associations in the Philippines

(F. Korten, 1982; Bagadion and F. Korten, 1985; Bagadion, 1987).

It became clear that much of farmers' uncooperative or destructive behavior within the irrigation system reflected the haphazard and unresponsive way this system was being managed. The conclusion emerged that unless and until engineers and other technical staff changed *their* attitudes and behavior, farmers were not likely to change theirs. From this came a recognition of the need for "bureaucratic reorientation" (BRO for short). Within five years' time, significant changes occurred not only in the physical operation of the system but also in the Irrigation Department's self-image and effectiveness, particularly in its relations with farmers.[1] A very complex process was involved, including changes from the farmer side which won respect from engineers, so that *mutual* learning and adjustment as well as confidence building occurred on both sides.

The analysis and practice of *reorientation* are still relatively new, but given its importance for irrigation management, we will bring together in this chapter as much clarification and experience as possible. The concept is relevant to any organization but we apply it here to public sector bureaucracies. Change in public agencies is unfortunately more difficult to accomplish than in business corporations because of the greater number of constituencies that must be catered to (Deal and Kennedy, 1982). However, change is possible, so we consider various approaches that may be taken to facilitate BRO.

7.1 STRUCTURAL APPROACHES

Structural approaches to agency reorientation involve more than modifications in an agency's organization for the sake of some particular goal, such as streamlining communication channels to increase efficient operation. The *structural* changes discussed in this section would be introduced to encourage new attitudes and behavior by making *changes in the situations* in which people find themselves. In Section 7.2, we focus on *normative* changes that might be sought directly *in people themselves* to improve bureaucratic performance. This distinction is made to clarify alternative ways of going about agency reorientation.

7.1.1 Organizational Changes. Certainly changing the structure of an organization can affect the orientation of persons working within it. But this should not be regarded as automatic. Too many "reorganizations" over the years have resulted in little or no change in the thinking and actions of the persons working in the agency. Boxes were simply redrawn on the organizational chart. People had their designations shuffled or new titles were given, but work responsibilities and routines remained essentially the same. No new linkages or incentives were created to change the way that staff worked with each other and with the public. What kinds of organizational changes can contribute to reorientation?

7.1.1.1 **Devolution.** If there is some downward delegation of authority to lower levels of operation and organization, people are expected to make decisions rather than pass them up the line. This should make staff at all levels more attentive to the situation around them in as much as they now have more responsibility for outcomes and have some means to influence these. Highly centralized systems, even ones that threaten punitive action against subordinates who do not "deliver," end up deadening most of the sensibilities of their staff, except those talents that enable subordinates to stay in the good books of superiors, quite possibly by deceiving them.

Unfortunately, simply devolving authority does not assure that it will be exercised. Many powers given to subordinates do not get used and they will not get used unless an environment is created in which lower echelons (a) are clearly expected to take responsibility, (b) are given recognition and other rewards for effective use of authority, and (c) are supported (not jettisoned) when actions undertaken properly are not successful. After all, superiors' decisions do not always succeed either.

7.1.1.2 **Feedback Mechanisms.** Staff can be made more concerned with the results of their activities if monitoring and evaluation (M&E) procedures, considered in Section 6.3.5, are introduced. This is more likely if coupled with moves toward team and self-management within the organization, discussed in Sections 6.2.1 and 6.2.2. M&E information can arm personnel with data they can use in getting others to cooperate in producing better outcomes. Much depends, however, on the desire of staff to utilize the new information sources in this way. Structural reinforcement can come from having well-defined feedback mechanisms for assessing M&E data and proposing ways that operation and maintenance should change to benefit from the available information.

The best organizational means for achieving this are not clear. One approach has been to establish a separate monitoring and evaluation division (or unit). Giving a measure of autonomy to the M&E function ensures that somebody has authority and incentive to carry out monitoring and evaluation activities. Certain managers might prefer to ignore or give low priority to them. However, the more autonomy that feedback mechanisms have, the less they get integrated into the ongoing management decisions of an agency or division. The alternative is to assign M&E responsibilities to certain persons or subdivisions within organizational units. This can give them a distinct identity while they work closely with and for the parent organizational unit. This puts less distance between M&E activities and decision-making.

While arguments can be made for and against each alternative, we favor the latter approach, with feedback mechanisms following up M&E findings being administratively as close as possible to, rather than separated from, those managers whose decisions should reflect the results of monitoring and evaluation. In such a relationship, managers are less likely to be defensive or to try to discredit recommendations that are made. Thus the reorganization suggested here would involve integrating new roles and functions within existing units rather than setting up new units for monitoring and evaluation.

To the extent that water user organizations and interface institutions are operating, as discussed in Section 7.3, they also provide feedback to system managers, even if the monitoring and evaluation they provide is not as systematic or quantified as that which an agency's professionals would provide. Some effort could be invested in making the inputs from such institutions more comprehensive and precise.

7.1.1.3 Horizontal Responsiveness and Coordination. Many of the pathological results of "bureaucratic" systems arise from having channels of communication and coordination that are strictly vertical, establishing a very high gradient as discussed in Section 2.2. Matters that might be resolved among decision-makers in different departments or sections at the same level get referred upwards and then decisions get passed back down. The higher authorities making those decisions will seldom have had the benefit of adequate information or of low-profile adjustments worked out among contending objectives and interests.

Organizational mechanisms can be created at different levels within an irrigation management structure to establish legitimate horizontal links among persons responsible for different tasks at each level. This may or may not involve crossing departmental lines. Team management can remedy some of these distortions on a voluntary basis, or instructions can be given to staff at lower levels to work out mutually satisfactory arrangements. For example, personnel doing design and construction work could be told to communicate and cooperate with those responsible for operation and maintenance, and vice versa. This could improve O&M particularly.[2] One mechanism would be to rotate personnel among positions at the same level, so they can understand each others' responsibilities better and are therefore better informed and able to interact.

One of the hardest things to accomplish is getting cooperation across departmental boundaries. Even at the same bureaucratic level, this is like making water flow uphill and it requires the administrative equivalent of "pumping" or "siphon" operations. Lack of coordination unfortunately cannot be eliminated by bureaucratic fiat. In most states of India, the Command Area Development Authorities (CADAs) created to bring irrigation, agriculture, credit, extension and other departments together have had much less impact than expected, largely because Irrigation Departments thought they should be calling all the shots (Hashim Ali, 1980). This exemplifies how purely structural reorganization ignoring the requirements for normative and behavioral reorientation will likely fall short of its goal.

In irrigation management, the difficulties of getting Irrigation and Agriculture Departments to work together are ubiquitous. One means of getting around them, but not resolving them, is to have a division of labor. In Pakistan, water management at the watercourse and farm levels comes under "agricultural" staff while the acquisition and distribution of water at higher levels is an "irrigation" matter. This establishes a "vertical" division which allows minimal "horizontal" overlap. Even so, there can be opportunities made for communication and cooperation at different levels of the agriculture and irrigation bureaucratic hierarchies. In Taiwan, this problem is handled by integrating agricultural expertise within the staff of the farmer-directed Irrigation Associations.

There are few examples of successful interdepartmental collaboration because the pyramidal model of bureaucratic organization has insisted on dividing responsibilities and linking units vertically rather than horizontally. There is now in the business and public administration literature an increasingly popular concept of "matrix management" that has emerged in response to organizations' dual needs for specialization and coordination (McCann and Galbraith, 1981; see also Galbraith, 1971 and 1973). The establishment and maintenance within an agency of co-existing horizontal and vertical linkages provides an alternative pattern of management departing from standard vertical-only channels for planning and implementation. This has been introduced within the Mahaweli Economic Authority in Sri Lanka, for example. This strategy of reorganization, like other "solutions," creates its own problems. Still, it is being adopted within the business sector and seems likely to spread.[3]

The irrigation systems covered in our study from Andhra Pradesh, India present a version of matrix management. Inter-departmental committees have been established at the sub-divisional level to decide on "localization" of the respective command areas, authorizing certain portions of each system to be cultivated with specific crops, which will be given certain amounts of water during the season. The committees are made up of an Assistant Engineer who considers technical irrigation matters, a Deputy Director for Agriculture who introduces soil and other agronomic considerations, and a Revenue Officer who is in charge of assessing and collecting charges from water users. Decisions on "localization" can be taken without referring them up the respective hierarchies, where considerations would be fragmented rather than integrated. On "technical" matters in their different domains of responsibility, however, the committee members remain accountable to their respective superiors. Vertical and horizontal linkages thus operate simultaneously. Which takes precedence depends on the problem at hand.

The need for such management modes is clear for irrigation. Water distribution schedules might conveniently be established by engineers according to hydraulic considerations. These would be reviewed and approved by irrigation agency superiors. But how would adjustments in schedules be made to take account of any delays in land preparation or in receipt of fertilizers or weedicides whose application should be timed with water deliveries to get maximum benefit? It should not be necessary to get approval vertically for such changes from administrators at the center. At project level, for such matters, one would want engineers, extension agents, agricultural input, credit and other officials to be making operating decisions jointly in a horizontal manner. Structural provisions can be made for such communication and coordination, not eliminating vertical linkages but rather complementing them and making them more productive. The usual problem is, who will take initiative for such adjustments in the patterns of decision-making and responsibility?

7.1.1.4 **Creating New Units.** Specialized units can be set up within the agency to bring new groups of personnel and new mandates to the tasks of improving management. Such a unit could be for monitoring and evaluation, though for reasons suggested above we think it best not to separate this function administratively from operational responsibilities. More to the point would be a special division handling operation and maintenance of irrigation systems, (Chambers, 1988). This would introduce professional standards and professional rewards for undervalued tasks, as discussed in Section 5.2.1.

One of the best documentations of such a strategy for organizational change comes from the U.S. It involves the Army Corps of Engineers, which constructs river and harbor facilities in the United States, particularly for navigation and flood control. To handle new responsibilities for environmental policies and impacts given to it by the legislature, the Corps set up environmental units at the district level. These were staffed by newly-recruited, young non-engineering personnel who were strongly committed to environmental issues. Not only were the staff and the attitudes new, but so were the functions of the unit, which introduced new procedures for project planning and getting public involvement in the process. An assessment of the agency 10 years after this new structural capacity was introduced found the Corps' image with the public changed for the better and its approach to the task of designing and building projects considerably modified (Mazmanian and Nienaber, 1979).[4] Setting up new units is no guarantee of reorientation, but with well-conceived, consistent changes in staffing and responsibilities, some broader "ripple effect" within the agency may be achieved.

7.1.1.5 **Changing Organizational Status.** One kind of reorganization considered quite far-reaching and profound is to convert an agency of the government into a quasi-governmental or even private enterprise. One way to minimize "bureaucratic" impediments, seized upon by certain governments and donor agencies, has been to establish _parastatal_ units, which operate outside the usual financial, personnel and other procedures. A more radical change is to _privatize_ operations, making the agency into a completely autonomous, for-profit or non-profit enterprise. This latter alternative has been experimented with in Pakistan, turning SCARP tubewells into private entities because of their long history of inefficient performance (Johnson, 1982). There are arguments to be made, however, that irrigation water is too much of a _public utility_ to be entrusted entirely to private entrepreneurs. Even Repetto (1986), whose analysis is oriented almost entirely to efficiency and economic values, does not recommend privatization of irrigation agencies as a solution to their shortcomings.

As discussed in our workshop, establishment of parastatal agencies to manage irrigation has come not just from a desire to break out of bureaucratic constraints but also to achieve more integrated resource use, linking the management of watershed and command area. This was tried in the U.S., with eleven major river basin authorities established in the 1930s, but most fell apart because legislative and state government interests, supervened by the new supra-departmental agencies, were able ultimately to reassert their supremacy. The Tennessee Valley Authority in the U.S. is widely regarded as a success, but has not been replicated abroad, the closest thing to a success being probably the MUDA scheme in Malaysia. The Damodar experiment in India was not judged successful. The Gal Oya scheme in Sri Lanka was started under a new, separate authority, but it was then put under regular line agency responsibility. Mexico established several river commissions to get integrated inter-state utilization of water resources, but after working well for several years these commissions are disappearing, we were told at the workshop, because of conflicts between states. It was reported from both the Sri Lankan and the Niger cases that parastatals are more rather than less susceptible to political manipulation, interfering with system performance. So there was little support from case experience for this structural approach.

7.1.2 **Creating Interdependence.** Most existing organization practice, if not theory, seeks to minimize conflicts and to simplify management by having all units operate independently of one another as much as possible. A frequent example of this in the irrigation sector is having design and construction units that do not work or communicate with those handling operation and maintenance.[5] This leads to systems that are planned and built with little regard for the problems and efficiencies of O&M. Whatever short-run management benefits there may be from having simpler, separate spheres of activity get offset in irrigation management by the various costs that arise from contradictory or uncoordinated action when cooperation is needed.

When two bureaucratic units do not depend on each another for the achievement of their respective mandates, there is no need for them to communicate and cooperate. Such need is created if they have some common objective that can only be met if they coordinate their efforts. One has to be careful about trying to promote cooperation through structured interdependence. To force two units to operate with a single pool of heavy earthmoving equipment, for example, could generate a great deal of conflict if both need to do construction at the same time during the dry season. The heads of both units might be asked to review and sign off on the budget of the other so that each knows the other's plans and capabilities. This is more relevant if some joint achievements are specified as part of their respective work plans.

If each by action or inaction can impede the other's accomplishment of its goals, there is reason for agencies to make mutual accommodation and support the operative norm between themselves.[6] An example of such evolution is the relationship which developed between the Agrarian Research and Training Institute and the Irrigation Department in Sri Lanka. ARTI's budget for work on farmer organization and socio-economic research had to come through the ID. Though this made for some awkwardness and difficulty in the first few years, a sense of mutual dependence and interdependence developed, cemented by personal contacts and regard. This would have been less likely if ARTI had had its own direct source of funds for this work from the donor agency involved, USAID.

In irrigation management, a second kind of interdependence is possible and generally desirable, i.e., <u>between agencies and water users</u>. Its significance for behavioral change is seen from several of the cases reviewed for this study. When the National Irrigation Administration in the Philippines undertook to rehabilitate communal (user-managed) systems, NIA engineers were required to get approval from farmers for the rehabilitation plans they were responsible for drawing up, and before work could begin, farmers organizations had to agree to repay the capital costs of the improvement. NIA deployed organizers to strengthen or set up organizations of water users so that there would be competent channels for local participation in preparing the plans, approving them, assisting in construction, as well as organizations to take responsibility for repayment.

Farmers could benefit from engineers' expertise for redesigning existing systems, for improving structures for acquisition and distribution of water and for extending command areas. Engineers were even more dependent on farmers. If the latter refused to agree to the final design for rehabilitation and to repaying the capital costs of construction after some grace period, the time and effort an engineer spent in planning the project would be wasted. His standing with bureaucratic superiors would suffer, as no work would get done. Consequently there were good reasons for engineers to listen to farmers' suggestions and arrive at a consensus plan (Bagadion and F. Korten, 1985; de los Reyes and Jopillo, 1986). Initially there was some resistance from engineers about this, but they came to see they could produce better designs from such a process. Attitudes toward farmers and toward cooperating with farmers changed as an outcome of this interdependence, where each needed the other's help.[7]

When rehabilitation of the Gal Oya scheme in Sri Lanka started, most engineers there rejected farmer participation in the redesign process, believing that the latter lacked technical knowledge (see footnote 1). But the engineer responsible for redesign and construction in Gal Oya was willing to consult with farmers about the problems in their respective field channel areas. This was done partly because no funds had been provided in the project budget for tertiary level rehabilitation work. Farmers were expected to do this as voluntary labor. It could be anticipated that they would not contribute later unless they were satisfied with the rehabilitation plans. So a process of communication and collaboration between engineers and farmers was initiated, facilitated by organizers who proceeded much as in the Philippines. In this case too, interdependence had beneficial effects on the orientation of the technical staff as they spent some time in the field hearing about and looking at the actual deficiencies in the system rather than attempting to remedy problems simply with drafting board solutions.[8]

Interdependence can cause costs of delay and possible conflict, so we do not suggest it without qualification. But it represents a category of structural change which can have substantial effect on working relationships and psychological orientations of technical staff.

7.1.3 Linkages with Users. Having regular, structured contacts with water users can have a beneficial impact on bureaucratic orientations separately from the dynamic of interdependence. With continuing, face-to-face exchanges, senses of friendship, accountability and mutual interest can be nurtured. There are two ways in which institutional development can support the establishment of linkages.

7.1.3.1 Water User Associations. One common factor in the agency reorientation in both the Philippine and Sri Lankan cases was the creation of organizations of water users (or their strengthening where they existed). WUAs, as they are commonly known, can work to solve farmer problems though some combination of self-help and external assistance and can enter into agreements with an irrigation agency on behalf of their members. Membership organizations can make many kinds of contributions to rural development (Esman and Uphoff, 1984). One of the most important is articulating local needs, ideas and demands, so that these will be taken into account in the activities of the administration. Otherwise, one has "supply-side" bureaucracy, giving people only what it thinks they should have or what is most convenient for it to provide, without necessarily knowing and meeting the requirements of the public (Uphoff, 1984).

Water user associations can work with an irrigation agency in handling various management responsibilities--decision-making, resource mobilization, communication, and conflict resolution -- at different levels. This is important because as our workshop participant from the Philippines pointed out, government staff seldom work more than 40 hours a week. Irrigation systems are effectively in the hands of users more than three-fourths of the time.

Investments in creating or strengthening such organizations will change the context in which a bureaucracy operates and should help to reorient its staff to be more responsive, innovative and persistent in problem-solving. This process has gone furthest in Taiwan where Irrigation Associations employ and supervise their own technical personnel. With staff dependent on users for employment, promotions, etc., relations have evolved to an advanced stage of interdependence or maybe even beyond.

An important contribution of WUAs is to reorient users too, to establish more self-discipline and reduce conflicts among users, thereby lessening the hassle which technical staff have with users' problems. (Many of these are made and thus solvable by other users.) Such changes affect officials' thinking about and respect for farmers. The senior engineer in charge of the Gal Oya irrigation scheme reported to our workshop that changes brought about in farmer attitudes and behavior through WUAs were crucial for getting changes within his department. For one thing, criticisms voiced of Irrigation Department performance became more informed and fair with the establishment of farmer organizations so user views were taken more seriously. Once officials began dealing with farmers who instead of seeking private advantages were, as representatives, pursuing the common interests of water users, officials felt more reason to act themselves in a manner matching their designation, "public servants." The point to be underscored is that reorientation is not just for engineers and technical staff; it is needed for water users too.

7.1.3.2 **Interface Institutions.** Along with having farmer organizations, it is important to have structures that facilitate communication between farmers and officials (Freeman and Lowdermilk, 1985). A good example would be the Project Committee and Sub-Project Committees (SPCs) set up by a senior engineer in Sri Lanka to upgrade operation and maintenance of the Minipe scheme covering 15,000 acres. The Committee was chaired by the Deputy Director of Irrigation for the region, but it had a majority of farmer-representatives; the SPCs had both farmer majorities and farmer chairmen, with irrigation, agriculture and other district and sub-district staff sitting as committee members at both levels.

De Silva (1985) reports the same kind of reorientation of officials occurring that was observed in Gal Oya when similar interfacing opportunities were provided. Irrigation personnel took deficiencies in system performance more seriously and were more accessible to and cooperative toward water users. The fact that farmers and officials knew they would meet each other face-to-face on a regular basis, and on a relatively equal footing, having the shared task of improving system management, made for different and much better relations. Such a structural innovation can have a positive impact on how government staff regard and fulfill their duties.[9]

7.2 NORMATIVE APPROACHES

The structural changes elaborated in Section 7.1 are expected to affect the behavior of personnel, whatever their individual motivations and values, by creating new patterns of communication and accountability. We want to consider also what can affect personnel norms so that individuals within the bureaucracy are more disposed to make persistent, innovative efforts on behalf of organizational objectives. This aspect of reorientation is more uncertain because it deals with social psychology and ideologies rather than with rules and procedures or with allocations of budgets and responsibilities. But to neglect it means giving up some major opportunities for agency reorientation, ones not costing much in economic terms, the constraint most often mentioned as limiting bureaucratic performance. White notes: "Part of the currency [bureaucratic] leaders have available are ideas and values, which leaders can use to persuade and encourage ... to enlarge their base of support" (1987: 207, 191).[10]

7.2.1 Value Commitments. Why do some persons persist in attempting to achieve organizational goals longer and harder than others? Why do some persons innovate while others are satisfied just to do what they are told? How many staff work only according to the material incentives given them? For how many are their outputs strictly proportional to the inputs of income, food or education they have received? The structure of situations in which people find themselves, in the midst of flows of information, authority, economic resources, status, etc., can explain only a certain amount of their performance. Large extents must be attributed to people's values and resulting motivation, not just to their responses to specific incentives and narrow self-interest.

Chambers points to this when discussing "the new professionalism" (1986a; also 1983: 168-197). Students of management in the private sector in the U.S. have been rediscovering the significance that values and social solidarity have for things as material as the "bottom line" of profitability in business (Peters and Waterman, 1982). Certainly the same factors affect organizational performance in bureaucracies, as examined by Beyer (1981).

It is difficult for individuals "to stand up to tall waves in the bureaucracy," as one workshop participant phrased the issue dramatically. He cited the unsuccessful attempt of one reform-minded irrigation engineer-manager in a country best left nameless here. Still, one occasionally finds individuals (or more likely, small groups of individuals) prevailing over or at least influencing the circumstances of their bureaucratic surroundings.

How can normative and behavioral dynamics be heightened to improve the effectiveness of irrigation agencies? Chambers (1983: 201-215) suggests that role reversals, including reversals in management, can acquaint the advantaged (which includes all government employees) with the needs and capacities of the disadvantaged. His proposals to build up value commitments that motivate officials to more energetic public service include rapid rural appraisal, systematic efforts to learn from the poorest, joint research and development, changed styles of communication, longer postings in an area, and game simulations.[11]

A good example of role reversal in the irrigation sector is a personnel policy in the Venezuelan Ministry of Works. It required all design engineers to spend several years managing an irrigation system they had designed. Apart from giving them specific insights into how certain design features affect operation and maintenance, this made them personally conscious of how design deficiencies make O&M difficult and gave them more openness to complaints from engineers responsible for O&M (personal communication, Gilbert Levine).

While it is important for better bureaucratic performance to strengthen or activate values for public service, one should not presume that the only way to get more public-serving behavior is to <u>first</u> change people's values in that direction. The theory of <u>cognitive dissonance</u> (Festinger, 1957) suggests that people may more readily change their <u>values</u> to conform to their <u>behavior</u> than vice versa. Thus staff responding to peer presssure or to lobbying from organized members of the public can start acting in a more public-serving manner whether or not they "believe" in this. To be consistent, persons are likely to start affirming norms that justify their behavior, which is not necessarily derived from certain abstract principles but may rather reflect incentives, sanctions or other pressures. So while calling attention here to the importance of norms and values, we do not assign them any autonomous primacy. The kinds of initiatives discussed throughout this chapter are relevant for affecting value commitments just as the latter can be supportive of all these efforts to improve bureaucratic orientation and performance.

7.2.2 Organizational Culture. Values do not exist and operate only in the minds of individuals. They emanate from shared understandings and survive or thrive in group circumstances. To an extent usually evident only to outsiders, people in an organization take on its normative "coloration," accepting the prevailing values and enforcing them on one another. This has come to be appreciated in the business literature under the label "corporate culture" (e.g. Deal and Kennedy, 1982). In the public administration literature, it has been addressed in terms of "organizational doctrine," as discussed in Section 8.2.

The "culture" of a bureaucracy can be studied and evaluated just as can its structure, though our categories of analysis are fairly primitive. Anthropologists could assist in this process (Raby, 1985). In fact, bureaucracies tend to have their own language or at least a jargon dialect; they have their own rules, rituals, superstitions and taboos; rules of succession develop; kinship networks are recognized; there are usually means to regulate internal conflict; means for socializing new members are well established, etc. But these are mostly descriptive terms, not dealing prescriptively with the norms underlying behavior.

There may be more than one culture within a bureaucracy, as Heginbotham (1975) has shown in his study of the Ministry of Agriculture in Tamil Nadu state of India. Heginbotham identified four distinct sets of norms affecting bureaucratic behavior as agricultural officers and extension workers set about extending the use of high-yielding varieties in North Arcot district. The "traditional" Indian ethos of doing one's duty (dharma) as prescribed by superiors or the scriptures co-existed with the British colonial legacy of working "by the book," strictly following the directives, circulars, regulations, etc. emanating from the administrative service. Two more recently emergent value systems motivated some of the staff -- Gandhian teachings of nationalism, self-reliance and service to the underprivileged, and the "community development" movement which had similar aims but a universalistic "modern" commitment to uplifting the poor through self-help.

Heginbotham showed that certain "Western" beliefs and practices could be highly traditional and conservative in their bureaucratic impact, while a "non-Western" value system (Gandhianism) could be innovative and "radical." Structural elements of hierarchy, job incentives, and availability of material resources certainly affected bureaucratic performance. But part of the variation in staff members' accomplishment could be traced to their values, instilled or reinforced by the culture they were attuned to within the Ministry, whether backward-looking in old-style Indian or British ways, or more development- and service-oriented in the new "traditions." Promoting the latter over the former would contribute to more effective bureaucratic contributions to agricultural development in Tamil Nadu, according to Heginbotham's analysis.[12]

A plurality of cultures within a bureaucracy can exist in another way. There can be a mainstream or dominant culture, expressing the sanctioned values and norms. Co-existing with this can be minority sub-cultures, small clusters of individuals who have divergent values and norms, who cooperate with the mainstream but perpetuate their own way of thinking, if not acting. An example for irrigation would be a Design Section sub-culture which has very "modern" values but has to compromise these in the work it does because of financial and other constraints. Members of the section may pride themselves on their "advanced" knowledge and aims, resenting the "sloppiness" or "backwardness" they feel is around themselves in the department. But they have to work with the other sections so this group sub-culture accommodates while persisting. A third possibility would be to have an adversary culture within the bureaucracy which champions alternative values and performance. In Plan Meris in Peru, the mainstream culture was oriented to engineering tasks and public works construction; but throughout the organization (to be sure, more toward the periphery than at the center) there were staff with an orientation toward agricultural goals and working with farmers. Where conflict was occurring, it needed to be understood as arising as much from "cultural" differences as from material or personal interests.

Most individuals are unlikely to adopt new values and practices without some modification of prevailing beliefs and principles at the organizational level. Hedberg (1981) has enumerated reasons for this: (i) constraining role definitions and standard operating procedures prevent individuals from changing their behavior in response to new knowledge; (ii) organizational pressures can counteract and neutralize individuals' initiatives to change; and (iii) individuals form their beliefs and modify their actions with reference to feedback from their environment.

Hedberg's observations reinforce the suggestion above that no dichotomy should be imposed between structural arrangements, because the two sets of factors interact. But one can focus on the normative dimension of a bureaucracy's performance and of individuals' orientation toward the bureaucracy and its performance. This normative dimension is indeed one of the main things that connects individuals with the organizations of which they are a part.

7.2.3. **Peer Dynamics and Career Paths.** One of the main sources of influence on individuals within an organization is the attitudes and examples of their peers. Reference group theory in sociology tells us that people derive their own self-image as well as their standards of conduct and evaluation in large measure from those persons with whom they interact most and whose respect and appreciation they most value. It is this dynamic which helps to build up and sustain organizational culture. It is more than a matter of what values are chosen and rests very much in the psychology and human needs of individuals.

To change an individual's performance, one usually has to affect whole groups because peer pressure will always be working on individuals. Will it work in a positive or negative direction? In support of or in contradiction to the organization's aims? That is the question. Because of reference group dynamics, giving training to individuals usually has less effect than providing collective learning for a whole group. Lack of appreciation for the post-training influence of peers is one reason why training programs that impart knowledge and skills simply to individuals are commonly less successful than expected.[13]

The phenomena associated with professionalism (Section 5.2.2) are manifestations of reference group interaction. One tends to develop sympathies and allegiances toward persons with whom one has lived and worked, because of shared experiences and perceptions, past mutual assistance, and a sense of common destiny. People who have been through the same career training and exposures will have similar orientations, and imparting new orientations can be linked to changing career paths.

If people move through their bureaucratic careers all in the same way, this creates greater insularity than if they have varied experiences. If engineers' professional development brings them into much contact with persons of other disciplines and with water users in early periods of their career, their orientation toward their job and toward each other will be different than if they interact primarily with each other.

It is also important to consider whether an irrigation bureaucracy provides rewarding career paths for non-technical (non-engineering) personnel. If not, this will prevent persons (or at least top-notch persons) from other disciplines from joining the organization. Those who do join will become, by virtue of their career experience and interaction with other staff, very much like the technical staff and the agency will not get the full benefit from having other disciplines.

We mentioned in Chapter 5 the effect of having young engineers start out with large responsibilities in the field, perhaps before they were well prepared for these and expecting never to have such responsibilities again, versus having senior engineers look upon being given such responsibilities as a capstone to their career. Whether engineers have a positive attitude toward operation and maintenance, compared to design and construction, will be shaped by their peers and their previous experiences. If these influences cannot be changed within the existing structure, a special division and cadre for O&M may have to be established, as suggested in Section 7.1.1.4.

Developing what Chambers (1983; 1986a) calls "the new professionalism" in irrigation bureaucracies involves changing peer dynamics and introducing new career paths. Role reversals can create reference groups for engineers beyond their usual set of technical peers, but it is important that enthusiasm generated for new service orientations be reinforced by peers. It is difficult for individuals to continue championing values scorned by colleagues, who have not shared his or her outward-looking experiences. New career paths can be established by changing rules for promotion, for example, so that all senior engineers must have handled O&M responsibilities satisfactorily. Or new criteria for promotion can be introduced, such as evaluation by water users of an engineer's performance as part of the review process, or training in management. Agency reorientiation depends in part on new values emerging and getting reinforced within the cadre of professionals by a variety of interactions.

7.2.4 **Organizational Development.** Dissatisfied with the way most organization theory dealt very "mechanically" with its subject, a more "organic" approach was introduced under the rubric of organizational development (OD). OD analysis pays particular attention to values, commitment and other normative factors. It regards them not as abstract things but as personalized, motivating forces affecting organizational performance (Friedlander and Brown, 1974; Beer, 1980; Burke, 1981).[14]

The several concerns discussed in this section--value commitment, organizational culture, peer dynamics--are incorporated in OD approaches on which there is a growing literature. Numerous consultants are available to assist organizations, particularly corporations, to become the kind of "success stories" presented by Peters and Waterman (1982). An evaluation of OD interventions by Golembiewski et al. (1982) found them to be generally effective, though how transferable they are across cultures is less clear (Faucheux et al., 1982). One needs to be careful in this regard, taking perhaps ideas, examples and encouragement from one situation to another but not specific models, roles or incentives.

A key element in these transformations is the leadership given from top levels of the organization, not just for the planning, direction and discipline leaders can provide but also for the values they project and infuse within the organization. Reference is often made in the literature to "champions" or "heros" who are committed to achieving higher levels of collective performance. They strategize, educate, inspire and persist for the achievement of organizational goals. Building group solidarity -- based on high morale and mutual respect -- is as important as encouraging innovation, as the two go together in raising a bureaucracy's productivity. Articulating and heightening the salience of values not only contributes to internal cohesion but can also change the perceptions and priorities of persons outside the organization, thereby expanding the base of support for the agency's enterprise.

Many activities can be combined under this kind of effort. There is no single formula for organizational development or transformation. The principles extracted by Peters and Waterman (1982) from their analysis of successful American corporate experience are representative of the ideas proposed with this approach:

(1) proceed experimentally with a bias for action, rather than try to solve problems entirely by advance analysis;

(2) work closely with customers or clients, water users in the case of irrigation; learn their preferences and needs and then respond to them;

(3) encourage autonomy and enterpreneurship, working in a decentralized manner so that subordinate units take initiative (always within a framework of shared values);

(4) appreciate that productivity comes more through people than through technology; create in all employees awareness that their best efforts are essential for the organization and that they will share in the rewards of collective success;

(5) evolve a hands-on, value-driven style of leadership, where executives are directly in touch with operations and are continually infusing values into employees' consciousness;

(6) concentrate on the organization's mission, doing well what it knows best how to do, not getting distracted into sidelines;

(7) have simple organizational form with "lean" staff, few administrative layers and few people at top levels; and

(8) foster a climate with simultaneous loose-tight properties, where there is both dedication to the central values of the organization and tolerance for all employees who accept those values, letting them innovate and deviate from established patterns if this might further collective goals.

These principles were found, after the fact, to apply in the efforts by ARTI and Cornell in the Gal Oya project in Sri Lanka, though working in irrigation rather than industry and in a less-developed country environment. These efforts, formulated more experimentally than with theoretical guidance, contributed to considerable agency reorientation as noted above. Because the OD approach is so broad and has so many aspects, we will not elaborate on it here. Anyone interested in pursuing it is advised to consult the literature on it, starting with some of the references given above.

7.3 INCENTIVES AND LEARNING

Apart from approaches to agency reorientation based on organization theory and social psychology, one can look to psychological and learning theory for guidance. Much of it has been dominated by the stimulus-response paradigm which in an organizational setting directs attention to incentives. Fortunately, in our view, this rather mechanistic paradigm is losing some of its appeal for being much too simple and reductionist to account for real world behavior (Gardner, 1985: 89-137). There is, however, some value in thinking about situations and resulting behaviors in such terms since clearly people do, by definition, respond to "incentives," just as they are deterred by "disincentives." This way of thinking can be enriched by linking it to broader conceptions of learning, in individual and still more important in social terms, which have gained currency in the social and behavioral sciences (Schon, 1983).

One of the most trenchant comments made in our workshop was that "irrigation bureaucracies learn, but their objective function is all screwed up" (Jack Keller). This is to say that goals are unclear, inconsistent and even incompatible, and that prevailing incentives misdirect effort, making it unproductive and even counterproductive. Some of these "irrationalities" in the situation of irrigation bureaucracies are analyzed by Repetto (1986), who shows how misaligned are the financial incentives which agencies face in terms of delivering water and collecting payments. To gain and maintain political support, the number of projects is emphasized over their efficient functioning, so it is no wonder that starts get more attention than completions.[15] Or that operation and maintenance are after-thoughts at best. It is very important that appropriate incentives attach to O&M.

Incentives cover a spectrum from material to non-material, as well as from individual or collective. Sometimes the dividing line is ambiguous, but the distinctions are important to recognize, because most recommendations stemming from psychological theory stress material and individual rewards. These can be crucial, especially because individual and material disincentives can have depressing effects on organizational performance. But it is important not to neglect and pass up the opportunities for affecting behavior through non-material and group inducements.

From a managerial point of view, individual material inducements are more easily manipulated and perhaps more predictable in their effects -- salary increases, housing and transport allowances, etc. Actually, few incentives are purely material. Promotions, for example, give status and authority, not just more money. Giving someone a larger office is material but its incentive effects have more to do with psychic considerations than with physical comfort. Similarly, individual benefits can be targeted distinctly, but a collective good such as group facilities can be enjoyed many times over by different persons.

In planning efforts to achieve agency reorientation, due attention must be given to material rewards and reinforcements. In India, it is estimated that irrigation staff experienced a 50% decline in real income between the 1960s and the 1980s. An Executive Engineer responsible for 100,000 acres, where farmers are willing to pay 200 rupees per acre for water service, is paid about 0.1% of the value of the resource provided. Present circumstances provide financial incentives for staff to manage systems badly, to increase the income they can expect through informal channels.

It is not likely that people will act in ways that go against their perceived material interest, forgoing income increases or losing physical facilities, for example. But it should not be assumed that these are the *only* things that matter to people.[16] While not all professionals are equally moved by respect from their peers, few will be indifferent to this or to psychic rewards, such as expressions of appreciation from the public or satisfaction from increasing the efficient use of resources and raising the income and well-being of rural households. Especially reinforcement from colleagues who share similar ideals, generating what Hirschman (1984) has christened "social energy," can be a powerful incentive for sustaining levels of effort and innovation out of the ordinary.[17]

It should be appreciated that changes in agency orientation may not be the result just of planned interventions. As Hedberg (1981) has observed, *organizational learning* is typically triggered less by opportunities than by problems, when gaps between expectations and performance loom large. Innovative leadership can then turn a problem into an opportunity for organizational learning and change. One key problem is organizational *decline*. Thriving organizations usually see little reason to reexamine their performance and direction, whereas ones that are slipping can become more open-minded. This is an explanation for the reorientation of the Royal Irrigation Department in Thailand, from an elite, exclusively technical department concerned with design and construction, into an institution upgrading O&M and accepting farmer involvement. RID had been losing status in the late 1970s, and when brought into the Ministry of Agriculture, some engineers with leadership vision were able to recast that agency for a new mission. In Sri Lanka, the challenge of the Mahaweli Authority was one reason why the Irrigation Department became more receptive to new approaches. This is to say that collective learning is more likely with some collective challenge.[18]

It is important that reorientation activities be undertaken in an "action research" mode (Bottrall, 1981a), and that training be similarly "action oriented," with an emphasis on organizational capacity building (Honadle and Hannah, 1982). This presumes that action, while based on knowledge, will itself build up knowledge to guide subsequent action. There is an emerging view in behavioral science that static knowledge is not appropriate (Argyris et al., 1985). To elaborate:

> Action science practitioners suggest that many of the mechanisms which are responsible for the status quo are invisible until they are activated by genuine attempts at change. In this view, . . . only dynamic knowledge, obtained by adaptive management starting from a very provisional plan [is useful]. (Smith, 1987: 165)

This echoes a conclusion by practitioners working among the rural poor in India: ". . . if you want to know reality, you must try to change it." (Volken et al., 1982: vii)

This is consistent with the evolutionary nature of both knowledge and objectives. Agency reorientation is not something that can or should be embarked upon with a blueprint. This is partly because the members of the organization themselves are to be participants in the process, not objects of some change process conceived externally and imposed upon them. The kind of professional development discussed here, with changing values, career paths, reference groups, etc., must be essentially voluntary, based on shared understandings and commitments, not forced.

We are encouraged that there are examples of successful change in agency orientation. Students of organizational development and transformation now have some methodologies they feel they can have confidence in.[19] In the Philippine and Sri Lankan cases, agency reorientation was more an outcome than an _a priori_ goal. In both cases, a "learning process" was employed, with methods and innovations being evolved as technical and social organizational specialists grappled with problems of improving agency performance (D. Korten, 1980). Very concrete tasks addressed over some number of years culminated in a shared learning that included new values and commitments as well as new structures and roles, for engineers as well as for water users.[20] From the documentation on such examples one can get ideas about how to proceed. As important, the cases give confidence that constructive changes are possible. The various complementary approaches considered in this chapter are relevant to such an effort.

FOOTNOTES

[1]Figures on the improvement in water use efficiency were given at the end of the previous chapter. On reorientation toward working with farmers, the Director of Irrigation in Sri Lanka, speaking at a national workshop at the International Irrigation Management Institute in May 1985 said: "Without active involvement of the farmer, I don't think any irrigation system can succeed. . . . At the beginning [1980], there was certain doubt and resistance, I can say . . . There was no concept of getting farmers involved as we have today. USAID brought the IO program and farmer participation in design. We were not very convinced. But now we can look back and see that we have been making useful changes. We are learning and continue to learn." On this experience, see Uphoff (1985 and 1987).

[2]As stated in Chapter 1, we draw on Sri Lankan experience more than any other because of the direct Cornell involvement with the Gal Oya project. An example of failed horizontal coordination occurred with the redesign of the Left Bank distribution system to switch from alternative water deliveries (five days on, five days off) to continuous flow. Many channels and gates were down-sized for smaller but constant volumes of water. Yet two months before the start of the season in which this new operating schedule would be introduced, the Irrigation Department staff responsible for O&M had not been informed about this radical change in deliveries and no time had been allowed to train them for the new management regime. To use our gradient metaphor, it is difficult to get information to flow <u>within</u> a level unless special efforts are made.

[3]The "pathologies" associated with matrix management, as analyzed by Davis and Lawrence (1978) include: tendencies toward anarchy, power struggles, groupitis, collapse when under economic pressure, excessive overhead, uncontrolled layering, navel gazing, and decision strangulation. The authors suggest in their article various means for prevention and/or treatment of these pathologies. Their conclusion is that: "The matrix [form of organization] seems to have spread despite itself and its pathologies. . . . It is difficult and complex, and human flexibility is required to arrive at organizational flexibility. . . . We believe that in the future, matrix organizations will become almost commonplace and that managers will speak less

of the difficulties and pathologies of the matrix than of its advantages and benefits." (1978: 142)

[4]The Corps of Engineers had been one of the richest, most powerful and influential of American federal agencies, a classical example of a well-entrenched bureaucracy. But with introduction of environmental legislation in the late 1960s, a process of bureaucratic reorientation began. In contrast to other federal bureaucracies which paid mostly lip service to citizen participation and environmentalism, the Corps made a conscious and serious effort to change, according to Mazmanian and Nienaber (1979). The criteria according to which they reached this conclusion were: (1) setting new goals, (2) reorganization of structure and routines, (3) changes in output, and (4) open decision-making. The number of personnel with non-engineering backgrounds increased from 75 in 1969 to 575 in 1977.

[5]Recall the example from Sri Lanka of the breakdown in communication between construction and O&M personnel reported in footnote 2 above.

[6]Honadle and VanSant (1984) in analyzing integrated rural development suggest steps like joint supervision of contracts and planning, shared personnel, loaning facilities and joint budgeting.

[7]Fortuitously, in terms of bureaucratic reorientation, in the first community where this consultative process was introduced, farmers told the engineers that the location and the building materials proposed for a new dam being planned would not withstand the force of monsoon floods. Engineers insisted that their calculations were correct and the dam would work. With considerable reluctance, farmers accepted the plan and provided labor to reduce the costs of constructing the dam. But they turned out to be right when it washed out in the next rainy season. This caused engineers to have more respect for farmers' technical knowledge even if the knowledge was informal (D. Korten, 1980). What was financially a setback for the program was quite beneficial in terms of learning for NIA engineers and administrators, who finally agreed that NIA should absorb the cost of building a new dam with more permanent materials rather than try to get the farmers to pay for what they had advised against and which no longer existed.

[8]This is discussed in Uphoff (1987). A similar experience, from the infrastructure rather than the

irrigation sector in Mexico, reinforces this point. The most successful component in the first phase of a World Bank-funded rural development project there was for building rural roads. A special unit was set up within the Ministry of Works to construct these by labor-intensive means. It was given no heavy machinery and no budget for hiring labor. So if it wanted to achieve its bureaucratic objectives, it had to enlist villagers' cooperation. This was obtained through ad hoc Roads Committees set up at local levels. Within six years' time, the road network in the project area was increased from 25,000 to 100,000 kilometers by this organizational strategy (Uphoff, 1986a:284). Had the unit been given sufficient budget and equipment to do the construction itself, it probably would not have worked cooperatively enough with rural communities to enlist their active support and expand the road network this rapidly and cheaply. (This example also supports the idea of establishing a special unit, discussed in Section 7.1.1.4.)

[9]The top administrative officer for Ampare district agreed with Gal Oya farmers in 1982 to have their representatives participate in the monthly meetings of the District Agriculture Committee. The DAC was otherwise made up of the district heads of all government departments dealing with agricultural development plus Members of Parliament and was presided over by the District Minister. That farmers' needs and complaints could be voiced directly at such a high level helped make officials more attentive to problems and shortcomings reported by farmers. As important, it enhanced farmers' self-respect and sense of responsibility. Singh (1983) reports a similar improvement in agency staff performance and farmer cooperation in the Pochampad irrigation project in Andhra Pradesh state of India during the time when farmer committees were functioning there.

[10]A third approach to reorientation, not really structural or normative, but concerning simply what people <u>know</u>, is to improve <u>methodologies</u>, discussed by Robert Chambers in Chapter 10.

[11]The simulation game "Green Revolution" (Chapman, 1973) is perhaps the best known and a very effective means for helping administrators, engineers, researchers and others get some feeling for the pressures, constraints and dilemmas of small farmers. The game vividly and personally demonstrates the frustrations and perils of depending on credit from moneylenders, on purchases of chemicals and

fertilizers, and on irrigation investments to ward off pest attacks and droughts while feeding a growing family on limited land resources. The ARTI-Cornell group working with the Irrigation Department in Gal Oya, Sri Lanka in 1981 developed a game called "Rehabilitation" to help reorient officials toward working willingly with farmers. Under the Water Management Synthesis II Project, this has been developed into a computerized game with computer graphics (Oaks, Vander Velde and Steenhuis, 1986).

[12]One failing associated with the "traditional" cultures was the tendency of the staff to do (or report doing) just what was asked of them by superiors. Meeting targets was seen as evidence of fulfilling one's "duty," which was to follow instructions. Negative consequences from this approach are seen footnote 10 in the preceding chapter.

[13]Tandon and Brown (1981) have documented this in controlled experiments with rural communities in India, and Charlick (1984) found this with <u>animation rurale</u> programs in Francophone Africa comparing training of a few leaders with training for whole villages. The effect may be much stronger within a bureaucracy where daily face-to face interaction is greater and the influence of peer groups can be more. White (1987: 231) following analysis by Leonard observes, "training cannot produce commitment, but it is possible to bring managers together with others who share similar values and encourage them to reflect on development goals."

[14]The organizational development literature as it relates to "development organizations" is well reviewed by Brown and Covey (1987). Our discussion here benefited from their treatment of the subject. Recently, a more radical approach known as "organizational transformation" (OT) has emerged giving even more weight to subjective, value-oriented influences. The OT approach is reviewed in Levy and Merry (1986).

[15]"The number of projects sanctioned and under way far exceeds the public funds available for implementing them. Available funds are doled out among projects, which prolongs construction periods, inflates construction costs, and delays the realization of benefits" (Repetto, 1986: 22). He cites an Indian government report that not a 18 single major or medium irrigation project has ever been completed on time in the history of independent India.

Given the structure of political and administrative incentives the irrigation bureaucracy faces, this is not hard to understand.

[16]Louise White writes "Although it is clear that such material rewards as pay and status do motivate individuals to contribute to development programs, these are not the only sources of motivation and may not even be the most important approach to motivation in resource-poor development organizations" (1987: 113-114).

[17]For a case study of benefits from "social energy" in an irrigation context, see Uphoff (1987a).

[18]A paradox is that organizations may learn best in the midst of change, whereas individuals need some stability. We have commented previously on the importance of having <u>stability</u> of staff postings so that engineers and technical personnel can become thoroughly acquainted with a system and its water users (Section 6.3.3). Frequent transfers reduce both the opportunity and the incentive for learning.

[19]Deal and Kennedy (1982) describe the change in a U.S. metropolitan sewer and water district which had a number of problems: misuse of public funds, existence of patronage jobs, a high degree of bureaucratization and red-tape, water use higher than design capacities, average staff age over 55, slow decision-making processes, etc. Outside consultants started by setting up three task forces in areas where the most persons were involved and where there was consensus changes were necessary: contracting, O&M, and personnel. After a few weeks, the task forces came up with recommendations that were implemented, and the whole orientation of the organization shifted. The ingredients for success were identified as: (1) having a "hero" in charge of the process, someone totally commited to change; (2) having a "threat" from the outside, in this case declining revenues and reputation; (3) involving many people in the process, not just imposing change from above; renegotiating new values and relationships; (4) providing transitional training in new values and behavior patterns; (5) utilizing "outside" consultants who were free from "inside" attachments and biases; although change driven by insiders may be more successful than that initiated by outsiders, the latter can diffuse conflict and provide confidence that change will work; (6) communicating clearly what the new directions involve and can produce;

and (7) providing job security in the transition process. The management announced at the start of the effort that no permanent employee would be fired, thereby reducing anxiety and possible resistance on grounds unrelated to organization goals.

[20]See Korten (1982) for an analysis of how the establishment of a special high-level interdisciplinary committee to oversee the process, including members from outside the irrigation agency, facilitated this process. Our workshop participant from the Philippines noted that the learning process there appeared to be more successful in changing engineers' approach to design and construction than to operation and management. This, if true, is disappointing. We noted above, in footnote 7, some dramatic "learning" which occurred on the design and construction side. O&M suffers generally for being less dramatic.

Chapter 8
SOCIO-TECHNICAL AND INSTITUTION BUILDING APPROACHES

In thinking further about how the performance of irrigation bureaucracies might be improved, having explored approaches derived from the literature on business and public administration and from organization theory, we will consider two other ways of looking at the tasks of irrigation management -- in socio-technical and in institution building terms. These perspectives on development administration are reviewed here briefly, as complements to the analysis in Chapter 6 and 7, not as alternative approaches.

8.1 SOCIO-TECHNICAL ANALYSIS

When it is recognized that irrigation is more than a technical undertaking of capturing and conveying water, there may be a temptation to try to conceive and manage irrigation in social or organizational terms if physical or technical ones cannot account adequately for the process. But any swing from one to the other extreme is not useful. Studies of irrigation management have satisfied most observers that social and technical factors are so embedded in each other, that it makes no sense even to try to think of irrigation as "mostly" one or the other, or to decide that it is some percentage (x%) social and another percentage (100-x%) technical. Such zero-sum thinking obscures the extent to which each set of factors influences the other. The most tenable conclusion is that irrigation is best understood as a compound socio-technical process.[1]

Persons invariably rest more comfortably on "one side of the hyphen" or the other. Those who work on irrigation are likely to have been trained _either_ in engineering or a physical science _or_ in one or more of the social sciences, knowing little about the other side. They will be inclined accordingly to ignore or generalize imprecisely about what they understand poorly, while making many detailed and specific judgments about variables in their familiar domain. They are likely to consider variables they do not understand as being _given or fixed_, not subject to manipulation because they do not know how to manipulate them. Partly to compensate, they will focus their attention on those factors that are better known to them, analyzing how to _vary_ these to best effect.

The result will be to arrive predictably at suboptimal outcomes. Whenever there are two sets of independent variables, it is unlikely that the best results can be achieved by using variables only from _one_ set and none from the other. Optimization usually involves some combination of factors from two or more sets to achieve the greatest production possibilities within accepted constraints. Utilizing only one set of variables forgoes all possible contributions from the other. An example should make this principle clearer.

Suppose an irrigation system encounters a drainage problem with a growing extent of waterlogging. One could try to correct this _either_ by installing channels or pipes to remove excess water _or_ by carefully managing the application of water, reducing the volume flowing to the area as much as possible. If there is no decrease in the flow of water, the number of physical facilities required will be greater than if the flow is adjusted. If water removal is not facilitated by physical structures, more detailed control in water issues will be needed to eliminate waterlogging. Some _combination_ of drainage structures and changes in operating rules should be able to manage and improve the situation at less cost (or with most net benefit) than if _only_ physical or managerial methods are tried.

To treat _one set_ of factors as fixed or as given--not changing the physical capacity to remove water, or not varying the water issues -- is bound to be suboptimal because _all_ of the adjustments will be made in the _other set_. A socio-technical approach considers how mutual adjustments made on _both_ sides of the hyphen can produce better results. It is not a matter of sequential consideration, of solving problems first on one side and then on the other. Rather there should be concurrent, or at least iterative, examination of possible adjustments to be made in both the socio-organizational realm and in the physical-technical realm. In this way, management does not opt for making all the changes (and bearing all the costs) on just one side or the other.

The choices involved in this approach can be dramatized by using concepts developed for working with computers. Both "hardware" and "software" are needed for computerized data processing, but there is usually some tradeoff possible between them, at least in the design stages. Hardware refers to the physical structures and equipment that do computing with great speed and accuracy. Software items, in the form of programming languages and programs, direct and control the computing. Software can be more or less speedy, reliable and efficient in the processing of data. It is useless without hardware to run the programs, and the computers themselves produce no results without the software to formulate and solve problems.

Software for irrigation management refers to the organizations -- the human activities of government agency and/or water user associations -- that are needed to handle the physical structures, the facilities which can control the water being applied to fields. Such facilities are material just like a computer but their functioning depends on what can make them run.

A socio-technical approach to improving irrigation management looks for variations in the hardware and/or software that can produce better results -- more productive, more equitable, more cost-effective, more ecologically sound. It will not try to resolve problems by changing only the physical features of the system with some abstract technical standard of efficiency in mind. It may require certain investments in improving the organization of the bureaucracy and/or of water users, or at least it will take the existing level and capacity of organization into account when arriving at technical design and operation decisions.[2]

We can make the approach more concrete by discussing two proposals by Oad (1987) for designing irrigation systems in ways that permit water users to share better the burdens of management with an agency. These suggestions presume certain organizational capacity among farmers and figure them into the performance optimizing calculations. Physical design and social organization are highly interactive, affecting dynamic factors like efficiency and incentive in many complex ways. Irrigation managers need to appreciate this element of contingency, where in effect, "simultaneous equations" need continually to be solved, rather than try to parcel out causal influences as being _either_ technical or social.

8.1.1. **Water Capture and Delivery.** For purposes of economic efficiency, achieving the lowest cost per cubic meter of water, irrigation systems are usually designed to acquire the largest possible volume of water from the source, whether this is a river, reservoir or groundwater (Section 4.2.1). The volume captured is supplied to the command area of the system in continuously smaller flows through a network of canals that branch at main, secondary and tertiary levels, according to conventional design. "If there is no intermediate storage between farmers' fields and the main delivery system, the farm system is directly connected to the main system" (1987:23). This, however, means that water users cannot take much responsibility for water distribution. Main system managers will seek to have maximum _stability_ of flow, keeping discharge levels within narrow parameters to minimize effects like erosion and sedimentation. On the other hand, water users will want operational _flexibility_ to deal with the unique conditions of their particular fields and crops during the season. Conventional technical design thus builds in tension and even conflict between managers and users.

Contemporary system design in a socio-technical framework could learn something from the way many indigenous irrigation systems have been planned and constructed by water users over the years. Water sources are usually unitary, but they can be broken down and buffered by intermediate storage facilities -- stabilizing tanks or small reservoirs at middle levels of the system, sometimes described in the Chinese figure of speech as "melons-on-a-vine." Such facilities can be operated by users fairly easily because the volumes of flow from each source are fairly small, well within farmer management capabilities. Farmer organizations and capabilities for water management may not even develop among users in a monolithic large water supply system which offers no opportunities for their participation.

The appropriate design and management strategy associated with a physical layout that permits storage and delayed flows can be called one of "augmentation." This is essentially the approach used for many years by the U. S. Bureau of Reclamation in assisting American farmers to develop their irrigation systems. Oad (1987) points specifically to the Colorado Big Thompson Project, which captures water from the Colorado River in the west and transports it across the Continental Divide to be released into a number of rivers flowing down the eastern slope of the Rocky Mountains. These rivers feed a number of small irrigation systems under the control of water users, as documented by Maass and Anderson (1978). The task of system managers becomes that of providing multiple supplies of water which can be respectively managed by water users or by lower-level agency staff on a decentralized basis. There is no need for the whole volume of captured water to be distributed from one central reservoir. Instead, dispersed storage facilities are integrated into the organizational capacities of water users, so that farmers can easily vary their irrigation supplies in frequency, duration and discharge.

A higher order of efficiency can be achieved by having better, more exacting water use by farmers which compensates over time for the added cost of constructing these intervening physical facilities. Such a system is designed and operated as a socio-technical entity, rather than being first created technically (with one concept of efficiency) and then managed socially (with other criteria) in ways that must compensate for constraints put in concrete, perhaps quite literally.

8.1.2 **Water Distribution at Tertiary Level.** Once water is flowing in these decentralized sub-areas of management, there is still a need to divide it further among field channels so that all fields can get their fair and needed share. If the volume of water in a system is known and reliable, and the demands for water are fixed as well as known, an appropriate physical distribution system can be designed to deliver certain amounts to each sub-area without any intervention, by users or managers. Weirs or other fixed structures can be installed to discharge constant volumes so long as the level and flow of water in upstream channels is kept sufficient. The water issued will not respond to downstream conditions and cannot be regulated by water users. It will depend only on what is done upstream. Farmers will have no incentive for efficient use of water unless the volume being issued is less than users would ideally want for the command area, a disequilibrium situation.

Socio-technical considerations under the conditions Oad is assuming point toward having gate or orifice control at the field channel level to be able to adjust flows, including to be able to reduce offtakes as soon as enough water has been received. It makes our point about taking social as well as technical factors concurrently into account to note that the conditions he presumes are more like those of Southeast than of South Asia, that is, of relative rather than absolute water shortage. Where the latter circumstances prevail, the preferred management system may be more like *warabandi*, delivering on a pre-set schedule fixed amounts of water, well below what farmers would like to have and could make good use of. In such a case, fixed structures represent an optimal social adaptation because there is less opportunity for tampering with deliveries.

Gated control structures permit downstream conditions to be reflected in operational practices. While these structures may be subject to breakage or abuse, fixed structures are not immune either, as seen from several of the case studies we consulted on Pakistan irrigation, where solid concrete turnouts are used. With enlistment of users in a scheme of management that places value on water use efficiency and with social controls activated among farmers through their own organizations, one can move closer to optimum water use, combining physical structures that give control over water and social organizations that give some control over users. Oad says, in endorsing gated orifices that are *flexible* rather than weir turnouts that are *rigid* (discussed in Section 4.2.2):

> Incentives are greater for farmers to participate in managing systems that use sluice gates at the turnout level. However, the greater freedom of discharge regulation can be misused by groups of farmers that are near the head of a distributary canal. To positively use the management potential created by sluice gates, greater participation and organization of farmers is inherently required (1987: 29).

This kind of socio-technical analysis considers tradeoffs between organizational and physical design factors, *judging the potential of each in light of the possibilities that can be identified in the other*.

A further example of such calculations affecting water distribution comes from the research Oad did in Indonesia jointly with Duewel (1982). It is commonly a problem that head-enders along a channel take more than their share of water, intentionally or simply by exploiting their locational advantage. In community-managed irrigation systems studied by Oad and Duewel, users had often broken the tertiary command area into smaller units of 5 to 10 hectares each, supplied by quarternary-level channels with a strict prohibition on anybody taking water directly from a tertiary canal.

This design required a larger number and greater length of channels in the total distribution network, including some loss of cultivable area where the quarternaries were constructed. But with this physical layout, there were fewer conflicts and water use was more efficient. With smaller groups (associated with smaller command areas) it was also easier for users to enforce maintenance obligations on each other and to ensure proper water rotations. Since these intensive strategies of construction and distribution predate any government imposition of such methods, apparently users had concluded the benefits from having quarternary channels more than compensated for their first-order costs.

This example further shows how optimization involves joint consideration of technical and organizational possibilities. Neither set should be regarded as fixed. Both should be examined for ways in which they can be productively varied. Adopting a socio-technical perspective does not give any preordained answers about how to improve irrigation management. Rather it is a frame of reference which if adopted throughout irrigation bureaucracies can reorient thinking, and subsequently behavior. It should result in better management decisions and strategies.

8.2 INSTITUTION BUILDING ANALYSIS

The second interdisciplinary approach considered here to improve agency performance derives from organization theory, drawing especially on experience and research with development administration.[3] The "IB model," as it has come to be called, focuses on five variables: leadership, doctrine, resources, program and internal structure. Beyond these, it analyzes linkages of various sorts between the institution being considered and its environment, and how these can promote a process of "institutionalization" that gives an organization like an irrigation bureaucracy more than narrowly instrumental capacities to achieve objectives.

It is often unclear whether to refer to an irrigation agency as an "organization" or as an "institution," the two terms are so commonly used interchangeably. However, if no distinction can made between them, i.e., if they represent essentially the same thing, we do not need two different words. There is no need to go into an extended discussion on the subject as it has been discussed in more detail elsewhere (Uphoff, 1986a). The most meaningful understanding comes, we think, from regarding the two terms as overlapping. This is to say that (a) some organizations are institutions, or vice versa, some institutions are organizations, but then (b) some organizations are not institutions, and conversely, (c) some institutions are not organizations. Examples from the legal realm, reflecting common usage, make the distinction quite concrete: (a) a court is an organization that is also an institution, (b) a new law firm is an organization that is not (yet?) an institution, while (c) "the law" or some specific tradition like "due process" is an institution that is not an organization.

What definitions can make sense of these generally acceptable classifications? Organizations are structures of recognized and accepted roles, whereas institutions, whether organizations or not, are complexes of norms and behaviors that persist over time by serving collectively valued purposes.[4] Organizations can become institutions to the extent that they acquire value in people's minds over and above the technical requirements of the task at hand. This process usually occurs over some period of time or when the organization is headed by a charismatic leader who affects people's value judgments and commitments. People will contribute to the maintenance of an institution beyond any direct or immediate benefits they derive from it because they value its existence for any number of reasons, giving it "the benefit of any doubt" when weighing whether to support it and its continuation.

An irrigation agency by definition is always at least an organization. Whether it is also an institution depends on the extent to which it has established its value, pervasively, transcendently, in many people's minds. Institutionalization is always a matter of degree. An institution's capacity to achieve objectives derives from its ability to mobilize and deploy a variety of resources associated with gaining compliance with its directives. The more legitimacy that people accord to an institution, the more voluntary acquiescence will be forthcoming on the basis that its decisions are thought to deserve obedience.[5] The same is true of status. The more an agency, its objectives, its leaders, its personnel, its procedures, and its decisions are respected, for whatever reason, the more acceptance they will enjoy and the better able the agency will be to carry out its work.

We noted above that institution building analysis treats _resources_ as one of the key factors in creating capacity. The IB model does not restrict analysis to "hard" resources like goods and services or coercion. Legitimacy and status are also regarded as resources even though they are "soft" resources based in attitudes and values. The IB model recognizes that what makes an organization into an institution is the _valuation_ it receives from the public, resulting in respect, loyalty, commitment and other supportive behavior based on norms.[6] Managers interested in improving the performance capabilities of their agencies will plan and carry out their activities with an eye to how these can enhance the status and legitimacy of their agency, its staff and its program, in the estimation of various groups on whom it depends for a steady flow of resources and for compliance to achieve its objectives.

This requires understanding the _criteria_ according to which persons may regard the actions of a bureaucracy as "right and proper" or the qualities of its personnel as "worthy and estimable." Legitimacy and status can be accorded either because of the _substance_ of what is done or because the _procedure_ whereby things get done is judged acceptable, indeed morally correct and binding. Attention to these criteria and to satisfying them in words and actions is one way managers can enhance agency capability. They can increase their implicit "fund" of status and legitimacy, as credits that can be drawn on to get compliance from various public or private sectors. Such efforts may entail little if any financial cost, which becomes a consideration more important to the extent that managers find their agency budgetarily constrained.

Much of the analysis in preceding chapters has been influenced by institution-building concepts, even without using the IB model explicitly. We discussed the variable of _doctrine_ in Sections 5.2.1 and 7.2.2, noting that it had been developed as part of institution building theory. We will not examine this variable further here, though this does not mean it is any less important than the other elements of institution building. Indeed, for improving the performance of irrigation bureaucracies, it is probably one of the most significant.

The centrality of concern with _linkages_ in IB theory was noted in Section 5.5. Analysts of institution building have distinguished several types of linkages (Esman, 1972). Managers need to be concerned with each of these, though for different reasons and in different ways:

- Enabling linkages provide the necessary resources (authority and funds in particular) that permit the institution to operate. These may be with the cabinet or legislature and with the Treasury Department or Budget Bureau, for example.

- Functional linkages represent the working relationships that any agency must maintain with other institutions or groups, such as cooperative arrangements with the Ministry of Agriculture or Extension Department to coordinate irrigation activities with agricultural ones, or liaison with water user associations where they exist. If there are district or local authorities that coordinate government programs, like District Commissioners or Village Panchayats, mutual working relationships need to be maintained with them.

- Supportive linkages include interactions with various organized sectors of the public whose backing will strengthen the hand of an institution when dealing with decision-makers, other agencies, etc. who control resources needed to accomplish the institution's tasks.

- Diffuse linkages refer to communications and liaison with the public at large, for example, through the press, to build up broad approval which will create a favorable climate of opinion. This should enhance the institution's reputation and its standing with decision-makers, other agencies, etc. whose cooperation is necessary for institutional success.

A key lesson from IB analysis is that managers' ability to maintain and benefit from their enabling and functional linkages can be improved by fostering and sustaining many positive supportive and diffuse linkages beyond the immediate circle of institutions and organizations on which the institution in question depends most directly. This calls for managers to have some public relations, diplomatic, political and other skills in addition to their technical competence, which gains them more credit with the first two kinds of linkage than with the latter two kinds.

The activities treated in Sections 3.1 and 5.3 constitute the program of an irrigation agency. It should be conceived and carried out in ways that strengthen the various linkages just discussed. To regard an agency's program only as a "technical" matter, as something to be implemented simply in the quickest and most efficient way, passes up institutional building advantages that could be gained from thinking the program through in "linkage building" terms.

The factors analyzed in various sections of Chapters 2 and 5 encompass what IB writers deal with as internal structure. These are crucial considerations, but have been dealt with sufficiently already and will not be examined further here.

The major IB variable not dealt with much in the literature as yet is leadership, though as noted in Section 7.2.4, the OD literature emphasizes the role of the "champion" or "hero" in bringing about reforms or reorientations in organizations. The IB model directs attention to leadership because of the observed centrality of this factor in the many case studies done of institution building experience.

In any institution, even one dedicated to purely "technical" tasks, it falls to the top leadership to articulate doctrine, to maintain a flow of resources to the institution, to formulate and carry out programs, and to utilize or revise the internal structure, in addition to forging and maintaining a wide array of productive linkages. Leadership is thus the main integrating factor in all institution building strategy and performance. It is especially important to recognize and promote this factor with regard to improving the performance of irrigation bureaucracies because their sense of "technical" mission may discourage managers from seeing themselves in the "political" role which institution building calls for.

Both the socio-technical and institution building approaches reviewed in this chapter are better regarded as perspectives or frameworks than as theories. They are not sets of hypotheses to be tested but rather sets of concepts to be used in identifying and exploiting opportunities. As analytical frameworks, they are necessarily somewhat abstract, in order to encompass a wide range of factual experience within categories and ideas that apply across specific settings.

At this stage of understanding about improving performance of irrigation bureaucracies, we think it not appropriate to suggest any complete or encompassing framework. In Part II, we have looked at variables or approaches which practitioners can think through and pursue if they have some strategic sense and imagination. Our hope is that researchers will also focus on the objectives, contexts, management means and performance outcomes in irrigation systems in ways that expand the body of knowledge that can be drawn on.

To enrich the repertoire of concepts and conclusions offered to practitioners and researchers, we invited several colleagues with experience in a variety of countries and irrigation settings to contribute observations on the issues we were addressing in this book. The disciplines represented include economics, geography, political science, and social science generally. Some of these colleagues have worked in different parts of Asia but also in Africa and Latin America, where the circumstances of irrigation management are quite different from Asia, the focus of most writing and consulting on the subject. We are pleased that the contributors to Part III have, to use a primitive irrigation metaphor, "carried water on both shoulders," offering both conceptual and empirical insights. With the expanded view of what irrigation bureaucracies can and should accomplish, we will offer in a final chapter some concluding observations on the subject.

FOOTNOTES

[1]This is discussed in Uphoff (1986), reflecting analysis done by Cornell colleagues Walt Coward (Rural Sociology), Gil Levine (Agricultural Engineering) and Randy Barker (Agricultural Economics) for an interdisciplinary course on irrigation started in 1975. The concept was used in their proposal to USAID in 1977 for funding research on irrigation management in the Philippines and Indonesia. The discussion below of irrigation alternatives in Indonesia draws on some of the research supported by that grant.

Socio-technical analysis derives from cultural ecological studies in anthropology and, quite separately, from management studies in Britain, starting with work by the Tavistock Institute on the coal mining industry. Trist (1981: 7-28) traces the historical background of the concept in management theory, showing how previous models of bureaucracy and scientific management, stemming from the work of Max Weber and Frederick Taylor, had subordinated the organization of work to technological "imperatives." Socio-technical studies started analyzing the social and technical domains more equally and interactively.

Trist, one of the founders of this approach, says that in socio-technical organizations, "the core interface consists of the relations between a human system and a nonhuman system." (1981: 12) Such organizations are directly dependent on their material means and resources for their outputs, in contrast to organizations which are concerned mostly with the psychosocial ends of their members and with the power and position of interest groups or the social structure itself (Emery, 1959).

[2]Water users may make "excess" demands for water for their sake of convenience or saving money, reducing the time they must spend in distributing water on-farm or in weeding. Not meeting such demand will not endanger crop yields. Some researchers and donor agencies, however, advocate providing considerably less water than the crop needs to meet its potential evapo-transpiration (PET) requirements, putting the crop under continuous stress to survive. This has shown some good results (maximum yield per unit of water) under experiment station conditions, giving crops as little as 40% of PET requirements.

But in the real world of gravity flow irrigation, issuing inadequate water to an area puts inordinate strain on the social organization of irrigators and on the bureaucracy. Head-enders have an inalienable geographic advantage, and with severe water shortage, it is difficult for management systems to overcome that advantage (except with very intensive and costly personnel investment). Yet sharing scarcity perfectly equally is called for by the theory of "under-supplying" water and is necessary to justify it economically.

If one knows that the management requirements of a physical design are not attainable, the design should be modified to approach a socio-technical optimum. To seek a technical maximum without adjustments to social realities cannot produce optimum net benefits. World Bank advisors have advocated designing irrigation systems in India and Pakistan that deliver less, even much less, than crop PET requirements in the name of water use efficiency -- even though agencies cannot implement a distribution plan that gives head-enders such a meager share of water which puts their crops under continuous stress. This is an example of technical considerations being promoted to the exclusion of social relationships.

[3]Our Cornell colleague, Milton J. Esman, headed a consortium of four universities (Indiana, Michigan State, Pittsburgh, and Syracuse), 1962-72 in an effort supported by USAID to develop the empirical and conceptual foundations of "institution building." This undertaking produced many empirical and theoretical publications. The core of this approach is presented in Eaton (1972), and especially Esman (1972).

[4]This is the definition given in Uphoff (1986a: 8-9). Another conceptualization of institutions, consistent with the formulation here, is that offered by Young (1980: 337) -- institutions are "recognized patterns of practice around which expectations converge."

[5]This formulation applies to an institution that is also an organization, that is, a structure of roles, so that there are certain persons in roles of authority within the institution who seek to mobilize and deploy resources and who issue directives with which compliance is sought. The same relationships hold essentially for non-organizational institutions. The institution of private property, for example, once accepted causes people to mobilize and

deploy resources in certain ways and not others; they feel themselves obliged to accept certain requirements or prohibitions associated with the institution (Uphoff, 1987a). Young's definition of institutions, cited above, as recognized patterns of practice around which expectations converge, is thus particularly apt for institutions that are not organizations. It describes also the institutional aspects of organizations that are also institutions.

[6]The norms we are referring to are those regarded as positive for achieving an institution's objectives. Within organizations (and even within institutions), certain <u>deviant</u> norms such as corruption, or unquestionable authority of superiors can take root, i.e., can become "institutionalized."

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PART III

SUGGESTIONS FOR IMPROVING IRRIGATION AGENCY PERFORMANCE

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Chapter 9
BUREAUCRATIC CULTURE IN IRRIGATION SYSTEM MANAGEMENT

John D. Montgomery
John F. Kennedy School of Government
Harvard University

Irrigation bureaucracies, like those engaged in other functions, develop their own "cultures." They share certain habits, perceptions, and behavioral patterns that make it possible for individual managers to respond to the routines and crises of daily operations. These features may not be obvious to the casual observer, even to experts in irrigation technology. They have to be studied in depth to be fully appreciated and observed by their own new recruits, and even more so by those who hope to influence or reform them.

Bureaucratic cultures change rather slowly, they do change, though sometimes their progress is not perceptible to the outsider. Not all changes are benign, to be sure, and not all are predictable, either. But such changes are not as mysterious as they once were. Bureaucracies are being subjected increasingly to examinations by specialists, who treat them as objectively as if they were isolated villages being visited occasionally by curious anthropologists and activist politicians for their own purposes. They have been observed long enough to permit organization theorists to identify their principal characteristics and even to recommend interventions in the interest of improved performance.

One way to sharpen the observer's perception of differences among bureaucracies is to classify them according to "ideal types" that facilitate assessment by providing a guide to data-gathering. Such short-cuts permit the observer to concentrate on important features and to monitor the changes that may be under way, and even to test hypotheses and make predictions about the consequences of proposed actions.

Social scientists and engineering practitioners have indulged in speculations about types of irrigation enterprises for decades, and some have ventured so far as to suggest comparisons among them, and to express preferences for one type over another. Complaints about corruption, lack of fairness, rigidities, and technological overkill all reflect such preferences. Several taxonomies for irrigation cultures have been suggested elsewhere in the literature and in this volume: Asian versus Latin American bureaucracies, large-scale- versus medium- or small-scale bureaucracies, one-level versus two- or three-level systems, learning versus non-learning, error-sensitive versus error-ignoring bureaucracies.

What I suggest here is a different kind of typology, identifying the essential perceptions and probable priorities of three types of irrigation bureaucracies, wherever they may be. It treats these phenomena as if they were independent of national culture and technological operations, in order to predict some of their behavioral characteristics. This discussion will follow convention and describe the ideal types in exaggerated form.

The types themselves are prompted by the observation of actual systems rather than from sheer imagination, but they are still abstractions. They do not conform perfectly to their real-world originals. Naming these three cultures as I do is intended to promote thought rather than to serve as descriptions of actual systems.

The three model bureaucratic cultures I will describe are identified here as "Organizational," "Technological" and "Motivational" types.[1] In each case I propose to explore the problems they characteristically encounter, devoting special attention to how each might respond to efforts to deal with corruption, with the demands for more equitable distribution of water, and with the entropy represented by rigidity and inflexibility.

9.1 "ORGANIZATIONAL" BUREAUCRATIC CULTURES

The first bureaucratic culture is so named because of its primary concern with internal management. Where it succeeds in performing its technical functions adequately, it is acceptable to engineers or water users. But survival, internal concerns and resource management, rather than efficiency or productivity, dominate the perceptions of major actors in such systems.

These concerns may seem parochial and inward-looking to the observer, but they are easily justified on operational grounds. Irrigation bureaucracies that work in this mode of organizational culture can be found both in the initial stages of their development after the technical operating snags have been eliminated, and in vestigial stages when the system is in decline, that is, at either end of the age continuum discussed in Section 1.3.1. There can be many reasons for either condition. When new systems are still being built or when existing units are being redesigned, issues of staffing and procedure have to be resolved for the present as well as the future. In later circumstances, when irrigation may be losing some of its original economic rationality or the scheme is suffering from prolonged deterioration of water supply or physical structures, considerations of organizational survival can eclipse all others.

In either case, the technical performance of the irrigation system may be only minimally satisfactory when judged in terms of delivering water and providing agrarian services. Managers confronting such a strategic environment are particularly concerned with the establishment and stabilization of cadres of engineers and administrators along with the installation of procedures for acquiring budgetary and personnel resources and developing satisfactory routines that permit the organization to perpetuate itself. In order to serve, a bureaucracy must survive.

New systems of this type are found fairly frequently in Africa; they include parastatal organizations like Senegal's SAED, an integrated system that seeks to make use of indigenous skills and institutions by organizing a network of small-scale irrigation systems. And they are also found in old systems that are in decline because of political neglect or engineering failures, such as some of those under the ill-fated Command Area Development Authorities of India.[2] The lack of responsiveness and flexibility in the management of the San Pedro de Atacama irrigation system in Chile may be attributable to the organizational culture that dominated its operations.[3] In such cases, the leadership of the organization is struggling for resources and gets involved in what may seem an inordinate amount of attention to administrative details. Bureaucratic leaders in such systems are often found defiantly resisting organizational innovations that might appear to undermine the present hierarchy.

Preoccupation with organizational concerns does not, of course, prevent an irrigation bureaucracy from functioning. The urgent demands of the engineering system cannot be neglected while bureaucratic survival is promoted. Where water flows, it must be allocated and delivered. Maintenance cannot be neglected indefinitely, and other operations have to be routinized so that managers can deal with emergencies. In new systems while the top management is working with bureaucratic concerns, technical personnel are responding to the physical demands of the system by working round the clock, even though (and sometimes, in fact, because) the organizational infra-structure is not yet in place. Where an organizational culture predominates, however, the physical priorities are more like emergency actions than policy-making; they take precedence over bureaucratic survival concerns only temporarily.

No sustained managerial operation can take place without some element of the organizational culture. What distinguishes the organizational culture from the other types to be described in this chapter is not the existence of such concerns; it is their place in the scheme of things.

9.1.1 **Characteristic Disorders: Corruption.** New systems deliver water to the users easiest to reach, or those most able to pay for it. Corruption is more an inadvertent by-product than an extraction scheme. In overripe systems working under an organizational culture, however, one of the major problems is the persistent web of corruption that pervades action. The political economy of corruption in South Indian irrigation has been carefully documented by Wade (1982a). Payments are exacted for each position in the irrigation bureaucracy and for each transfer from one post to another. Job rights are sold either to the highest bidder or according to some informal scheme of allotment on the basis of fixed market prices (Wade, 1985). The whole set of relationships is financed by "fees" extracted from the contractors who are paid to construct system facilities and from the farmers who depend on the system's outputs.

Dealing with corruption in such a system requires intervention from the outside. It will not occur as a result of internal dynamics because the prevailing culture would resist any actions against individuals whose behavior reflects the organizational preoccupations of the group. It would require action at very high levels, such as that taken in ridding the Hong Kong police of its bribery scandals in the 1970s or in dealing with corrupt procurement contractors in South Korea during the same period, both of which were possibly only because of concerns in the highest political offices (Klitgaard, 1984 and 1988).

There is a menu of tactics that might be employed for dealing with corruption in such cases. The repertory includes: (1) enlisting the support of major political figures to bring the top figures of the bureaucracy to account; (2) bringing in a powerful anti-corruption czar with the image of Mr. Clean to whom violations could be reported; (3) calling public attention to the problem by picking ceremoniously on certain "Big Fish" as scape-goats; (4) once major offenders have been identified, wielding the "Big Stick" of punishment against them; (5) through publicity, introducing "the light of the sun" to destroy the "germs" of corruption; and (6) changing the system itself to eliminate or at least reduce temptations. Such tactics have often appeared in the histories of anti-corruption crusades.

But can such tactics succeed within a survival-oriented bureaucracy where an "organizational" culture crowds out technical or motivational concerns? The conventional tactics will encounter strong resistance. Getting political leaders to attack corrupt irrigation practices in India would not be a promising approach because politicians are among the principal beneficiaries of the current system. Putting Mr. Clean to work would require selecting an insider rather than relying on a distinguished jurist or public figure since the technical requirements of the system are likely to elude and even embarrass an outsider. Wielding a Big Stick would not bring down the major offenders because swinging it would probably disrupt the whole service, which is very dependent on those personnel whose corrupt practices grease the wheels of the machinery.

In short, organization theory does not provide us much in the way of tactics that might succeed in dealing with pervasive corruption in so technically complex a system. It seems likely that problems of the magnitude Wade describes will yield only to major changes in the bureaucratic culture. Bringing about changes of such magnitude would involve alterations in the structure and priorities of the organization and its members such as discussed in Chapters 6 and 7.

9.1.2 The Problem of Equity. Getting water to the tail end, usually benefiting the poorest lands and farmers, is not a task easily discharged by bureaucracies in the organizational culture mode. Characteristically, they deliver the best service to those who can pay for it, or those in a position to threaten the organization if it deteriorates too rapidly. The internal preoccupations of this kind of bureaucracy divert its attention from the plight of poor or remote water users who are marginalized within the community of users and who are regarded by officials as "outside" their purview. Those who can neither pay nor threaten do not gain bureaucratic attention. Current wisdom prescribes participatory styles of management as an antidote to those conditions. But gaining the kinds of participation that can counter exploitation of the poor is a task ill suited to an "organizational" culture.

9.1.3 Introducing Change. Modifying the organizational culture is not ordinarily possible through personnel rotation, since rotation is itself a source of corruption. Leadership changes may introduce cultural reorientations, if sweeping replacements at the top are possible. New leaders of such stature cannot be simply a collection of administrative generalists drawn from other parts of the government, however impeccable, since they can hardly be expected to replace the engineers in charge.

In a large irrigation organization, however new or routinized it may be, engineers are the ones required to operate the system. In the organizational culture, preoccupation with personnel and financial resources exposes top staff to the necessity of behaving like administrative generalists, because they are compelled by circumstances to observe the bureaucratic amenities of organizational survival. But they are also compelled to behave like engineers to make the organization function. Engineers may not like devoting precious hours to budgets and personnel, but they recognize how important such tedious tasks are to the perpetuation of the system. Changing personnel is a step toward changing culture, but the other steps may not follow.

As managers of new systems become more familiar and confident, performance criteria need to be agreed upon and rewarded, so as to displace preoccupation with internal processes. If resource constraints on the bureaucracy are so pervasive that no professional success or satisfaction is possible and this causes a bureaucracy to "turn inward," these constraints can be attacked. If a canal irrigation system is too unreliable, perhaps introducing pumps and wells to achieve conjunctive use can jolt the bureaucracy into new, more productive patterns of behavior that alter the prevailing institutional culture.

The point to be borne in mind is that what individuals in a bureaucracy do is not just the result of their own habits, perceptions and behavioral patterns. Incentives will not change bureaucratic performance without some alteration in the culture in which persons find themselves. After all, culture shapes how persons interpret and respond to incentives. This is one of the lessons which organization theory teaches us.

9.2 "TECHNOLOGICAL" BUREAUCRATIC CULTURES

In the second culture of irrigation organizations, the priority objectives are those concerned with water supply and delivery. Engineering considerations (and therefore engineers) dominate these systems. From the moment of design to the period when operations become routine, in the technological culture the management treats whatever challenges emerge as professional ones. Administrative generalists are presumed to be available to take responsibility for internal management, but they are rarely in a position of dominance. Their expertise is not on top because it is not deemed adequate to meet the perceived challenges.

Delivering water efficiently requires the kind of calculations that draw on centuries of hydraulic lore and data, available only to trained engineers.[4] The subdivision of tasks in a large irrigation system is perceived as requiring a fairly high degree of expertise throughout all levels. The system is geared to be self-monitoring. It keeps track of its operations by measuring the adequacy and efficiency with which water is distributed. The expertise required is seen as readily transferable between different systems. Career personnel may be easily assigned from one state, or even one nation, to another, with little loss of time in learning how to apply their knowledge. The technological culture is international. The pride of the service is its objectivity.

9.2.1 Characteristic Disorders: Corruption vs. Rigidity. In this setting, assignments and transfers are unlikely to be subject to extensive corruption. Where it does occur, it is thought of as an individual aberration rather than as a characteristic of the system. Its incidence is associated with infrequent, but important, decisions. Dealing with corruption in these systems is usually a matter of demonstrating the existence of inefficiency, locating it in the physical or administrative structure, and introducing external disciplines such as competition or publicity.

Complaints against the technological culture are more likely to focus on rigidity or on haughty indifference of the hydraulic technicians to the requirements of the users and the advice of the agricultural production specialists. Concern with water delivery alone is deemed too narrow a goal in the wake of huge investments made in large-scale irrigation. Critics, particularly agronomists associated with irrigated agriculture, want productivity to become the norm, a criterion that calls for expertise beyond hydraulic knowledge.

Successful technological cultures can thus become a battleground between engineers and agronomists, the one concentrating on delivering water to the outlet in the most efficient manner (which may measured in terms of least effort or least difficulty to system managers), the other on the actual merging of water requirements with those of the crops. The latter will be willing to reduce the "efficiency" of water delivery in order to achieve optimal timing and amounts for different crop patterns that maximize production.

Both groups tend to be indifferent to considerations of "the market" and of political viability. The Hippo Valley and Triangle Estates in Zimbabwe's Lower Sabi drainage area are described by Moris as "an enclave of modern technology unconnected to its surrounding economic and administrative environment." The pathology of "gigantism" is endemic in the technological culture, which naturally seeks state-of-the-art solutions on a grand scale when the resources permit, or even when they don't (Moris, 1987: 103-104). In these cultures, disputes over matters like design and location are among experts from different organizations, not involving other participants in irrigated farming significantly.[5]

9.2.2 **Ineffective Community Action.** Engineers even more than bureaucrats find it difficult to elicit popular participation in the performance of operations and maintenance functions. Being highly centralized, they tend to treat farmer participation and organization as being like technological problems, and to lack both the instinct and the means of communicating with users. Some of the SCARP (Salinity Control and Reclamation Program) projects in Pakistan illustrate these limitations clearly (Merrey, 1982). In an analysis of World Bank experience, for example, only a "limited" role for community inputs was reported in the design phase of projects, and then only with regard to demand generation. The study points to project cases in the Philippines, Indonesia and Mexico where technologically-oriented agencies were at least initially hostile to community action (Paul, 1987: 21, 24).[6]

9.2.3 **The Problem of Equity**. When engineers define their task as delivering water in specified amounts throughout the system and agronomists concentrate on overall production records, smallholders may be ignored. The engineers find it too difficult and costly to reach the tail-enders, the production specialists prefer to allocate water where they will get the biggest payoff, which is likely to be at the head-end. Additionally, they may be oriented to working with "progressive" farmers who as defined usually have the largest holdings. The bureaucratic culture norms of efficiency and productivity can easily crowd out considerations of equity (Merrey, 1987). Getting the latter attended to requires not just policies but also changed values within the bureaucracy.

9.2.4 **Introducing Change**. Correcting rigidities and inequities is unlikely to result from within such bureaucracies. This will come, if at all, through changes in water allocation practices imposed from outside the organizational system. But as noted, these practices are rooted in cultural presumptions. Any changes introduced have to be made effective by technical means, including the measurement of deliveries and the use of management information systems, including ones that permit water users to share the knowledge generated. An advantage of the technological culture is that data will be given due consideration, and efficiency in achieving any given goal is valued. If flexibility and equity are specified as organizational objectives, and if means to monitor and measure their achievement are introduced, and if professional satisfaction can be given in the course of their achievement, there are strengths in this culture that can be drawn upon to correct certain deficiencies.

9.3 "MOTIVATIONAL" BUREAUCRATIC CULTURES

If the technological culture's concern with achieving the "right" water deliveries as outputs from the system, the third type of bureaucratic culture concentrates on broader issues. It measures its performance in terms of outcomes -- benefits delivered to (and perceived as such by) farmers and other users. Productivity and equity are merged in the operational guidelines of this system, which is monitored in turn by user groups or powerful political overseers.

The structure of bureaucracies with motivational cultures will tend to be decentralized, though one cannot easily sort out cause and effect -- whether staff by being closer to the impact of their actions have become more attuned to outcomes or whether a desire among personnel to achieve beneficial outcomes prompts devolution of staff and authority. Management of irrigation systems by user associations may be considered "motivational" if they employ the engineering, technical and administrative cadres required to operate the system. Not all farmers associations are capable of exercising such responsibilities, but when they do so their success is justly celebrated.[7] Commercial irrigation enterprises in which users bear the costs of operation also maintain effective discipline through incentive structures that have similar motivational characteristics (Maass and Anderson, 1978).

9.3.1 **Characteristic Disorders: Internal Capture.** Familiar forms of corruption can occur in devolved systems, even ones that are fully responsible to user groups. The more responsibility that is put into the periphery of a bureaucracy, the more attenuated is central oversight and control. Special interest groups may become unfairly influential and corruption can enter into operations and maintenance. These distortions can be countered by an organization that is determined to maintain its integrity. Career rewards to staff can be based on probity and performance with failure to maintain these qualities punished immediately and directly.

The system of irrigation management in Taiwan, where water users are members of authoritative Farmers Associations and Irrigation Associations which employ and supervise technical staff, has been able to integrate engineering and agronomic expertise (Stavis, 1982). These associations have been liable to some malpractices, to the point that the government took over their management in 1975 to restore financial integrity and viability. But the government decided by 1981 that it was best to return full responsibility to the associations.

Motivational bureaucratic cultures are not perfect. Devolved administration, even that by user groups, can be "captured" by local elites, and members can become apathetic if the system seems to be working satisfactorily without their active participation or surveillance. These cultures, too, are parochial, with their tight linkage to small-scale, sometimes village-level, user groups that can be indifferent to larger regional or social concerns that transcend their immediate needs. In such cases, the remedy appears to be reversion to certain characteristics of the organizational culture, protecting the routines and prerogatives of members of the organization.

9.3.2 **The Problem of Equity.** Village-level organizations, like commercial enterprises, are not necessarily noted for their altruism. The basis of solidarity which makes such groups strong may also pit them against others, such as downstream claimants. We do find generally that motivational cultures give more weight to equity considerations than do the other two. By focusing attention on the outcomes of irrigation efforts, the spread of benefits (or lack thereof) becomes an issue when assessing system performance. Any observed deviations from equity can be expected to be taken seriously because they violate the norms of the particular bureaucratic culture. Any efforts at correction must depend on the existence and effectiveness of water user organization, however, as in a situation of anarchy among users, norms of equity are likely to disintegrate.

9.4 CONCLUSIONS ABOUT BUREAUCRATIC CULTURE

The principal advantage of observing such "cultural" phenomena among irrigation systems is the opportunity it gives to identify different sources and structural dimensions of problems that otherwise seem to be generic or even identical. If, as Moris (1987:117) says, "small systems can be just as bureaucratic and inefficient as large ones," they can be just as completely dominated by engineers and technicians or even by managing owners. To the extent that these dimensions are different, the policies introduced to correct the characteristic pathologies may also have to be different.

It may be true, for example, that corruption is everywhere. But its manifestation in the organizational culture may be indicated by the sale of posts and the illicit and secret extraction of fees from users, not as in technological and motivational systems, by siphoning from the public treasury. In the technological culture, corruption in the allocation of water is not the explanation for distortions in the distribution system; rather they are to be identified in the guidelines under which the system functions. Motivational cultures, on the other hand, reflect managerial efforts to satisfy the owners or their most prominent clients if the user groups are not themselves perfectly representative, and to possess sufficient power to displace individual offenders. In the first setting, it is likely that corruption will not be satisfactorily dealt with until some responsiveness along the lines of the third culture can be installed; in the second, political interventions may be needed to address the technological conflict between the goals of the hydrologists and those of agronomists. In the third, some form of bureaucratic intervention may be required (Montgomery, 1979).

Problems of equity will not be perceived in the same way in the three cultures either. In the first, managers have no patience with the extra refinements needed to bring water to the least convenient outlets in the system; in the second, delivery to the outlet is seen as the only requirement of the system, with an alternative mode of response that concentrates on overall productivity without much concern for the less efficient users. In the third, issues of equity may be overlooked because it is assumed that if user groups are involved, however inadequately, the needs of all their members will have been attended to.

It is obvious that the systems in each case, to the extent that they are "pure" manifestations of the ideal types, have problems of their own. One of the ironies of this analysis is that the remedy for defects with any one of the three cultural modes seems to be homeopathic: the injection of some elements of one into the others. The antidote for bureaucratic excess may be a dose of participation, as occurred in the Philippines (Bagadion and F. Korten, 1985), implying a movement from the first to the third culture described here. Engineers and agriculturalists can perform better technically when bureaucratic elements share responsibilities for their operations with user groups. And motivational systems sometimes need more organizational routines and rules to keep them responsible to their less conspicuous members. The role of bureaucratic leadership in introducing such changes is largely unexplored unfortunately (Uphoff, 1986:152).

Perhaps the closest approach to system perfection will be achieved when the three cultures coexist in some sort of balanced equilibrium.

FOOTNOTES

[1]These cultures correspond, roughly, to Second-Order, First-Order, and Third-Order decisions described in Montgomery (1974). They are derived, respectively, from my observations of the points of view I encountered at the Mahaweli project in Sri Lanka, the Pochampad project in India, and the Muda Project in Malaysia.

[2]See Diemer and van Laan (1983), and Singh (1983).

[3]See case study by Lynch summarized in Uphoff (1986a: 270-271).

[4]It might be noted that engineering handbooks used by hydrologists contain data that might have been (and perhaps were) gathered from the time of Julius Caesar. It is only in the softer, operational and managerial sciences that data gathering is a new phenomenon.

5Parastatals, irrigation ministries and international agencies provide the battleground for such disputes in cases observed in Niger and Kenya, according to Moris (1987:103).

[6]In the Philippine case, there was reorientation after it became clear to the irrigation agency -- especially after difficulties encountered with the huge Upper Pampanga project -- that it could not meet its objectives without farmer organization and participation.

[7]The Taiwan experience is the best known, although the National Irrigation Administration in the Philippines includes some associations that can operate and manage whole systems. Most take on more limited responsibilities, maintaining agreed lengths of canal or collecting fees on behalf of NIA (Bautista, 1987).

Chapter 10
METHODOLOGIES: THE MISSING MIDDLE

Robert Chambers
Institute of Development Studies
University of Sussex, U.K.

10.1 NORMAL PROFESSIONALISM AS PROBLEM

The main reason for improving the performance of an irrigation bureaucracy is to improve the performance of the irrigation systems for which it is responsible. Improved performance can be defined as raising sustainable benefits, including productivity, equity and well-being, while reducing adverse effects and costs as discussed in Chapter 2. One aspect of improved performance will be benefits, i.e., rewards and satisfactions, for those who work in a canal irrigation bureaucracy itself, but irrigation staff are a small minority of those affected, and such benefits are more of a means to the well-being of others than an end in themselves. The major purpose of systematic analysis and agency reorientation has to be not a better life for the staff, but a better performance for the system, thereby yielding benefits for others.

Improving that performance presents a more complex challenge than perhaps any other domain of rural development. It is not just that canal irrigation systems are large, unique, changing and complicated, including as they do elaborate physical works, a bureaucracy, communities, farming systems with farm families and crops, and a valuable but maddeningly transient and elusive resource in the form of water. It is also that normal professionalism -- the thinking, values, methods and behavior dominant in a profession -- sets bounds on what is feasible.[1]

The normal professionalism of the disciplines most concerned with canal irrigation system management is competent only with the more obvious physical, visible fringes or domains of the subject. It does not cover the core. This, the missing middle, is a family of methodologies for system management, connecting the bureaucracy with the rest of the system. This lack of methodologies is like a slipping clutch. The theme of this chapter is that the methodological blind spots of normal professionalism are a central problem and opportunity, demanding a new professionalism which goes beyond past concerns and conventions.

Normal professional biases are well known. The civil engineers who become irrigation engineers are trained in design and measurement. They are oriented to construction and maybe maintenance, handling static physical things, more than to operation and management, dealing with dynamic processes and people. For their part, social anthropologists with their village and community studies, and sociologists with their questionnaire surveys, are primarily concerned with farmers, households, villages and communities more in themselves than with regard to their specific involvement in irrigation. Agronomists at the field level, where crops grow, and also agricultural engineers are normally engaged at or near the farm level, with land shaping or with works for water distribution and delivery. These familiar focuses leave unexplored two vital sets of activities: <u>how to combine disciplines</u> and analyze canal irrigation systems in order to see how best to improve their performance; and <u>how to manage the main system</u> in support of irrigation's objectives, agricultural production and human well-being.

10.2 METHODOLOGICAL GAPS

These gaps are not a new discovery. They were emphasized in 1982 by the study team which recommended setting up a new International Irrigation Management Institute (CGIAR 1982) . They have been stressed since by others (e.g., Lenton 1983, 1986). Yet the challenge they present has not been fully recognized or met. Let us consider them in turn.

10.2.1 Diagnostic Analysis. Practical methods for appraisal and analysis of canal irrigation systems, to see how feasibly to improve their performance, are still at a primitive level of development. The common experience is that diagnosis and prescription for whole irrigation systems are dominated by normal reflexes in which professionals see the standard problems in terms which fit their disciplines, and prescribe the standard solutions which require their skills.

One striking example is the frequency with which irrigation engineers faced with waterlogging prescribe hardware solutions -- lining canals, pumping out the groundwater, or building drains -- rather than the software solutions of supplying less water in the first place or changing cropping patterns. Preferred solutions tend to define the problems. Moreover, it is problems, not opportunities, that are the focus of attention.

Although appraisal and prescriptive analysis of existing canal irrigation systems are widely undertaken, those who conduct them hardly ever record their methods. Where they have done so, most emphasis has been on the activities of appraisal (e.g. Bottrall, 1981; Chambers and Carruthers, 1986; Potten, 1985, 1986; Tiffen, 1985), rather than the methods of prescriptive analysis which identify what best to do.

One promising source of insight is the incipient National Water Management Project in India. This has started with iterative diagnostic analysis carried out jointly by the managers of irrigation projects and consultants and staff from the World Bank, and has gained some good experience. The approach has been to develop an operational plan for each system. Through 1987, though, the approach has not been recorded as a systematic methodology. Part of the difficulty is that those with an interest in the methodology per se are few and usually academic, while those who conduct diagnostic analyses, though more numerous and more experienced, are practitioners and busy. They are not inclined or able to abstract and describe the processes of investigation, analysis and interaction which they use. To say, as some do, that whole-system diagnostic analysis, is an art captures just enough of the truth to be plausible for those who want to evade further thought. In any case, arts involve techniques, as does diagnostic analysis. In the absence of systematic records, manuals and guides, appropriate methods of appraisal and analysis are constantly having to be reinvented and rediscovered. This is inefficient.

The range of strategies and interventions possible for improving performance is wide. Considering only water allocation and distribution, and cropping, decisions, they include:

- scheduling (continuous, rotation, demand, redistribution, etc.),

- crop zoning,
- zone sequencing (i.e., zones take turns missing a season, or growing a crop),
- staggering cultivation,
- reusing drainage water,
- sequencing and sharing cultivation rights.

More generally, there are many other initiatives such as improving physical structures (e.g., canal lining), maintenance work, rehabilitation, conjunctive use, on-farm development, communications, farmer organization, monitoring and evaluation, action research, drainage, administrative reorganization, legal changes, and water pricing which can be considered, things discussed in Part II already.

Then there are alternative points of entry for starting change. Three of these are operational plans; farmer participation; and monitoring and computer analysis, as sketched already in Section 6.3.5. Beyond these and other options, there are questions of which methodologies are best, when, where, and in what sequence, and how they should be introduced.

All this may seem obvious and only common sense. But then it is puzzling why methodologies for diagnostic analysis of whole irrigation systems are not a professional preoccupation.[2] It is difficult to get anyone to focus on this as a subject. Perhaps it is too much of a challenge. Perhaps each profession and person is fully occupied just doing whatever is normal. Perhaps too many disciplines are potentially relevant for methods of diagnostic analysis to look feasible. Perhaps the practitioner-academic gap is too wide. Perhaps normal professionals are too timid in exploring and developing methods which trespass on the territories of other disciplines.

Whatever the explanation, if I may mix metaphors, the blind spot remains a black box, or at best grey. It is as though medical diagnosis and prescription were undertaken only by specialists who worked within their narrow competence, and there were no general practitioners who could assess, understand and prescribe for the patient's condition as a whole. To my knowledge, there is no practical guide or manual for diagnostic analysis of a whole system, nor any proposal to produce one.

10.2.2 Main System Management. The second set of methodological gaps concerns main system management. Until recently, any list of these knowledge gaps would have included farmer participation, or joint management by bureaucracy and farmers. This gap is being actively worked on (see Uphoff, 1986) and remains a very high priority. To this can be added four other major subjects where "gaps" remain:

- scheduling, determining how water should be distributed;
- water delivery and monitoring, managing, controlling, measuring and monitoring the movement of water from source to point of handover;
- communications, the organization and flow of information from farmers to managers, from managers to farmers, and from different parts of the irrigation system to both;
- staff management, the management of the irrigation bureaucracy itself

Crosscutting these, there are other challenges and opportunities which deserve systematic treatment. Three examples are:

- anticipating and responding to rainfall to save water, to avoid flooding and danger, and to ensure reliable deliveries;
- canal irrigation at night, how to reduce and/or improve it (Chambers 1986b);
- handling corruption, methods for irrigation staff to contain or fend off pressures, and to minimize their adverse effects.

Each of these subjects could and should be studied, analyzed, and experimented with through action research, and distilled into practical manuals and textbooks. If there is anywhere a manual or textbook which deals with any of these, adequately, comparatively, and in a practical manner, it has been well hidden.

10.3 PRACTICAL IMPLICATIONS

10.3.1 Training. Faced with poor performance, one normal reflex is to recommend training. In India, training irrigation engineers and others concerned with canal irrigation performance has been given priority. By 1987 at least ten Water and Land Management Institutes (WALMIs) had been set up in different states. But when workshops were held for developing policies and strategy for nationwide irrigation and management training, the agenda did not explicitly mention any development of methodologies (Venkatesan et al., 1986:15). The agenda included topics like the numbers of persons to be trained, faculty development, and the roles of different institutions. To be sure, the lead points for discussion included rapid appraisal as a forerunner to diagnostic analysis, implementation of action research, adaptive research, monitoring and evaluation, and "Adequacy of the Acts and Manuals, as framed at present to implement the practices." It was recognized that "There is a need to evolve appropriate curricula for the different courses" (1986:20). But how better methodologies would be evolved and how new materials would be developed to go into the curricula was not confronted.

When 'Organizational and Procedural Changes' were taken up as a lead point, this was taken to refer not to improving system management, but rather to solving things like 'stagnation, lack of promotional opportunities, absence of incentives, lack of appreciation for good work [and] lack of financial powers, inadequate infrastructural and physical support' (1986:19). The categories for considering organization and procedure were quite conventional and general, not specific to canal irrigation management. In the absence of methodological development, training will do little more than reproduce normal professionalism, and the gaps will remain.

10.3.2 Methodological R and D. Deliberate R and D to develop methodologies should be a priority. Action research has much to contribute, but it itself has methodological problems, not least the recurrent bias to give preferential water supply to the experimental area at the cost of the rest of the system. A past error may have been expecting too quick results from action research. More seriously, action research itself has rarely had an explicit methodological purpose in the sense of being intended to result in a guide or manual on some aspect of system management. Ways forward include comparative analysis, for example, of how to prepare and execute operational plans; canal irrigation at night; responses to rainfall; and communications. These are manageable subjects with practical applications.

10.3.3 **Manuals and Textbooks.** The lack of manuals and textbooks remains extraordinary. For the farm level, below the outlet, some have been worked out and prepared, for example, by the Water Management Synthesis Project. But for main systems, they are still awaited. USAID in India has had funds available for the preparation of training materials since the early 1980s, yet no manual or textbook on main system management has yet been produced. IIMI initiated a series of 'Management Briefs,' but these have not been detailed or numerous enough to meet the need. Not only has no textbook been written; to my knowledge, none has been commissioned. It is not difficult to envisage one, with chapters on diagnostic analysis, operational plans, scheduling and delivery, communications, monitoring, farmer organization, and staff management, for a start. Such a book is such a high priority that whoever prepares the first good text will make a major contribution.

10.3.4 **New Professionals.** To develop and use new methodologies requires a new breed of professionals and a new environment in which they can work, as discussed in Chapter 7. Professionals must be innovators, eager to spread their activities and work beyond the confines of their formal disciplines. Their environment must encourage and reward them for being inventive explorers. Such persons already exist. They include managers of canal irrigation systems who try out new approaches, who develop new relationships, who improvise new methods. Unfortunately, it is rare for them to be recognized or rewarded. In India, the National Workshop on Scheduling of Irrigation held at the WALMI at Aurangabad in 1983 (WALMI, 1983) promoted scheduling as a topic of importance, but the paper by Joshi (1983) which reported on actual successful improved performance through main system management (by reducing water deliveries at night) was mostly overlooked.

This is partly a question of basic values. A paper about theoretical computer applications receives more attention than one about better practices which have in practice improved performance. The lack of recognition is sustained by the fact that without complicated innovations, improvements can indeed come from application of commonsense, simple calculations, rules of thumb and improvizations -- which may be dismissed as too lowly to merit notice, let alone acclaim. They are still not recognized for what they are, early steps in exploring a professional frontier.

The missing methodologies create a vicious circle or Catch-22 situation. Because developed methodologies for diagnostic analysis and main system management do not exist, there are no manuals, textbooks or training about them; because there are no manuals, textbooks or training about them, they are not professionally recognized and do not exist. Because methodologies are improvised and amateur, they have low professional status; because they have low professional status, they are matters for amateur improvisation. Here is a major challenge for the International Irrigation Management Institute, to give leadership in breaking out of normal professional ruts and to seizing the high ground in between.

The opportunity is greater than may at first appear. Just as negative factors interact to establish a vicious circle, so positive ones can interact in a virtuous one. New proven methodologies for canal irrigation management, especially methods of diagnostic analysis and main system management, would not only provide the modes of operation for better performance. They would also provide personal incentives. They would raise the status of irrigation system management as a profession, and at the same time encourage managers' pride and satisfaction in their work.

Many factors constrain managers' performance, and many reforms can remove impediments or predispose persons to do better. Organizational structures can be altered. Terms of service can be changed. Conditions of work can be ameliorated. But these, though enabling, are not sufficient. <u>There is no substitute for knowing what to do and the satisfaction of doing it well. Good methods are basic to good performance and good motivation</u>. For improving the performance of canal irrigation managers and systems, methodologies remain the missing link.

FOOTNOTES

[1]"Normal professionalism" is elaborated in general in Chambers (1986a) and specifically for canal irrigation systems in Chambers (1988:Chapter 4). The role of professionalism in irrigation management has been addressed in Chapters 5 and 7 already.

[2]This reference is to diagnostic analysis generally, not to the specialized version developed at Colorado State University which has been a preoccupation of a number of professionals from different disciplines there and which concentreates attention at the field level.

Chapter 11

PERSPECTIVES FROM ORGANIZATION THEORY ON IRRIGATION BUREAUCRACIES IN EAST AND WEST AFRICA

Emery M. Roe
Graduate School of Public Policy
University of California, Berkeley

Nobody needs a good typology more than the practical man or woman. Those of us who have worked with or in irrigation bureaucracies probably know a great deal about the specifics of these organizations. We will understand them better, however, when we can determine the variation not only within this set of bureaucracies but also between them and other types of complex organizations. How does it matter that the organization in question is an irrigation bureaucracy? In what sense is an irrigation bureaucracy in sub-Saharan Africa different from or similar to those found in, say, various regions of Asia? This chapter will suggest some answers to these questions.

While the typology offered here is still a tentative one, it offers various insights for improving the performance of irrigation agencies, shedding light particularly on the issues raised in Section 1.3 of this book. Irrigation bureaucracies in Africa are for the most part "new." Their managers face a difficult choice of whether to aim for "management" with all of the flexibility this implies or for "administration" to achieve at least predictable outputs even if this involves some rigidity. Disorganization is always a waiting alternative.

11.1 ERRORS, TOLERANCE AND LEARNING IN BUREAUCRACIES

As the preceding chapters have considered the variations in structure and performance of bureaucracies, two dimensions of bureaucratic orientation have stood out, with special relevance to irrigation management in Africa. The orientations are:

(a) toward learning -- whether this is valued and encouraged, and

(b) toward errors -- whether these are expected and accepted.

It may be quickly observed that learning and errors have some connection, that people learn from errors, and learning is intended to avoid or at least minimize errors. But the relationship between these two outcomes of human activity, one considered positive and the other negative, is not so simple, especially when dealing with it at the organizational rather than just the individual level.

Learning is, of course, an elusive term which can mean many things to many different people. In one sense, all organizations "learn," since they all evaluate, to some degree, their performance by how responsive and effective they are in dealing with obstacles to meeting the goals set for them, whether official or unofficial, latent or manifest. (In subsequent discussion, we will link learning to be responsive with having learned how to be effective, though they remain different kinds of learning.) What is of interest for us is not the fact of learning, which is common though not always useful, but rather a bureaucracy's <u>orientation</u> to learning, that is, how much emphasis and support it gives to expanding the knowledge base within the organization for achieving its ends.

Some organizations are still learning to be as responsive (and effective) as they would like to be, while others are not concerned with learning, either because (a) they have already learned what they need to know in order to be able to respond, or (b) they are unable or do not care to learn what is required of them to be responsive. Bureaucratic orientation toward learning to be responsive (and effective) is shown in Figure 11.1 as a continuum ranging from (a) learning more and more to (b) learning little, nothing, or less and less.

The idea of learning "less and less" may need explanation. There are some organizations where knowledge of (that is to say, agreement over) cause and effect in carrying out the organization's purposes becomes less certain and clear over time. Despite experience (or because of it), confusion and disagreement rather than confidence and consensus can grow, even among organizational insiders. The knowledge base for action thus can diminish rather than expand within an organization. This would seem too rare an outcome to worry about if it were not for the fact that a number of irrigation bureaucracies in Africa seem to be in precisely such a situation.[1]

The second dimension, namely, the bureaucracy's tolerance for error, will become clearer as we consider the four types of bureaucracies indicated by the typology. It suffices to say here that some complex organizations are comparatively more averse to making errors than are other organizations. Researchers have identified a set of bureaucracies that can be considered "high reliability organizations" which are error-intolerant because of the nature of their tasks and the high costs of any major mistakes (LaPorte, 1987). Examples are known to everyone: regional electric power companies, airlines, nuclear power installations. Such high reliability organizations are oriented to one overriding performance standard: avoid major system errors be they power blackouts, airplane crashes or nuclear meltdowns. How such bureaucracies relate to irrigation agencies will be considered shortly.

	Bureaucracy Oriented to Learning	
	More and More	Little, Nothing or Less and Less
Bureaucracy Oriented to Becoming Error Tolerant	**Type I** Creating/Adapting Standards of Responsiveness	**Type IV** Failing to Develop Standards of Responsiveness
Error Intolerant	**Type II** Getting Up to Standard	**Type III** Keeping Up to Standard

Figure 11.1: TYPOLOGY OF ORGANIZATIONS ACCORDING TO ORIENTATION TOWARD LEARNING AND MAKING ERRORS

Four types of bureaucracies arrayed along these two dimensions are set out in Figure 11.1. Type I bureaucracies are the classic "trial and error" organizations, so much discussed by organization theorists presently. Korten (1980:498) tells us that these organizations "embrace error." The focus is on organizations using errors as part of a systematic learning process whereby the organization and its members evolve (create, modify, discard) standards for judging responsive performance and means for achieving this. Type II and III bureaucracies are those "high reliability" organizations whose standard of acceptable performance is well known in advance. They cannot afford to make mistakes; their first error is their last trial. For our purposes, there are two types of such error-intolerant organizations:

(a) those that are not yet up to this standard, though they are actively trying (learning) to get there (Type II), and

(b) those that have already learned what it takes to achieve and maintain this standard of performance (Type III).

A non-irrigation example will make this distinction clear. The routines and procedures for controlling foot-and-mouth disease among cattle are well-known and unambiguous in sub-Saharan African countries. Some countries such as Kenya have a government veterinary system that, while currently falling short of ensuring control or eradication of the disease, is nonetheless working (and learning) to achieve this end. A few countries such as Botswana, which is heavily dependent on subsidized foreign exchange earnings from beef exports, already have learned these routines and procedures and have in place a high-reliability veterinary and disease control system for foot-and-mouth disease. These are respectively Type II and Type III cases, namely, organizations that know the difference between "success" and "failure" and that are clearly committed to avoiding the latter, the one learning and the other having learned how to do so.

There are, unfortunately, also Type IV bureaucracies, which can best be understood as having failed at creating, adapting, getting up to or keeping to whatever standards these organizations have judged suitable. In contrast to organizations that operate with trial-and-error or by trials without errors, Type IV organizations proceed as errors without trials, or as mistakes waiting to happen. These bureaucracies have become so tolerant of error and <u>so</u> unable to learn that they are eventually overwhelmed. They are what Korten (1980) characterizes as "defeated organizations," in contrast to "learning organizations."

Still, for such organizations it is often easier to say that they have failed than to determine precisely the reasons why they failed. The linkages of cause and effect frequently remain murky in such organizations.

11.2 APPLYING THE TYPOLOGY TO IRRIGATION BUREAUCRACIES

We can draw significant implications from this typology for the issues analyzed in this book. Reflecting the majority opinion in the literature on organization theory, and particularly the current mainstream in business and public administration literature, the authors tend to favor a Type I bureaucracy for managing irrigation systems, one that is willing and able over time to create and adapt performance standards in response to changing needs and environmental constraints. The authors acknowledged in Section 1.3.2 that one could prefer a bureaucracy that is extensively programmed to achieve predetermined performance objectives, which operates more or less "on automatic." Yet there is frequent endorsement, explicitly or implicitly, of a "learning" bureaucracy.

In the real world, many irrigation bureaucracies aspire to be what are called here "high reliability" organizations, Type II or Type III bureaucracies. They want or may already have limited and unambiguous objectives that ensure distribution of a predictable supply of water in adequate, timely amounts. Advice tendered for Type I organizations may not be that welcome or useful to these other kinds of bureaucracies.

Unfortunately, whatever their aspirations and whatever they should be achieving, most of the irrigation bureaucracies I am familiar with in sub-Saharan Africa seem in reality to be closer to Type IV organizations. Most donor-funded, government-sponsored irrigation projects south of the Sahara in arid and semi-arid areas are neither succeeding nor oriented to learning as described earlier. Equally distressing, there is little agreement on why the failure, because there is so little stability in project management and little continuity in evaluations.

I will comment on the empirical basis for such a conclusion in the next section. Let me say here that if my analysis is correct, the suggestions of the authors are most relevant for Type I and maybe relevant for some Type II or III irrigation bureaucracies. Most discussion so far applies to an irrigation bureaucracy that has already learned how to administer an irrigation supply reliably and can try to learn how to manage that supply better in order to be more responsive to local needs and complaints which administrators tend to overlook in the short and intermediate terms. What about the plight of the irrigation bureaucracy that has yet to learn how to administer, let alone manage, an irrigation water supply in reliable fashion, using the distinction introduced in Section 1.3.2?

11.3 SOME DATA AND POLICY IMPLICATIONS

What evidence is there that sub-Saharan irrigation bureaucracies approximate Type IV organizations? Only a brief review will be provided in this section, but even a few figures on the exceptionally high cost of creating irrigation systems, let alone operating and maintaining them, show that we are faced in that part of the Third World with tasks and performance in irrigation that are often beyond any reasonable expectation of efficiency or profitability. These figures are given not to "blame" the agencies responsible for these projects but to suggest how an approach to improving bureaucratic performance in Africa must differ from that proposed for other regions of the Third World.

One of the more recent and comprehensive reviews on formal and informal irrigation systems in Africa concludes that "African irrigation has often been more expensive than elsewhere" and that this cost problem "is particularly acute in Africa south of the Sahara" (FAO, 1987: 7, 46). Nor does the future hold out much prospect for lower costs on agency-sponsored irrigation projects there: "No significant reduction in investments and recurrent costs for irrigation can be anticipated in the immediate future" (FAO, 1987: 40).

Just how expensive is such irrigation in Africa? A review of seven World Bank-funded irrigation and drainage projects south of the Sahara found actual construction expenditures to have ranged from $900 to $14,740 per hectare (Ibid: 160). Construction costs for surface irrigation schemes in Francophone Africa were estimated to have ranged between $3,200 and $5,400 per hectare for village schemes and betwen $4,400 and $6,800 per hectare for larger schemes (Ibid: 153).

Other research indicates comparable, if not higher, costs. According to research on the Senegal River Basin in West Africa, "Estimates for construction costs of the small-scale [irrigation] schemes are less than $5,000 per hectare while estimates for constructing large-scale schemes are as high as $10,000 to $15,000 per hectare" (Miller, 1985: 60). Similarly, a Club du Sahel report concluded that "Investment costs per hectare are always more than one million FCFA (US$ 5,000) and can reach 3 and even 4 million FCFA (US$ 15 to 20,000)" for irrigated agriculture in the Sahel (Club du Sahel, 1980: 17). Investment costs for some irrigation projects in West Africa have apparently gone well beyond $20,000 per hectare according to USAID figures (Glenn Anders, personal communication).

On the other side of the continent, Arao (1986: 12) notes that "Past experience in Kenya has shown that irrigation development can be extremely costly -- $5,000 to $10,000 per hectare." Other authors suggest even higher costs per hectare in Kenya, at least in its arid and semi-arid regions. Indeed, a 1984 report on a long-standing, donor-funded small-scale irrigation project in Turkana district of Kenya reported an investment cost of over $63,000 per hectare (Ministry of Agriculture and Livestock, 1984: 3.3). An investment cost of some $17,000 per hectare was recorded for a small-scale irrigation project in Isiolo district (Hogg, 1983: 580, 584). As for large-scale projects in Kenya, figures in a recent report suggest an investment cost of some $39,000 per hectare for the Bura irrigation settlement scheme serving 2,800 hectares (Ledec, 1986: 2).

Such figures are subject to the usual computational caveats, but their order of magnitude indicates two important things. First, the differences in per hectare costs between large-scale and small-scale irrigation projects are not consistently in the direction expected, given standard economic assumptions about economies of scale; "... even small-scale projects that have few infrastructural elements and that are implemented by the farmers are expensive" (FAO, 1987: 46).[2] Many reasons could be brought forth to account for the differences on a case by case basis, but the point is that circumstances are highly varied, not fitting neat predictive models.

Second, we should be staggered by the sheer magnitude of the investment amounts reported. When one starts probing to determine why it should cost between $5,000 and $20,000 per irrigated hectare, it is frequently impossible to unravel what are the capital (development) costs of the project in question and what are its recurrent (operating) costs. The donor-funded, government-sponsored projects I am familiar with in the arid and semi-arid regions keep changing their technical package, their physical perimeters, their staff, their donors, and their management plans. It becomes difficult to say that the "project" is even the same from year to year, save in name only.

If the completed projects were productive, profitable enterprises once created, one might take a less jaundiced view of their cost of creation. But the history of irrigated development in Africa by and large does not get any better once projects are built.[3] Against such a backdrop, it is not surprising that there is a growing reluctance on the part of donors to fund agency-managed irrigation projects in sub-Saharan Africa (see, for example, FAO, 1987: 7). This attitude is more and more articulated within some governments, notably by their Treasuries and Finance Ministries concerned with the opportunities costs associated with such financing. In its place, donors and even some government irrigation bureaucracies are expressing more and more interest in funding improvements in user-managed, indigenous irrigation systems of the sort documented by Ssennyongo (1986) and Fleuret (1985).

This shift in interest and focus is not only the result of "push" factors represented by high costs on agency-managed schemes. There is a "pull" factor operating as well, for it turns out that many of these indigenous irrigation systems are "high reliability systems" in their own right. If we return for a moment to the literature mentioned earlier on high-reliability organizations, several features have been identified as necessary for such reliable, error-free performance, including:

(1) almost complete causal knowledge of the operating system,

(2) nearly error-free performance from the technologies involved in the operating system,

(3) organizational capacity to detect errors and deviations from predetermined standards of performance, and

(4) capacity to absorb these errors without jeopardizing system performance, e.g. having back-up systems for emergency use (LaPorte, 1987).

Without pressing the point here, let me suggest that those familiar with indigenous irrigation systems will probably agree that these systems exhibit the same four features within the agro-economic and socio-cultural context that the systems operate in. This high-reliability "fit" is important for their operation.

Understandably, since the subject has received little attention in the past, this book is focusing on improving performance of the bureaucracies that handle agency-managed irrigation schemes. However, one might ask whether the route to go in much of Africa, if Type IV schemes predominate, is to try to "fix" them. We leave aside the debate whether donors and governments should be trying to build more of these new "gold-plated" schemes, whose record for O&M and production after completion is so disappointing anyway. One can ask whether existing schemes might not best be managed, following some earnest experimentation and learning, by handing over schemes entirely or almost entirely to users, as quickly and as fully as possible. If with (sunk) capital costs already paid for by government these cannot be operated profitably, perhaps they should be left fallow until such time as prices and demand for food justify their resurrection.

The authors have explicitly left aside consideration of design and construction as part of the irrigation management process, a decision which can be justified for most parts of the world. In Africa, so much of the current resources of irrigation agencies have been going into creating new or continuously "rehabilitated" systems, at least until external funding began drying up, and there has been so much commingling of resources between design and construction and O&M, that one has to be concerned in Africa with the latter.

One critique of the typology suggested in Figure 11.1 derives from a general commentary on the irrigation enterprise. Our colleague Gilbert Levine has responded to the popular current political axiom potentially applicable to irrigation management, "If it ain't broken, don't fix it," by observing that it is difficult to know in irrigation when a system is really "broken." One can identify and respond to major failures in the physical system, such as breaches of channel bunds or collapses of structures. But most of the declines in irrigation system performance are incremental, and some even imperceptible unless very carefully measured and monitored. Decision-making systems based on the premise that managers respond to clear alternatives, i.e., between "success' and "failure," are likely to produce frustration.

It is probably misleading to think that managers can maintain "high reliability" irrigation organization always (optimally) on the desirable side of the line between success and failure. Catastrophic failures in irrigation, the equivalent of a nuclear plant meltdown, will be due to events like drought or flood beyond the control of system managers. Most of the time, managers have the less dramatic and less enviable task of handling myriad marginal adjustments. Mobilizing resources and modifying practices to deal with such changes can be more difficult than coping with major shifts.

But even this discussion presumes that there are functioning systems in place for handling irrigation tasks, which is too often not the case in sub-Saharan Africa. Thus, we probably need to have a different book on improving performance of irrigation bureaucracies where the agencies themselves lack the capacity to manage in even elementary ways. The first step would be to institute simple "administrative" measures along the lines that Bottrall (1981) suggests, the most basic rules, procedures, routines, and sanctions, to create an organizational system that can, one hopes, some day be "managed."

FOOTNOTES

[1]The author has worked with bureaucratic agencies in Botswana and Kenya, and, if anything, the bureaucracies in these countries demonstrate "above average" responsiveness and effectiveness in sub-Saharan Africa.

[2]However, small-scale schemes in Kenya built and operated by farmers cost only a fraction as much as government-built systems (Ssennyonga, 1986). Similarly in the Senegal River Basin, costs per hectare are lower for smaller schemes.

[3]One of the classic "failures" is the Mokwa scheme in Nigeria, documented by Baldwin (1957). The Tono scheme in northern Ghana, many years in the planning and construction, once finished has had similar difficulties in achieving production goals (Chambas, 1980). Such stories have been repeated over and over again, both for irrigation and for other government-sponsored water points as well. The author has analyzed problems of operation and maintenance of water points in Botswana for support of agricultural production (Roe and Fortmann, 1982).

Chapter 12

REORIENTATION OF IRRIGATION BUREAUCRACIES UNDER ENFORCED AUSTERITY: A VIEW FROM LATIN AMERICA

Ray Bromley
Department of Geography and Planning
State University of New York at Albany

The economic crisis of the 1980s has had a profound effect on the performance of irrigation bureaucracies in Latin America. After more than three decades of modest economic growth, albeit with a tendency toward the widening of socio-economic disparities between national elites and the great mass of rural and urban poor, the 1980s has been a decade of economic stagnation or outright decline.

In most of the Third World, the 1980s has been the worst decade for development progress since the end of the Second World War. After more than three decades of modest economic growth, albeit with a tendency toward the widening of socio-economic disparities between national elites and the great mass of rural and urban poor, the 1980s has been a decade of economic stagnation or outright decline (World Bank: 14-35 and 202-205). In Latin America the pessimistic views of the 1960s dependency theorists, repudiated by most analysts in the late 1970s as failing to recognize the capacity of governments to stimulate self-sustaining growth and even to emulate the Asian NICs (newly industrializing countries), now seem to have been vindicated. This major world region with only about 11 percent of the Third World's population includes the three largest Third World debtor nations, Brazil, Mexico and Argentina, and has around 46% of the total Third World foreign debt.[1]

In many Latin American countries virtually every activity of government has been affected by the austerity measures and cash flow uncertainties associated with attempts to repay or at least limit debt, and the stop-go disbursement measures and demands for policy changes imposed by foreign lenders. The over-riding preoccupation with debt has meant that policy issues have become increasingly "externalized," focusing on relations with the IMF and the international banking community, on how much and when to pay, on foreign exchange effects, on exchange rates and on trade balances. In turn, fiscal policies and bureaucratic procedures resulting from these preoccupations have created an obstructionist environment that makes it exceedingly difficult for line irrigation agencies to perform even their most basic functions.

12.1 BUREAUCRATIC DEMORALIZATION AND THE DEMISE OF RURAL DEVELOPMENT

In most of Latin America the news media seem to highlight either the succession of deaths and abuses stemming from terrorism, repression, natural disasters, capital flight, corruption and the narcotics traffic, or the procession of delegations from the IMF, World Bank, Club of Paris and other financial organizations.[2] The dominant concerns are whether there is any way out of the national economic, political and social crises, how the Central Bank and the Ministry of Economy and Finance will negotiate with the visitors on the themes of "structural adjustment," "stabilization," "privatization" and "trade liberalization," and what the implications will be for personal safety, jobs, savings, incomes and costs-of-living.

So far at least, the 1980s has been a dismal decade for persons without hard currency assets kept safely outside the country; professional salaries have typically fallen from the equivalent of between 500 and 1500 US dollars per month to the equivalent of between 120 and 360 US dollars per month. Government bureaucrats have become disillusioned, demoralized and increasingly preoccupied with finding additional income sources in the desperate search for ways to maintain a "middle-class" lifestyle with such modest privileges as home ownership, car ownership, and being able to send their children to the local university. Many bureaucrats, most notably in Guatemala, El Salvador, Nicaragua, Colombia, Peru and Bolivia, have also become increasing fearful for their lives and those of their families, with a proliferation of terrorist attacks and in some cases also of official repression and narcotics-related criminal activity. In these countries, government bureaucrats are viewed as representing an increasingly unpopular civilian state apparatus under pressure from right and left and from seemingly-institutionalized military, terrorist and criminal elements.

In many Latin American countries, "muddy-boots fieldwork" -- the practical involvement of bureaucrats in rural development -- has become difficult and dangerous. Unfortunately, the chief motivation for such fieldwork is often not the chance of contribution to national development but rather the desire to receive per diems and thus increase gross income. Even the most dedicated professionals complain about the "insecurity" to which they are subjected: job insecurity, irregular payment of salary, few means to supplement inadequate salaries, little capacity to achieve satisfying results through their work, even danger to life and limb. Many fieldworkers also complain that their visits to needy communities increase popular discontent because they arouse expectations and mobilize requests for support, lead to promises of governmental action by bureaucrats and politicians, and then generate cynicism and resentment when the promised support and cannot be given or when projects are left uncompleted.

12.2 THE PUBLIC WORKS SYNDROME

Despite the economic problems of the 1980s and the demands of competing sectors, in most Latin American countries irrigation still receives a significant proportion of the national public investment. Regrettably, however, this investment is rarely cost-effective because it is heavily biased in favor of large-scale construction projects, with a corresponding neglect of small-scale constructions, routine maintenance and agricultural extension. In many contexts, this is a continuation of a broader political phenomenon which David Epstein calls "the public works complex":

> [a] a relatively greater emphasis by politicians, in deeds and words, on the construction of physical public projects (<u>obras</u>), as opposed to the ongoing tasks of public administration, the institution of new programs other than public works, and changes in the pattern of social relations; (b) the identification of individual political personalities with the public works they sponsor, and the furtherance of their careers on this basis; and (c) the connection of most works only haphazardly and uncertainly with programs or plans of a longer duration and scope than a single executive term of office (<u>mandato</u>). As a result, public works that are incomplete when the politician associated with them leaves office are often abandoned (Epstein, 1973: 31-32).

The heavy emphasis on large-scale construction projects is not just a vice or idiosyncracy of Latin American politicians. It also responds to the accumulation objectives of powerful construction, real estate and financial interests, and it is reinforced by the policies and behavior of international lending agencies. Thus, it is more appropriately described as a "syndrome" showing remarkable persistence under successive regimes and through periods of economic boom and bust.

Major capital investments in irrigation infrastructure are usually heavily supported by foreign loans in hard currency, with long-term, ongoing financial commitments entailed. In contrast, budgets for operation, maintenance, repairs, small-scale construction projects and complementary programs such as agricultural extension are financed out of local currency. Depending on revenues generated through taxation, they are very susceptible to economic crises and fiscal austerity measures. Even in times of severe economic crisis in Latin America, major construction projects continue to soak up a disproportionate share of government revenues and foreign loans. A particularly bad example is Peru's monumental Majes Project, which irrigated a mere 3000 hectares in 1985 after over 800 million dollars of direct investment, massive interest payments on the loans to finance it, and 14 years of construction effort (Velazco 1985:36). Meanwhile, in most of Latin America, irrigation bureaucrats and other potential rural development workers languish in their offices for lack of funds to repair damaged vehicles, to pay for gasoline and per diems, and to finance such minor works as repairing flood-gates and clearing landslide debris out of canals.

It is obvious now that too many projects and programs were initiated in the 1970s, a decade when Latin American governments usually found it easy and relatively painless to borrow from international financiers. Many of the projects dating from this period were too big, relied on continued foreign funding and on stock technologies, and were based on over-optimistic projections of national and world economic growth. Some of the blame can be placed on previous governments, but much of it lies with foreign banks, aid agencies, consultancy firms and construction companies, who were only too keen to lend funds, promote themselves, and make over-optimistic predictions. Regrettably, the majority of uncompleted projects dating back to the 1970s, and sometimes even earlier, cannot easily be abandoned. Powerful interests are at stake and massive costs have already been incurred just to reach the stage they are at now. In most cases substantial loans have been received and interest is being paid, yet most of the benefits which were originally projected for these projects and programs are still not forthcoming. These costs incurred will grow even if implementation is suspended because of the burden of interest payments, and total suspension of the projects would meet with tremendous opposition from foreign financiers and consultants, as well as from local interest groups (construction companies, materials manufacturers and suppliers, importers, transporters, bankers, etc.) who stand to benefit from the projects' continuation. The 1970s cost-benefit analyses which originally justified these projects have proved hopelessly wrong, with costs mounting rapidly and benefits being delayed and then falling short of expectations.

The continuation of large number of over-dimensioned capital investment projects has a high opportunity cost because it draws funds and effort away from operation, maintenance, and repair of existing systems as well as starting new small-scale projects. Small-scale community-based irrigation projects which could yield benefits to small farmers within a couple of years lose out to massive high-technology schemes which soak up well over 90 percent of total irrigation investment in countries like Peru and Mexico.[3] The former are neglected while the latter are still being implemented despite the fact that they contribute little or nothing in the short term towards overcoming the current socio-economic crisis.

12.3 BUDGETING AND ORGANIZATIONAL PATHOLOGIES

The difficulties which Latin American irrigation bureaucracies face because of national economic crises, the demoralization of those in public service, and the public works syndrome are compounded by a range of problems associated with the budgeting procedures and organization of government. Many of these problems related to the ways in which the IMF and other members of the international banking community require "structural adjustment" to be conducted. In the classic IMF prescription, most attention is focused on the country's capacity to pay the interest on its foreign debts; control over government funds is deliberately centralized so that external payments can be given priority. This leaves the "internal functioning" of the governmental apparatus in a situation of great uncertainty, with bureaucrats in line agencies never knowing how much money will be eventually come through.

More broadly, budgetary allocations to specific agencies, projects and programs often bear little relation to their needs. There is little relation between allocation and actual disbursements, and the flow of funds is totally uncoordinated with project implementation cycles and the seasonality of activities. Three common complaints of senior staff directing field projects outside the capital city are that: far too little money is available for most of the year; no extra funds are immediately made available to cope with natural disasters and other emergencies; and occasionally excess funds are made available when it is too late to find a way to spend them effectively and in accordance with procedures.

In most government agencies, most of the time, money arrives late and in short supply, and priority is given to ensuring that bureaucrats' salaries are eventually paid. The pool of potential government suppliers and contractors is sharply reduced by the fact that payment usually takes place long after goods and services are delivered. In many countries substantial sums are wasted because the few suppliers and contractors who are willing to work for government overcharge for their services and then petition for additional financial compensation for late payment. Even if more money arrives than expected, field operations cannot be programmed and executed quickly enough to comply with central government requirements about prompt spending or return of funds, so equipment purchases and payments to external contractors tend to be emphasized instead of fieldwork, maintenance and repair.

Some of the difficulties of irrigation bureaucracies relate to the classic tendency of budget officers to respond to adverse circumstances by cutting operating budgets rather than reduce government employment in the capital city. Indeed, in many countries the economic crisis and growing white-collar unemployment have generated additional pressures for governments to provide jobs for the party faithful. With the decline in real incomes of most civil servants, the most talented and energetic staff have often left, and their replacements have assumed a "satisficing mentality" as desk-bound bureaucrats with little knowledge or interest in field operations of rural development.

Further difficulties arise in most Latin American countries because of the relatively high levels of inflation, a problem which has increased dramatically in recent years (IDB, 1978: 21; Baer and Welch, 1987). Budgetary calculations and allocations are normally made in local currency, even though the purchasing power of this currency declines dramatically during the financial year. Initial budgetary allocations and disbursement schedules are not normally adjusted to compensate for diminishing purchasing power toward the end of the financial year, and there is a general tendency to predict lower inflation rates than actually occur. The result is that projects can seldom be completed with the local currency funds allocated, and can be finished only if generous supplementary budgets are approved and disbursed to compensate for inflation. In most cases as supplementary funds are not available, uncompleted projects and partially-implemented programs run on from year to year without achieving their desired effects.

The most problematical issues relating to budgeting and organization result from attempts to introduce two types of reform: zero-base budgeting and special projects. These "reforms" have been pushed through by central governments with strong support from international lending agencies, and they have contributed to the growing centralization of government and the further demoralization of line agency staff and fieldworkers. However well-intentioned, they have often led to the deterioration of conditions for rural development work in the 1980s, and in a climate of austerity and internal insecurity, they have reinforced preexisting centralist tendencies in Latin American bureaucracies whereby capital city paperwork has proliferated while little interest is shown in on-the-ground impact in rural communities (Veliz, 1980).

Zero-base budgeting procedures are usually designed by visiting foreign consultants contracted through agreements with the international banking community. The affect of these "reforms" has been to increase the bureaucratic obstacles to public expenditure through ever-growing paperwork requirements to justify each agency's existence and programs, both to obtain budgetary allocations and subsequent disbursements. More and more complex accounting procedures are required as preconditions for the processing of further requests for allocation and disbursement, and procedural "errors" are increasingly punished by non-disbursement.

As a result, attention has often been diverted from "efficacy of expenditure" to "ability to follow the ever-changing rules" and "capacity to spend quickly when money is disbursed." In such circumstances, small government agencies located far from the capital city are particularly disadvantaged, and dedicated fieldworkers must be kept in the office to complete crucial paperwork whenever it is required by central government.[4] Top-level bureaucrats who could have a great impact on field operations have to spend most of their time on paperwork and on lobbying and negotiating in the capital city to obtain funds for the agency. Meanwhile, efficiency has been reduced to paying salaries and making urgent disbursements to local suppliers and contractors whenever funds become available. Field projects get subordinated to paperwork requirements, and "means" get substituted for "ends."

The relative inefficiency of most line agencies and the diminishing professionalism of their staff have contributed to the consolidation of parallel governmental operations through "special projects," partly or totally foreign-funded activities, explicitly temporary, attached directly to a high-level central government department such as the Peruvian Ministry of the Presidency or the Mexican Secretariat of the Presidency, and offering relatively attractive salaries and working conditions. These elite institutions attract better-qualified staff than most of the line agencies, and their greater dynamism, more secure funding and exemption from some budgetary restrictions generally leads to higher success rates in project and program implementation. They are usually created to handle major construction projects, for example dams, hydroelectric power plants and trans-montane aqueducts. Their success tends to accentuate the public works syndrome and to simultaneously undermine the reputation and resource base of the line agencies. The differences in salaries, working conditions and type of contract between special projects and line agencies tend to generate jealousy, non-cooperation and a continuous climate of intrigue about the "talent drain" from the line agencies.

The special projects are often subjected to highly centralized and personalistic control, sidestepping the normal mechanisms of parliamentary and public oversight for line agencies. As a result, when the special projects are eventually terminated, the line agency staff are often unwilling and sometimes even incapable of adequately maintaining their public works, thus reducing even further the cost-effectiveness levels of public investment. It is increasingly evident that the "dual" governmental structure that has been established in most of Latin America now, giving special projects and public corporations a privileged status vis-á-vis the line agencies, generates substantial long-term diseconomies. These may well outweigh the short-term gains to be achieved through the greater efficiency of the privileged institutions, and the whole dualist structure of government needs to be re-evaluated and substantially remodelled.

In sum, successful irrigation development strategies in Latin America will depend upon reorientation not only of irrigation agencies, but of other, often more powerful agencies (e.g., the Ministry of Economy and Finance in Peru) whose procedures have a debilitating effect on the performance of the irrigation bureaucracies. Second, while the special project or semiautonomous agency may appear to be a useful means of circumventing problems in the line agencies, it is only a temporary solution that compounds problems later. Finally, bureaucratic reorientation of the irrigation agencies is needed to redress the present emphasis on works and the neglect of institutional development and to provide a reasonable degree of job security as well incentives for fieldwork.

12.4 "IRRATIONALITY" CAN BE A BASIS FOR HOPE

The crisis decade of the 1980s need not be reproduced in the 1990s, and in some Latin American countries at least, there are signs that the worst may be over. Many governments have shown a refreshing unwillingness to tighten belts any further, or to impose additional hardships on their populations for the sake of satisfying the international banking community. There is a growing recognition that most foreign debts can probably never be paid off, and that the threat of a debtors' cartel can persuade even the international bankers to moderate their demands.[5] Heterodox stabilization packages are now the order of the day, though they have clearly been more successful in some countries such as Argentina and Peru than in others such as Brazil, and there is a growing emphasis on internal policies and national self-sufficiency.

The crucial issue now is how to formulate and implement a package of policies which are less damaging to the economy and the interests of the poor majority of the population than orthodox "structural adjustment" prescriptions. In outline terms, such a package should simultaneously reduce imports, inflation and public expenditure, stimulate private sector investments and exports, avoid any further reliance on foreign loans, reduce the need for expensive foreign expertise and technologies, generate increased employment and demand for local products, and improve the living and working conditions of the poor majority of the population.

It is impossible in a chapter to cover the full range of policies required to achieve such a set of objectives, but one can outline the roles and implications that they have for irrigation bureaucracies and other public sector groups working to stimulate and support the domestic productive apparatus. If irrigation bureaucracies are to recover the levels of effectiveness that they had achieved by the mid 1970s, and if they are to improve on those levels, six major policy changes are essential:

First, the satisfaction of the basic needs of the poor majority of the population using national resources must be given the highest priority so that the country's human resources can achieve their potential. This will mean that the increased production and improve distribution of food, housing and clothing will become central policy objectives, together with the expansion and improvement of water supply and sanitation, primary health care, elementary education, and vocational education. These priorities can be justified in terms of improved human welfare, increased worker productivity, reduced waste (for example, on feeding children who subsequently die of malnutrition or food-and water-borne diseases), and ensuring a wide base of support for the government. They can also be justified in terms of increasing employment and purchasing power so as to both generate internal demands and ensure that they can be satisfied.

Second, resources and technologies available within the country should be used whenever possible, thus minimizing imports and technological dependence. In the short term at least, there is no chance of most of Latin America emulating the Asian NICs with large-scale inflows of foreign investment and a massive drive to capture world markets in manufactured goods. World markets are currently well-supplied; the world economy is close to depression; there is massive excess production capacity for many raw materials and for such manufactures as steel, ships and petrochemicals; and Latin America labor is not yet quite as cheap, disciplined and desperate as its Far Eastern counterpart. Instead, policies should be based on the mobilization of internal resources to satisfy internal demand, with emphasis on "self-reliance" and the restructuring of consumption toward the satisfaction of basic needs.

This means emphasizing development and use of indigenous crops such as the ubiquitous _yuca_ which makes delicious bread, and such little-known but nutritious crops as the Andean _quinoa_, _ocas_ and _mellocos_. It also emphasizes maintenance and use of all existing infrastructure and the efficient distribution of scarce resources. This would lead to new emphasis on the rehabilitation and maintenance of canal systems, and to reducing irrigation water waste. On several occasions in Latin America, I have heard it said that "we don't so much irrigate as flood." All too many field observations have confirmed the frequency of gross water wastage (Wollman, 1968). Too often again, massive irrigation investments are proposed when more effective water-conservation measures and cropping systems could bring greater short-term benefit.

Third, there must be a reformulation of bureaucratic status hierarchies to support those who work outside the capital city and who engage in the direct delivery of services to the rural population. This revindication of the muddy-boots fieldworker is essential if government programs are to achieve their objectives in terms of increased production, employment and the satisfaction of basic needs, and if governments are to win popular support through the delivery of tangible benefits to grassroots communities. Such a revindication requires a substantial increase in salaries, fringe benefits and promotion prospects for good fieldworkers,and particularly those who work in remote and dangerous parts of the country. Such increases could be financed through a gradual reduction in the number of desk-bound bureaucrats in the capital city. To be fully effective, there needs to be a substantial decentralization of governmental activities from the capital city to the regional and local levels.

Fourth, there must be a new emphasis on community participation in the construction, management and maintenance of local infrastructure, and in the orientation of supervision of local extension programs (Uphoff, 1986). This will help to maximize the impact of grass-roots development efforts, to focus these efforts on small-scale interventions which can yield benefits in the short term, and to mobilize local resources so as to reduce public expenditure per unit of output. It will also help to broaden the base of political support for the government, to overcome the prevalent cynicism and apathy about governmental programs and objectives, and to create local oversight and control mechanism to ensure that government fieldworkers are both hardworking and honest.

Fifth, the criterion of cost-effectiveness in the delivery of benefits to the poor majority of the population must dominate the project selection, budgeting and evaluation procedures of government. Measurement, the careful selection of projects, the evaluation of implementation, and the programming and coordination of future expenditures, are all necessities for effective government. On innumerable occasions, however, cost-benefit analyses have been biased in favor of the projects under consideration by the manipulation of discount rates and shadow prices so as to underestimate costs and exaggerate benefits. The cost-effectiveness concept, whereby costs are compared for different project and approaches to achieve standard non-monetary units of output, is far less susceptible to such manipulation. Cost-effectiveness measures are also considerably easier for the majority of bureaucrats and politicians to check and interpret, and they are much better adapted to the so-called "social sectors" where outputs (e.g., education, policing, or health care) commonly do not have a precise monetary value.

Sixth, and finally, until the current crisis period is clearly ended, short-term benefits, intermediate technologies and low-cost replicable projects must be prioritized vis-à-vis long-term benefits, advanced technologies and larger-scale projects that cannot easily be replicated. This would require a moratorium on all new large-scale projects for at least five years, and a re-evaluation of all major uncompleted construction projects so the least cost-effective ones can be suspended altogether and others can be reformulated so as to bring them to a speedier and cheaper conclusion. In many cases, projected second, third and fourth stages may have to be indefinitely postponed, and the total cost of projects reduced by reconceiving them on a smaller scale. Such an re-evaluation should instill a new sense of economy and purpose in government, permitting a reprogramming of public investment over the next decade, and the diversion of some investment funds to ongoing production-oriented extension programs, the repair and improvement of existing canals, and the implementation of new but replicable small-scale projects.

12.5 THE PROSPECTS FOR CHANGE

It will take several years to complete the transition to implementing of the above policy orientations, and they will require unprecedented governmental resolve, fundamental changes in current bureaucratic procedures, and debtor solidarity vis-à-vis the international banking community. Hopefully, however, the depth and persistence of the 1980s crisis, the dismal record of existing policies and the growing discontent of most Latin Americans, can produce the political momentum for profound changes, which emphasize the elimination of wasteful expenditure and the effective use of available resources rather than simple "public expenditure cuts." These changes should lead to the more effective functioning of government as an active agent stimulating the mobilization of national resources toward both the renewal of economic growth and the satisfaction of basic needs. In the long term, these new policies will favor the whole international community through the resurgence of economic growth in Latin America, the strengthening of national economies, the mobilization of human resources for national development, and the renewal of capacity to participate effectively in the global economy.

The major policy changes outlines above will be highly favorable to the effective functioning of irrigation bureaucracies because they will stress the importance of governmental efficiency in field programs, the stimulation of agricultural production, the delivery of direct benefits to the poor majority of the public, and close collaboration with community organizations. Irrigation bureaucrats can contribute to this achievement by documenting the factors that make current governmental programs ineffective, by marshalling the arguments for new policy orientations, and by making political leaders aware of the extent to which human and natural resources are currently being wasted. Above all, they must demonstrate that many of the current so-called "economy measures" result in diseconomies and are counter-productive, leaving skilled manpower and expensive equipment idle, failing to capitalize on investments already made, increasing cost, diminishing benefits and dissipating the potential basis fo support for government. Irrigation management always operates within a political and economic context framed by political leaders, and this is made dramatically clear in Latin America these days. In less turbulent times, one can look forward to decision-making which is more able to optimize resource use rather than reflect basic survival needs.

FOOTNOTES

[1]Calculated from data in World Bank (1987: 232-233).

[2]This chapter is based on the author's general reading on Latin American bureaucracies, on eight years of field experience in various Latin American countries, most notably Peru, Ecuador, Colombia and Mexico, and on printed sources which give a sense of Latin American concerns and priorities, including Latin America Weekly Report, such major newspapers as O Estado de Sao Paulo (Brazil) and La Nacion (Argentina) and such newsletters as Resumen Semanal (Peru).

[3]For background information on some of the large and small-scale irrigation schemes in Mexico and Peru, see Barkin and King (1970), Cleaves and Scurrah (1980, Ch. 3), Lynch (1985), Maradiegu (1977) and Velazco (1985).

[4]During the 1981-83 period, for example, when the author was working with the Integrated Regional Development Project in Cajamarca, Peru, there were numerous occasions when key personnel had to work well into the night preparing urgent budget information required within 48 hours by the Ministry of Economy and Finance in Lima. This information was usually hand-carried to Lima by a staff member in a project vehicle or express bus, a journey taking 10-20 hours. Whenever Ministry deadlines could not be met (for example, because of landslides blocking the road to Lima), disbursements were suspended and all field projects had to be brought to a halt.

[5]Key illustrations of this growing realism are the moves by commercial banks to sell off the debts of many Third World countries at prices from 30 to 95 percent below the sums actually owed, and the decision by a number of banks to offset dubious loans against profits so as to avoid the potentially catastrophic effects of Third World embargos on interest payments. Furthermore, the orthodox "structural adjustment" measures inspired by the IMF and the World Bank have become increasingly discredited because of the growin internal equalities and mass poverty that they have generated, and because many of the countries that have adopted them have become locked into a spiral of accelerated devaluation and rising inflation (Hayter and Watson, 1985: 94-1941 Korner et al., 1986: 128-161; Scheertz, 1986).

Chapter 13
CONCLUDING OBSERVATIONS

Originally, this final chapter was to be titled "Conclusions." But after reviewing irrigation management experience and analyzing it we found general recommendations too hard to justify. Measures for improving the performance of irrigation bureaucracies, to be effective, must be related to specific situations and goals. Our consideration of possibilities led us to develop an analysis of the goals, situations and structures of irrigation management in Part I, and to examine the elements and process of agency reorientation in Part II.

The preceding chapters in Part III have demonstrated some of the directions in which analysis and prescription for improving the performance of irrigation bureaucracies can proceed. John Montgomery and Robert Chambers, each having extensive experience across different parts of Africa and Asia, focused on quite different subjects, elaborating on subjects introduced in previous discussions. In Chapter 9, Montgomery showed how different kinds of bureaucratic culture affect the possibilities for administrative reform while in Chapter 10, the role of methodologies for translating objectives into practice was emphasized by Chambers.

The first focus is on the normative and conceptual "air" that agency personnel "breathe" in their work environment, which animates and orients them. The other focus is on the specific kinds of guidance embodied in procedures, routines, lessons, evaluation criteria, feedback loops, etc. Chambers considers these to be at the core of bureaucratic performance, and when they are absent or underdeveloped, they constitute "a missing middle."

Bureaucratic culture permeates the choices and actions of staff "from outside," while methodologies shape behavior "from within." This distinction explains why the latter are much more accessible as means for trying to improve performance than the former. The metaphor of "air" also makes clearer why the former is so pervasively significant and needs to be taken into account by anyone seeking to change the way an irrigation agency operates. Culture cannot be directly manipulated like rules or procedures. It can and should be understood, however, for the influence it has on the way people carry out tasks.

The contributions by Emery Roe and Ray Bromley are keyed to the specific environments of irrigation development in Africa and Latin America. We did not ask them to address the question of how to improve the performance of irrigation bureaucracies in the Third World generally. Our analysis in Parts I and II contains some tacit assumptions and conceptions reflecting our greater personal familiarity with irrigation management in Asia as we know about African and Latin American irrigation systems and their performance only from reading. That is why we asked Roe and Bromley to contribute observations based on their respective experiences with irrigation bureaucracies within these two regions.

Reflecting differences in the general state of irrigation development in those parts of the Third World compared to Asia, Chapter 11 and 12 place relatively more emphasis on how agencies manage the <u>creation</u> of irrigation systems than on traditional O&M concerns more prominent in most Asia countries. If irrigation bureaucracies in African and Latin America are more preoccupied with design and construction, we must take cognizance of this, even if the main concerns under the heading of management are with how to make <u>existing</u> irrigation systems function better and more productively.

13.1 PURPOSE AND CONTEXT

One of the main conclusions arising from a review of irrigation bureaucracies across a wide range of circumstances is the importance of viewing and assessing their performance <u>not as entities in themselves, but with respect to certain objectives and environmental conditions</u>. It is easy to erect some abstract standards according to which bureaucracies might be judged. But this is inappropriate and unhelpful. An initial but also a continuing task of managers is to get and maintain agreement on what are the <u>purposes</u> for which an irrigation system is to be managed.

There will of course by multiple objectives, weighted differently by various actors in the irrigation process. Political leaders and water users have their respective and not always compatible expectations, which are not always reconciled ever within their respective groupings. The personnel who manage irrigation schemes may side more with one or the other or have their own version of system objectives. It is up to system managers to weld some consensus together, within their agencies, with other government agencies, and with their respective clienteles at national, regional, district, community and field levels. Since objectives stated by any of these groups may not reflect their true preferences, managers need to be brokers and diplomats, not just technocrats.

Managing with multiple objectives means that decisions have to aim at <u>optimizing,</u> not maximizing. Tradeoffs need invariably to be weighed and made. Single criteria like achieving a target water duty per hectare or a rate of irrigation fee payment will not do justice to the complex set of goals any irrigation system can legitimately be expected to serve. The manager should not try to resolve all conflicts in goal attainment unilaterally. The lesson we draw from our analysis is that the various actors should be drawn into discussions of objectives, to become knowledgeable about the constraints which system managers face, so that decisions and their implemention approximate some agreed best solution under prevailing conditions.

The <u>contexts</u> in which irrigation needs to be managed vary widely. Whereas bureaucracies are organized for standardization, their activities have to be tailored not just to the objectives determined in specific contexts but to variations in the context of irrigation itself. In Chapter 4 we appraised the ways in which the situations managers face may differ. Certain physical contexts are more "forgiving" than others, less likely to penalize non-optimal decisions; specific historical traditions may be more "supportive" than others by giving managers in the field more authority to deal with crisis situations; some technical arrangements of facilities are more "flexible" than others;[1] and so forth.

Concepts of <u>efficiency</u> and <u>effectiveness</u> usually imply that the standard of evaluation is some 100 percent level, which in fact is practically impossible to achieve. Having such an unattainable standard in mind detracts from what may be substantial accomplishments by agency managers, possibly demoralizing staff and certainly diminishing the satisfaction they derive from their work. It has been said that the best is enemy of the good -- expecting something superlative makes the beneficial appear disappointing. Just as objectives need to be assessed by managers at the outset and in a continuing manner, the obstacles and opportunities presented by irrigation system environments should be the subject of ongoing evaluation.

The question is not whether 100 percent efficiency or effectiveness can be achieved, but what is the present level? Why is performance not higher, and what can be done to move performance in desired directions? While the internal components of irrigation systems need analysis and often correction as discussed below, the starting point for improving an agency's performance is an assessment of the purposes for which it works and of the contexts in which it operates.

13.2 MANAGEMENT VS. ADMINISTRATION

We have found ourselves returning again and again to the choice framed in stereotyped definitions of "management" and "administration," discussed in Chapter 1. If objectives are well defined and contexts fairly stable, with sufficient information available on the many facets of a system's environment, one can aspire to relatively routinized modes of operation. Even making exceptions to a rule may be rule-bound, possibly in quite beneficial ways. In irrigation more than in most productive activities, a high degree of predictability is highly desirable.

On the other hand, with conflicting or unclear objectives, and especially in a fluctuating environment, managers need to allocate and reallocate resources, to modify or countermand decisions, to broker and negotiate among various actors, to resolve disputes as they arise. Dynamic optimization of water use then calls for a kind and level of responsive management that represents expenditure of effort and thought unnecessary in more stable, predictable settings.

We thought when we started this book that we would be able to offer advice favoring one approach or the other, giving persuasive reasons. But in summing up, we find that this choice between responsive and routinized control over water, physical structures and organizational arrangements is too contingent on considerations of purpose and context -- what is desirable and what is possible -- to advocate one over the other.

The choice depends partly on stages of development, but only partly. One can argue that in new systems like those found more often in Africa and Latin America, needs, problems and capacities are too poorly known to be able to routinize anything. A responsive, problem-solving orientation is needed, whereas in established systems with more information and shared understandings on all sides, it should be possible and desirable to proceed in an "administered" fashion.

The converse argument is, however, also tenable, as Roe and Bromley suggest. Where behavior in new systems is not yet "channeled" by institutional expectations, where water flows are unpredictable and even chaotic, there is merit in simply delivering water reliably in standard amounts to particular places at announced times. In more established systems with all parties understanding and accepting their respective responsibilities, it is possible to attempt adjustments that optimize the productivity of scarce irrigation water, modifying practices to approach some optimum. Management is seen from this perspective as more feasible and desirable where conditions are relatively stable, whereas the best that might be achieved in unreliable systems, at least during an initial period given limitations of personnel, information and funds, is the predictability of administration.

So we are not able to resolve this dilemma: which style of operation to prefer, management or administration? Much depends on how one defines the terms. Our analysis is intended, if not to offer a generally preferred solution, to clarify the alternatives. We have a fear, though there are not data to be found on this dilemma, that trying to optimize between the two alternatives may produce the least attractive features of each, enough rigidity to impede optimization, enough flexibility to destroy predictability.

If this is true, managers (administrators?) should be clear about the strengths and drawbacks of each style of operation and should try to make the most of either one, with the help and understanding of the staff and clientele group involved. This means the choice should not be a unilateral one but rather one emerging from discussions with various collaborators in the irrigation enterprise.

If the distinction is applied to individuals responsible for operating systems rather than to whole systems of irrigation operation, perhaps some optimization is possible. Agency leaders can fashion a strategy which blends flexibility and predictability in appropriate areas of performance. If all the parties to irrigation know the respective domains where "management" and where "administration" prevail, it may be possible to get some of the best of both approaches.

13.3 INTERNAL STRUCTURE

In the institution-building literature, variables relating to internal structure get little attention, being less exciting than leadership, doctrine, resources or program. But we found internal structure to be one of the factors affecting bureaucratic performance which though less evident is nevertheless important, and crucial to agency reorientation. The four variables identified in Chapter 2 -- concentration of authority, structuring of activities (specialization, standardization, formalization), mechanisms for accountability, and mechanisms for responsiveness -- summarize the main aspects of internal structure we found at work.

The first two represent features that invite optimization, to an extent that can facilitate meeting the goals of the organization. Neither is to be maximized, but neither should they be minimized. Organizations need some clear assignments of authority and some "rigidity" in roles and procedures. Otherwise no collective advancement toward objectives is possible.

The latter two can more safely be recommended as necessary features to be established or strengthened. Yet they too can be taken to unproductive extremes. Personnel in irrigation agencies are accountable not simply to bureaucratic or political superiors, though these persons must figure prominently in any consideration. Some element of accountability to water users is needed for furthering goals like increased production. If personnel should be accountable in several directions, this variable cannot be maximized. Also, it and responsiveness may come into conflict. Mechanisms that permit, even impel, an agency to respond to changing situations and demands may outpace those that link staff to superiors or others outside the bureaucracy. Maximum responsiveness will clash with an agency's accountability to its various audiences.

So the design or revision of agencies' internal structures will face real tensions. If there were any "perfect" solutions, we would see more uniformity in and satisfaction with bureaucratic arrangements. In fact, we see much experimentation or simply change, as agency leaders cast about for more appropriate organizational vehicles through which to seek attainment of agency aims. As has been said, each solution creates its own problems, and this is nowhere truer than with administrative "reforms."

Two concepts introduced in Chapter 2 give some metaphorical expression to structural relations otherwise difficult to speak about: _gradient_ and _distance_. That the effects of the first are different in organizational dynamics than in hydraulic systems is quite significant. Greater gradient offers advantages in an irrigation system for moving _water_ more quickly and assuredly, with lower percolation losses (but higher potential for erosion). In organizations, more gradient may increase the speed with which _information_ flows downward, but it greatly impedes crucial flows in an upward direction which are essential for effective management.

Various factors contribute to the internal gradient in organizations, among other things, the number of levels of organization and the prevailing bureaucratic culture. The factor we found most important was distance, conceived along several dimensions. _Geographic distance_ is something well known and common in irrigation systems, affecting the speed and frequency of communication. _Social distance_ is something quite different but it can have similar consequences, as persons of different statuses communicate in limited ways.[2] The most profound distance is _cognitive_ for being rooted in the inner perceptions and logic of staff at different levels and of water users. All three kinds of distance can cumulate to make the management of an irrigation system difficult for lack of knowledge and agreement flowing in needed directions.

The most easily overcome is geographic distance with sufficient means of communication and transportation. Social distance derives not just from the norms and traditions within a bureaucracy but also from the cultural suppositions of a country. It is therefore not easy to eliminate, yet it can be ameliorated by new agency norms and new "traditions" that stress common goals and interests within the bureaucracy. With leadership that indicates approval of more equal social relations, stressing functional more than hierarchical divisions of responsibility, and creating an atmosphere of free and open communication, social distance can be reduced.[3]

Cognitive distance has the simplest remedy, requiring time more than money. People of varying backgrounds can align their views of the world through discussion and common experiences. Leaders in an agency concerned with gaps in communication arising from disparities in the way people think about its tasks can reduce these by providing opportunities for continuing exchange of ideas, for example, in "training" or "reporting" sessions if more informal and egalitarian "buzz" sessions are not socially acceptable. Within an agency, restructuring the relationships among people is a major part of any effort to improve that organization's performance.

13.4 LEADERSHIP AND VALUES

The various means discussed throughout this book for increasing the contribution of a bureaucracy all require some initiation and adaptation, some push and persistence to get the changes sought and to achieve results. Leadership is needed from some source, practically by definition, to get the status quo revised. Otherwise only very slow, maybe imperceptible changes are likely through "routine" channels. Instructions on paper are not self-implementing -- they require explanation, follow-up, evaluation, etc. But what even gets them on paper in the first place? In a technically-oriented agency, the social and psychological factors involved in leadership may appear somewhat "foreign," but they shape the workings of that agency for better or for worse.

In the social sciences almost as much as in the physical ones, there has been an aversion to dealing with "values." By definition, they are subjective and thus subject to different interpretations and rankings. Because they always warrant discussion and are liable to some disagreement, it has been thought better to sidestep or ignore them. But as seen particularly in Chapter 7, there is increasing reason to break with previous ways of thinking, to give values their due consideration.

What is leadership? It encompasses many functions within a group, but specifically within a bureaucracy, one of the principal tasks is to help members of the organization reach agreement on the nature and priority of values that the organization will promote.[4] Further, it will seek to reconcile those values that the organization emphasizes with the expectations held for it by outsiders on whom it depends in various ways. Conversely, it may work to bring outside expectations into line with what organization members judge to be the most defensible priorities (Lindenberg and Crosby, 1981).

In any case, leaders are responsible for achieving some kind of "fit" between goals and evaluations within and outside the bureaucracy. Of course, if there are competing and even conflicting values within the organization, no "fit" will be possible, so a prior task may be achieving internal value coherence through discussion, persuasion, compromise, reformulation, advocacy, exemplary action, etc.

Leadership has some other functions to fulfill. Personnel management is one of the most concrete, identifying appropriate staff in terms of skills, motivation, energy levels, compatibility and so forth. Getting a good combination of people together is a first requirement; keeping them together is the second, allowing for the degree of mobility which was seen in Chapter 7 as positive. Motivating staff so as to get the best out of them -- not just best efforts but also their best ideas-- is also part of personnel management. This gets into capitalizing on the constructive side of "professionalism" at different levels.

The management of other resources -- funds, information, facilities, etc. -- as analyzed in Chapter 6 is also important and interacts with personnel management. If these latter resources are badly managed, there is little possibility of successfully managing personnel, that is, of getting the best and the most out of people. In an irrigation bureaucracy, staff will have technical contributions to make within their respective areas of competence, but their interpersonal connections are also part of their contribution to agency performance. Top managers need to be concerned with the quality of human relationships within their organization so that social or psychological barriers do not obstruct fulfillment of technical missions of the bureaucracy.

The subjects addressed in Chapters 9 and 10, bureaucratic culture and methodologies, are both amenable to improvement through agency leadership, as discussed in Part II. The complex of interacting values and expectations that give expression to a particular organizational culture will not be as malleable as are techniques for scheduling or monitoring. But certain values and expectations once articulated by an authoritative figure who represents the interests and experience of the organization acquire special status and can become the prevailing ones over time, especially if accepted and reinforced by a growing number of persons occupying key positions in the bureaucracy. Certain kinds of methodologies can reinforce people's values and expectations, such as using water efficiently, distributing it fairly, or maintaining facilities well. So although what Chambers calls "the missing middle" may seem more mundane than the more global influences treated by Montgomery, these two ends of the intervention continuum can connect through the conceptions and actions of agency leaders.

Values likewise operate at micro or at macro levels animating individuals or whole organizations, and often both. They evaluate the work of a bureaucracy beyond simply performing tasks. Whether expressed as objectives or as criteria, values give direction to personal and collective activity. In ways not adequately understood, they also give impetus to such activity, energizing individuals and organizations for the attainment of preferred results.

This said, we recall the proposition in Chapter 7 that values are not independent variables autonomously controlling people's behavior. The theory of "cognitive dissonance" holds that values get changed to match behavior at least as much as the other way around. A junior engineer assigned the task of equitably distributing water, given appropriate skills and support as well as rewards for success, will probably come to believe that equity is something "good" whether or not he thought so when he started the job. This suggests that agency managers can attempt to create a climate of values supportive of performance goals not just by advocacy or example, important as these are, but also by structuring tasks in ways that reinforce ideas of commmon purpose and shared objectives.

It is appropriate to end our consideration on the theme of leadership. Althought our dual focus has been on systematic analysis and agency reorientation, both of these undertakings depend on leadership. The one requires conceptual and empirically-based efforts, the other an engagement with people and their ideas and values. Such efforts and engagement do not happen abstractly but rather are the products of personal initiative.

An irrigation bureaucracy has many machine-like characteristics, suggesting that its improvement is a matter of design (or redesign) and then of building (or reduilding) and operating it. More appropriately, an agency should be viewed like a community or even a large family; many different roles exist and there may even be conflict, but all share a common background and future. The success or dishonor of one member gets reflected on all others. In this situation, leadership requires more than some abstract grasp of human motivation that permits orderly design, operation and maintenance of organizational functions. Rather, agency leaders have to observe and intervene with the care and wisdom of "elders" who are concerned simultaneously with the individual and with the collective interest. Problems need to be identified and dealt with in ways that both maintain harmony and contribute to the achievement of goals, both specific and overarching.

This concluding chapter, like many of the discussions of this book, has set forth contrasting alternatives, such as pervasive cultures vs. specific methodologies, material incentives vs. ideal values, individual vs. collective interests, or specific vs. overarching goals. This is the taks of analysis, to make distinctions. Beyond analysis, there needs to be some synthesis, some amalgamation of diverse characteristics, a merging of different strengths, to create desirable outcomes where there were otherwise only ambiguous possibilities. What is judged desirable, of course, depends on values that are understood and shared. The quintessential task of leadership is to make desirable possibilities more probable. This process requires both good analysis, which we have tried to assist in Part I, and then perceptive synthesis, which apparently rests more on insight than instruction.

Agency reorientation requires "putting the pieces together," once those pieces have been understood in themselves and in relation to one another. Part II thus represents a contribution to the task of synthesis, though it cannot be as systematic as the analytical treatment of irrigation structures, goals and contexts which proceeded it. We expected the chapters in this final part to extend the discussion, offering observations reflecting a range of experience greater than ours. Being somewhat divergent, in this final chapter we have tried to weave those observations together.

The tasks of improving the performance of irrigation bureaucracies are many and varied. Having given so much attention to <u>analysis</u> in this book, we close with a call for <u>synthesis</u> through the minds and hands of those who are in positions of leadership, in agencies responsible for boosting the production of irrigated agriculture. They need to be guided not only by technical considerations but also by consideration of the <u>values</u> that are embedded in the socio-technical enterprise of irrigation.

FOOTNOTES

[1]A demonstration of this is found in an evaluation of experience with irrigation rehabilitation projects in Sri Lanka (Murray-Rust and Rao, 1987). The redesign of field channels to have rectangular cross-sections for carrying specific capacities of water was found less suitable than trapezoidal cross-sections with more flexible capacity (pp. 14-15). Also, sophisticated control structures requiring more trained personnel at lower levels proved to be a hindrance when the number of staff had to be reduced because of budget constraints (p. 20).

[2]Social distance physically manifested in some Indian irrigation bureaucracies where the colonial practice continues of having junior staff wear short trousers (signalling "youth" or "immaturity"?) while senior engineers wear long pants. This was pointed out by our workshop participant from India, Mr. S. K. Kumar.

[3]One point at which to attack such distance would be to remove gratuitous symbols of lower status, such as the short pants for junior staff referred to in footnote 2.

[4]In his classic study of leadership in administration, Selznick says, "The institutional leader, then, is primarily an expert in the promotion and protection of values" (1957: 17). A more recent analysis by March and Olsen concludes: "The leadership role is that of an educator, stimulating and accepting changing world views, redefining meanings, stimulating commitments" (1984: 739).

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